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IN RESEARCH FOR DEVELOPMENT

BIOSECURITY
EDITION



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for more
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About Partners

Partners in Research for Development is the quarterly publication of the Australian Centre for International Agricultural Research (ACIAR). *Partners* presents articles that summarise results from ACIAR-brokered research projects and puts ACIAR research initiatives into perspective.

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Front cover: A smallholder cattle farmer in Indonesia caring his animal; the health of the environment, livestock and people is all connected (story page 12). Photo: Conor Ashleigh

Back cover: Agroforestry in South-East Asia. Photo: Shutterstock



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From the CEO

Andrew Campbell

Effective biosecurity begins long before the border

Biosecurity has always been a core element of the ACIAR research agenda. Protecting plants and animals from disease is central to securing safe food and livelihoods. Our long history of supporting biosecurity research is a good foundation, but as with the rest of our portfolio, our biosecurity work must anticipate and adapt to dynamic contexts.

Biosecurity risks evolve, and so must our knowledge and systems to prevent and address disease incursions. As climate change and other environmental disruptors increase selection pressure on plant and animal pathogens, they have the potential to become more prevalent and more virulent. This threat is compounded by the spread of human settlements into ecosystems that further expose plants and livestock (and humans) to new pests and diseases.

Consequently, our systems for risk analysis, surveillance, diagnostics, preparedness and response cannot only be based on historical data. We must be forward-looking. We must assume pests and diseases will turn up in new places or at different times of year. We must invest in new tools and technologies, new research networks and new training with new people in new places.

Andrew Campbell speaking at TropAg 2022, in Brisbane.
Photo: Lyndon Mechielsen



Research partnerships and policy collaborations are ever more important because a protective biosecurity network is only as good as its weakest link.

This challenge speaks to the strength of ACIAR and our bilateral and multilateral partnerships. Some of these are explicitly about improving biosecurity. These enduring relationships allow Australian researchers to work in partner countries on pests or diseases that are new to Australia (such as fall armyworm and varroa mite) or have not yet reached Australia. This builds the knowledge and capability of local researchers while giving Australian researchers experience and insights that better prepare partner countries and Australia.

The value of this type of research is that it can lead to the control of potentially devastating pests and diseases where they exist, rather than waiting for their arrival.

The eminent economist Professor Tom Kompas from the University of Melbourne told the recent TropAg conference in Brisbane that, over a period of 50 years, avoiding the damage and cost of diseases (such as foot and mouth disease) becoming endemic in Australia would save the Australian economy about \$350 billion. 'A big payoff' he said with some understatement. He made the point that the most effective biosecurity system is one that prevents or minimises an incursion. This substantiates the work of organisations like ACIAR that focus on pre-border biosecurity partnerships.

Australia has extensive technical strengths in plant and animal biosecurity. It is enormously to our advantage to deploy this capability in the region to help neighbours better understand and respond to the diseases and pathogens that threaten and constrain their farming systems and food security. In doing so, we also help to manage the risk to Australian farmers, primary industries and rural communities.

This issue of *Partners* looks at some of the key projects through which ACIAR is continuing to keep our biosecurity approach effective and agile. 🌱

Professor Andrew Campbell
Chief Executive Officer, ACIAR



Forest biosecurity protects more than just trees

Forest surveillance in a eucalyptus plantation in Cambodia.
Photo: University of the Sunshine Coast

An increasing number of people rely on Australian acacia and eucalypt plantations for economic and ecological needs, which makes improving forest biosecurity crucial to their livelihoods.

Australia has exported its acacia and eucalypt tree germplasm around the world, with plantations providing valuable incomes for smallholder farmers across South-East Asia and Africa. Acacias, and now eucalypts, also provide the foundation for large-scale commercial plantations in countries such as Indonesia.

ACIAR-funded research is helping partner countries plan for and respond to biosecurity threats, which in turn helps Australia improve its own biosecurity preparedness, as Australian species adapt to new environments – and those environments adapt to the introduced trees.

ACIAR has two major projects underway in South-East Asia to improve forestry biosecurity practices and build capacity. Another project in Ethiopia has moved to quickly assess a devastating new threat wiping out an acacia species that has become integral to community life.

Risks in South-East Asia

The University of Tasmania is leading the project 'Managing risk in South-East Asian forest biosecurity' to improve the tools and technologies available for good forestry biosecurity practices in the region. Indonesian and Vietnamese researchers and plantation stakeholders are collaborating on this project.

The project aims to improve knowledge of pests and pathogen risks, increase disease tolerance through tree breeding, and evaluate technology and other resources to improve surveillance for pests and diseases.

Technological resources being evaluated include the use of uncrewed aerial systems to detect symptoms of pests and diseases in plantations. It also includes modelling that examines the effects of climate change on host species and the distribution of its pests and diseases.



Charcoal production in Ethiopia has been threatened by a disease affecting *Acacia mearnsii*.
Photo: University of the Sunshine Coast

Working on the project in Indonesia is Dr Anto Rimbawanto, at the Research Center for Plant Conservation, Botanic Gardens and Forestry, National Research and Innovation Agency. He said the ACIAR-supported project is highly valuable because of the emphasis on improving scientific capacity and the impact of research on the community and smallholders.

The cross-disciplinary research has helped to create strong partnerships between the public and private sectors.

'Industry partners are a crucial part of the project,' said Dr Rimbawanto. 'The ones facing the problem head-on are the plantation managers. They have a very good team of forest pathologists to help solve this problem, and the ACIAR-supported project helps reinforce the capacity of their team.'

This will also be important to smallholders, as the industry will need to introduce the knowledge obtained from this project to smallholders to strengthen the country's capacity to respond to biosecurity threats to plantations.

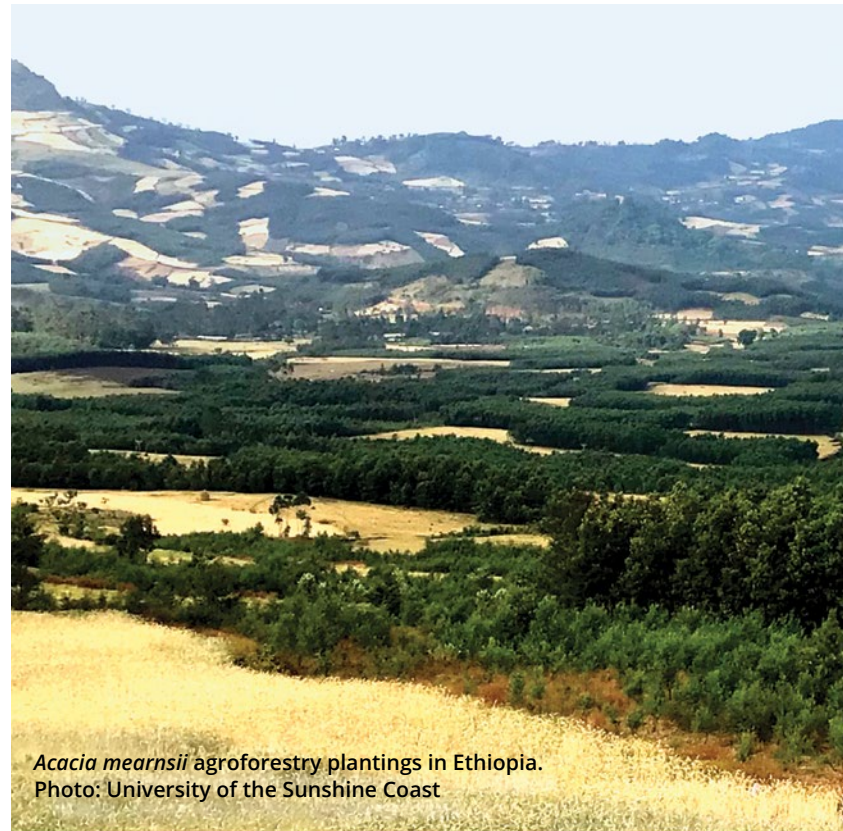
Breeding for resistance

Indonesia has one of the biggest pulp plantation industries in the world, and for many years has relied heavily on *Acacia mangium* plantations.

However, a major infestation of the fungal diseases *Ganoderma* and *Ceratocystis* devastated both large and small plantations of *Acacia mangium* across the country within a few years. *Acacia* plantations in Vietnam also suffered significant losses to *Ceratocystis*.

As the vulnerable *Acacia mangium* was replaced with another Australian species, *Eucalyptus pellita*, the current project includes tree breeding as part of a preventative approach.

Dr Jeremy Brawner, University of Florida, leads this part of the project, working to identify existing diseases to which eucalypts may be susceptible in Indonesia, Vietnam and Laos.



Acacia mearnsii agroforestry plantings in Ethiopia.
Photo: University of the Sunshine Coast

'This consists primarily of setting up trials with partners across South-East Asia to work towards an understanding of the pathogens' limits and which eucalypt populations are most affected. Getting that network organised has been a big part of the project,' said Dr Brawner.

Knowing what diseases are out there allows his team to test the susceptibility of *Eucalyptus pellita* and other species before outbreaks occur, and to identify germplasm with resistance that farmers can use in future plantations.

Building networks

This risk management project feeds into another ACIAR-supported project, 'Building an effective forest health and biosecurity network in South-East Asia', which focuses on building capacity more broadly across the region. Project leaders are Associate Professor Simon Lawson and Dr Madaline Healey at the University of the Sunshine Coast.

It follows previous ACIAR-supported forestry projects with partners in Laos, Thailand, Vietnam and Cambodia over the past decade that identified the value of a collaborative approach between countries in controlling invasive insect pests and pathogens.

Dr Healey explained that although there are trans-border biosecurity protocols for some agricultural produce, such as rice and vegetables, there have been few formal processes related to forestry biosecurity risks. 'The idea is to connect with and expand on these existing agricultural biosecurity protocols and resources in a joined-up approach.'



Key points

- 1 Improving diagnostic capacity is essential for a rigorous response to forest biosecurity threats.
- 2 Building networks between countries allows for swift and united responses to emerging biosecurity threats.
- 3 Protecting Australian tree germplasm overseas also strengthens the Australian capacity to respond to emerging biosecurity threats.

‘Sharing information, resources and technical capacity allows these countries to be prepared for what pests might turn up in their forests,’ said Associate Professor Lawson. ‘Collectively, they can then share their capacity to contain or eradicate any pests or pathogens that come in.’

The project research team initially analysed the capacity of the 6 partner countries (Cambodia, Indonesia, Laos, Malaysia, Thailand and Vietnam) to identify where help may be needed, such as in the diagnostics or policy fields. Ground surveillance and trapping is also underway to get a better picture of existing pests and pathogens.

Dr Quang Dao Ngoc, Forest Protection Research Centre, Vietnamese Academy of Forest Science, is the project coordinator for Vietnam and said his staff are building their skills through involvement in the surveillance program.

‘They are able to identify high-risk sites, and improve their sorting, triaging and diagnostics skills. We benefit from project outputs such as increased awareness of

invasive forest pests and diseases and their negative impacts on forest industries and the environment, and also obtain protocols for pest and disease management,’ said Dr Dao Ngoc.

Disease diagnosis in Ethiopia

Diagnostics has been central to an ACIAR-supported project in Ethiopia, where the introduced Australian *Acacia mearnsii* has established itself as a species of significant ecological, economic and social importance. In recent years, it has been devastated by a disease that has wiped out smallholder plantations.

Dr Nora Devoe, ACIAR Research Program Manager, Forestry, said when the outbreaks were reported in 2021, ACIAR initiated a project to help local organisations identify what they were dealing with to better plan their response. This project was also led by Associate Professor Lawson and Dr Healey.

‘We were contacted by our colleagues in Ethiopia who said there’s some disease happening and it’s almost decimated the whole value chain of acacia,’ said Dr Healey. ‘That includes the farmers who grow it, to the people who use it for charcoal production, to the transport workers who transport the charcoal, to women who now have to walk much further to try and find firewood.’

In Ethiopia, *Acacia mearnsii* has become known as ‘black gold’ or ‘black sesame’ due to its many uses, as forage feed for livestock, as charcoal and fuel wood, and as a soil improver that helps to fix nitrogen. It also provides local economic and job opportunities, reducing the need for regional migration.

After being introduced from Australia in the 1990s, it grew relatively untroubled for many years, before its pests and diseases also began to find their ways to Ethiopia.

While trying to identify the disease, researchers also realised that the imported tree species had been misidentified as *Acacia decurrens*. Through collaboration between the Ethiopian Environment and Forest Research Institute, and the Forestry and the Agricultural Biotechnology Institute, based in South Africa, it was re-identified as *Acacia mearnsii*. This helped to diagnose the disease as *Uromycladium acaciae*, a type of wattle rust.

Associate Professor Lawson said the next steps for Ethiopia will include biosecurity initiatives to prevent the spread of disease and assessing management options in affected areas, along with preparation of management strategies to counter other invasive pests and pathogens. 🌿

ACIAR PROJECT: ‘Managing risk in South-East Asian forest biosecurity’ (FST/2018/179), ‘Building an effective forest health and biosecurity network in South-East Asia’ (FST/2020/123), ‘Management of *Acacia decurrens* Pests and Diseases in Ethiopia’ (FST/2021/162)



Genetic knowledge leads to effective options for crop threats

Untangling the genetics behind two devastating crop threats – faba bean gall disease and fall armyworm – is helping to develop better control and management options for farmers worldwide.

When faba bean gall disease was identified in Ethiopia a decade ago, surveys showed that 50–100% of crops quickly became infected. What followed was complete crop failure in many instances.

Today, the story is very different. Work to identify the correct pathogen has helped to develop targeted control and management strategies. This now includes a fungicide seed dressing that has vastly reduced disease levels.

This ACIAR-funded research project is a good example of how a better understanding of pests and diseases is an essential part of developing effective management practices. In turn, this brings important biosecurity benefits to Australia and its partners.

A similar approach as part of another ACIAR-funded project is also helping to counter a more recent pest incursion – fall armyworm – and create more targeted management options for farmers.

Dr Eric Huttner, ACIAR Research Program Manager, Crops, said that both ACIAR-supported projects showed what could be achieved, especially when genetic solutions, such as resistant material, were still being sought. ‘Crop management can often be the only option farmers have to keep pest and disease levels below economic thresholds.’

Faba bean gall disease

Faba bean is of critical importance to food security in Ethiopia, where it has been cultivated for millennia.

Dr Asnakech Tekalign Beyene, a plant pathologist and breeder at the Ethiopian Institute of Agricultural Research, said the pulse crop was used:

- as a protein source
- as animal fodder
- to fix atmospheric nitrogen thereby maintaining soil fertility
- to reduce soil-borne diseases and as an income source.

Until recently, strategies to control and manage faba bean gall disease were based on the incorrectly identified pathogen *Olpidium viciae*, which belongs to a genus generally restricted to underground parts of the plant.

Instead, the correctly identified pathogen, *Physoderma*, is an above-ground pathogen primarily spread by rain splash.

The project team behind the correct diagnosis included the University of Western Australia (UWA), the New South Wales Department of Primary Industries, and researchers from the Ethiopian Institute for Agricultural Research, Debre Birhan Agricultural Research Center in Ethiopia, and the International Center for Agricultural Research in the Dry Areas (ICARDA) in Morocco.

UWA Professor Martin Barbetti said management strategies could now be aligned with the pathogen’s nature and behaviour, which is important in managing biosecurity risks. ‘We can now predict when the zoospores will be released and other intervention strategies to reduce reinfection cycles and disease severity.’

Dr Asnakech, the project’s co-principal investigator, said the diagnostics to correctly identify the pathogen had proved crucial. ‘Without properly identifying the causal pathogen and knowing the pathogen’s genetic variability and diversity, disease control efforts can be a waste of time and money or lead to further plant losses.’ But with this new knowledge, Dr Asnakech said the right fungicide seed dressing could be applied and has proved successful.

Key points

- 1 Genetic research to better understand pests and diseases plays an essential part in developing effective management practices.
- 2 In Ethiopia, identifying the correct pathogen behind faba bean gall disease has led to improved management options.
- 3 For the devastating fall armyworm, which has been widely detected in Africa, Asia and Australia, an understanding of its genetic differences has helped inform pest management strategies.



ACIAR project leader Dr Wee Tek Tay examines fall armyworm samples in the CSIRO laboratory. Photo: ACIAR



Dr Asnakech Tekalign Beyene inspects a faba bean trial project that is monitoring the disease in Ethiopia. Photo: ACIAR

Fall armyworm

Since its first reported detection in western Africa in 2016, the invasive fall armyworm has also been widely detected in Africa, Asia and Australia. It is now spreading through the Pacific region.

However, recent genomic studies undertaken via an ACIAR-supported project have provided the foundational work needed to develop integrated pest management plans and challenge previous population classifications.

Historically, fall armyworm has been classified as either rice-preferred or corn-preferred, alluding to both the pests' preferred food source and genetic diversity.

Research, led by Dr Wee Tek Tay from CSIRO, has instead confirmed significant genetic differences between these 2 classifications. It also led to the realisation that the worm's spread was due to multiple independent introduction events, not only in western Africa but also in eastern Africa, Asia and South-East Asia.

These diverse pest populations have had varied responses to insecticides. The knowledge gained from




Dr Nguyen Van Liem inspects maize attacked by fall armyworm in Vietnam's Central Highland province, Gia Lai. Photo: Vietnam Plant Protection Research Institute (PPRI)

the research has helped inform pest management strategies, cautioning against an over-reliance on strategies based solely on western African fall armyworm populations. Instead, it highlighted the need to undertake regional insecticide bioassay studies to increase regional biosecurity preparedness and responses.

Fall armyworm is capable of damaging maize, sorghum, cotton, ginger, rice, barley and sugarcane. In Vietnam, Dr Nguyen Van Liem from the Vietnam Plant Protection Research Institute said that when fall armyworm was first officially recognised in 2019, corn growers were very concerned. 'However, thanks to the instruction and guidance from local plant protection agents, several control measures were applied, and it was quickly controlled.'

He said using the information learned in the ACIAR-supported project, the country was now working to identify fall armyworm migration within its northern provinces, determining natural enemies, and researching other management measures.

The fall armyworm project had many partner organisations in Indonesia, Vietnam, Laos, Myanmar, Cambodia, the Philippines, Malaysia and Uganda. It was also funded by the Grains Research and Development Corporation, Cotton Research and Development Corporation, FMC Australasia and Corteva Agriscience, and supported by Sugar Research Australia. 

ACIAR PROJECTS: 'Faba Bean in Ethiopia – mitigating disease constraints to improve productivity and sustainability' (CIM/2017/030), 'Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and Northern Australia' (CROP/2020/144)



New measures of biosecurity success

Biosecurity programs are critical to protect the environment and improve food security, and a new impact assessment framework will help evaluate the multiple benefits of ACIAR contributions in guarding against agricultural pests and diseases.

A new framework for assessing the impact of ACIAR-supported biosecurity programs is being developed. It will measure not only tangible economic and environmental impacts, but also benefits to society such as improved livelihoods and capacity building, which may not have previously been systematically assessed.

The framework is being designed by The University of Melbourne's Centre of Excellence for Biosecurity Risk Analysis (CEBRA). It presents a range of modelling options to evaluate impacts across a wide scope of biosecurity-related projects supported by ACIAR.

CEBRA chief investigator Professor Tom Kompas leads the framework development for ACIAR, which he said is due for completion early next year. The framework establishes a template for a transparent, rigorous investigation of the contribution that particular sets of projects make to biosecurity and societal outcomes.

Measuring change

Although economic benefit remains a critical measure, the framework contains other features that provide a more far-reaching and nuanced assessment of impact, he said. 'It's not just dollars and cents. It's community impact, social impact and environmental impact.'

Measurement of the broader impacts around societal change are guided by employing a 'Theory of Change' (ToC), developed at the framework's core. A ToC distils the thinking behind how a project is expected to contribute to longer-term changes. For ACIAR-supported biosecurity projects, this may include increased policy capability to manage pests and diseases, better health, more secure and profitable livelihoods, and even improved gender equity.

The impact assessment framework developed a series of generic ToCs for different types of biosecurity research projects – for example, biological control, vaccination and integrated pest management projects. These generic ToCs represent the hypotheses about how these projects were expected to work. The team will then collect data and develop models to test the hypotheses in the real world and show the scale of changes achieved in these different domains.

CEBRA ecologist Dr Edith Arndt, who developed the framework's ToC models, said significant societal benefits from biosecurity projects have traditionally flown under the radar.

'This framework builds on the good evaluation culture ACIAR has, and provides a more robust structure around evaluating the impact on issues, such as food security and gender equity, by using metrics and not just qualitative information based on anecdotes and observations,' said Dr Arndt.

Other features of the framework include bioeconomic modelling options for evaluation, such as a sophisticated cost-benefit analysis that can measure intangible benefits of suppressing pests or disease, and a toolbox of spread models that simulate the growing distribution of target pests.

CEBRA economist Ms Christine Li, who identified and developed the framework's economic and spread analysis models, said the resource aligns with ACIAR objectives by enabling the collection of quantifiable data on economic, social and environmental impacts.

'Having these sorts of evaluation guidelines means that people can collect data necessary for evaluation right from the start,' said Ms Li. 'Because you can't manage what you don't measure.'

Benefits and improvement

Over the past 40 years, ACIAR has invested in more than 90 biosecurity projects focused on pests and diseases affecting food security and livelihoods for smallholder farmers in diverse agrifood production systems in partner countries.

'Most of these projects also have a significant value to Australia as it helps us to understand, prepare for and prevent cross-border spread of pests and diseases more effectively,' said Ms Bethany Davies, ACIAR Research Program Manager, Portfolio Planning and Impact Evaluation.

The need to more accurately capture the regional benefits of strong biosecurity systems, as well as the value of benefits for Australia in terms of forward defence against biosecurity threats, underpins the new framework being developed.

Ms Davies said that although ACIAR can clearly demonstrate that its use of the Official Development



Key points

- 1 A new framework is being developed to assess the impact of ACIAR-supported biosecurity projects.
- 2 The framework will enable the measurement of economic and environmental impacts as well as benefits to society that may not have previously been recorded.
- 3 This will demonstrate the scale of benefits to partner countries and to Australia, and help refine the design of future projects.

Australian researchers working on a banana *Fusarium* wilt biosecurity program with partners in the Philippines gained valuable knowledge that has helped to shape the Australian industry's response to the disease. Photo: Conor Ashleigh

Assistance budget has made a substantial difference to the specific places where it works, the value of co-benefits to Australian farmers has not been as clear.

'Our work in biosecurity is an example of an area of work that simultaneously delivers huge benefits to both partner countries and it is important to share these stories as well.

'The evaluations also help us learn more about how to conduct agricultural research for development more

'Our work in biosecurity is an example of an area of work that simultaneously delivers huge benefits to both partner countries and it is important to share these stories as well'

effectively in the future – by reflecting on what worked and what didn't and how we can achieve better development results,' said Ms Davies.

She expects the new framework will help to more systematically document how biosecurity projects can contribute to multiple benefits and support the development of more sophisticated and nuanced research projects in the future. 🌱

ACIAR PROJECT: 'Valuing the contribution of ACIAR to biosecurity in Australia and overseas' (IE/2021/168)



One Health lens on Indo-Pacific biosecurity

A strong animal health workforce in the region is essential to good biosecurity and thus health security in Australia and globally.



By Australia's Ambassador for Regional Health Security Dr Stephanie Williams, on behalf of the Indo-Pacific Centre for Health Security

The natural environment, production systems, the urban environment, and human health and wellness are interlinked. As one example, climate change is impacting biodiversity, increasing temperatures, altering water systems and animal behaviour, and increasing the intensity of environmental disasters. These impacts threaten livelihoods, food security and health systems, and are likely to influence the emergence, resurgence and distribution of infectious diseases around the world.

One Health is a unifying approach that aims to sustainably balance and optimise the health of people, animals and ecosystems.

Appropriate biosecurity measures are an important way to prevent diseases spreading through the environment and between animals and humans. These measures are particularly needed on farms and in animal and human health laboratories.

The Indo-Pacific Centre for Health Security is a part of Australia's Department of Foreign Affairs and Trade. The Centre partners with organisations such as ACIAR, working with governments in the Pacific region and South-East Asia to support regional infectious disease control, detection and response in both animals and humans.

Partnerships for engagement

Partnerships are essential to enable collaboration of research, sharing of information and joint use of finite resources. The Indo-Pacific Centre for Health Security has built a strong relationship with the Australian Centre for Disease Preparedness (ACDP), run by science research agency CSIRO.

The partnership with ACDP aims to improve systems, structures and processes that support quality laboratory diagnostics in partner government institutions in South-East Asia, enabling biosafety, quality assurance, laboratory data management and communication within facilities. Importantly, it helps laboratories to generate consistently accurate testing results when identifying pathogens and resistance.

The ACDP partnership is providing training and mentoring in diagnostic disciplines including pathology, virology, tissue culture, serology, genome sequencing and bioinformatics. This approach helps to build staff competency, increase the number of trained staff and provides opportunities to improve diagnostic processes to align with international best practice.

As is the case with ACIAR, gender equality and promoting opportunities for women in leadership are priorities within all the Centre's partnerships. It provides specific opportunities, such as short research activities and laboratory placements, to develop women's leadership skills, building expertise and professional relationships.

The Centre also partners with the World Organisation for Animal Health (WOAH) to support countries in South-East Asia and the Pacific region. This partnership was established in 2019 and supports the WOAH Performance of Veterinary Services (PVS) cycle with a focus on delivering national bridging workshops.

The workshops are a joint effort by WOAH and the World Health Organization to bring human and animal health

Key points

- 1 One Health offers a unifying approach to address the challenges to human, animal and environmental health emerging from changes in natural and human systems.
- 2 Partnerships are essential to building capacity for accurate diagnosis, surveillance and reporting to improve control of animal and human disease in the Pacific region and South-East Asia.
- 3 Support is also being provided to respond to the spread of antimicrobial resistance in the Pacific region.



The Australian Centre for Disease Preparedness at CSIRO provides training in how to prevent contamination of samples collected for disease diagnosis. Photo: CSIRO



Mrs Kamlesh Nandini is among the many smallholder farmers in Fiji who will benefit from efforts to prevent the development of antimicrobial resistance to animal and human medicines. Photo ACIAR

counterparts together to identify priority areas where they can work together to improve the national health security system.

WOAH also makes available targeted support under the PVS cycle to strengthen the capacity of veterinary services using diverse training methods, ranging from more traditional physical formats to the delivery of e-learning modules. It supports improved and timely reporting to global disease surveillance systems by training veterinary services to use the World Animal Health Information System and its data to inform decision-making.

Tackling antimicrobial resistance

It is not just diseases that can spread through human health, animal health and ecological systems. Antimicrobial resistance (AMR) undermines the effective treatments of many human and animal diseases. It is increasingly recognised as a major challenge across the world. Support to address AMR in low-income to middle-income countries mostly targets countries in the African and Asian regions, leaving gaps in the Pacific region.

The Research for One Health Systems Strengthening (ROHSS) Program is a partnership between the Indo-Pacific Centre for Health Security and ACIAR, which includes a project to support Fiji's multisectoral National AMR Coordination Committee. This project is led by CSIRO and is helping the committee implement the National Antimicrobial Resistance Action Plan. Fiji was the first Pacific country to create an AMR action plan.

The ROHSS project 'Enhancing the management of antimicrobial resistance in Fiji' has been determining opportunities and gaps for integrated surveillance and training for practitioners and professionals working on AMR. This includes laboratory technicians, human healthcare support workers and animal health workers.

Research to strengthen One Health systems

The Research for One Health Systems Strengthening (ROHSS) Program is co-funded by ACIAR and the Australian Department of Foreign Affairs and Trade (DFAT). It is managed by ACIAR and delivered through a partnership with the DFAT Indo-Pacific Centre for Health Security.

The program is bringing together leading Australian researchers and regional counterparts to address issues at the critical interface between people, animals and the environment. A better understanding of the impacts of food production and other agricultural activities on human health and the environment can help generate the evidence base for moving forward with One Health across the Indo-Pacific region. Research plays a critical role in this.

The Indo-Pacific Centre for Health Security has valuable experience in strengthening human health systems and ACIAR has expertise in agricultural systems research. Working together, these two agencies have made a significant contribution to intersectoral and multidisciplinary approaches that address One Health in a sustainable way across the Indo-Pacific region.

Its aim is to position Fiji as a leader for AMR efforts and skills training in the Pacific region and to make recommendations for cost-effective One Health AMR intervention pathways and surveillance suitable for Fiji's Pacific context. This, in-turn, will be able to help partner countries in the Pacific region. 🌿

ACIAR PROJECT: 'Enhancing the management of antimicrobial resistance in Fiji' (LS/2019/119)



Animal health: a cornerstone for public health

Research into the role of traditional or so-called ‘wet markets’ following the COVID-19 pandemic has shown they have an important economic and social role that also benefits public health. Researchers say a key lesson is the need to strengthen the systems to prevent animal disease as a core foundation for improving public health holistically.

The COVID-19 pandemic saw people around the world subjected to the kinds of restrictions and mandatory practices common to the control of animal diseases. Travel limits were imposed, markets were closed and trade was restricted. New hygiene requirements were enforced and vaccinations became mandatory in many countries.

But disrupted markets and reduced economic activity, along with the loss of jobs and livelihoods, have led to rising poverty and food insecurity, along with increasing physical and mental health issues. Low-income to middle-income countries are most severely affected.

Dr Anna Okello, ACIAR Research Program Manager, Livestock Systems, states that COVID-19 puts a very human spin on the challenges that many people working in animal health regularly face: is the impact of the disease equal to or worse than the impact of the control measures? What can be done instead to prevent disease?

Dr Okello sees a One Health approach as key to answering such questions. One Health is based on the interconnectedness of humans, animals and ecosystems. It looks at systems in a holistic way, including agrifood systems, to recognise that improving the health of one improves the health of all.

Preventing the spread of zoonotic diseases (diseases and infections transmitted between vertebrate animals and people) is an important aspect of One Health, but so too is the broader health and productivity of livestock and the impacts of this on both people and the planet.

Zoonotic diseases

Dr Okello said many new diseases were emerging as the relationships between people, animals and the environment changed.

‘Human populations have grown into new geographic areas, more people are living in close contact with domestic animals, and deforestation and intensive farming practices have disrupted biodiversity and habitats. This provides new

opportunities for diseases to pass between animals and people.

‘When animal diseases get into the human domain, people take them seriously. But when animal diseases are circulating among animal species, it’s very hard to get funding for preventative measures,’ said Dr Okello.

To address this, much of the ACIAR livestock systems research program is focused around generating evidence to promote the business case for investment in animal health services. One Health, as a concept, is part of that business case.’

‘Much of the ACIAR livestock systems research program is focused around generating evidence to promote the business case for investment in animal health services.’

Traditional market challenges and opportunities

Traditional or wet markets offer an example of the complex interactions between people, animals and the broader environment. There are many forms of traditional markets around the world but they are essentially farmers’ markets where fresh produce and meat are sold.

Original reports that COVID-19 may have emerged at a traditional market as a consequence of zoonotic transmission heightened concerns about the health risks these markets represent. As part of a rapid research impact series commissioned in 2020, one ACIAR study looked at the role of traditional markets within local communities and the impacts of COVID-19 controls on this role.

The project was led by medical anthropologist Dr Kevin Bardosh, a United States-based research associate with



Key points

- 1 Disease control responses can benefit from recognising the interconnected impacts of animal, human and environmental health, otherwise known as One Health.
- 2 Zoonotic diseases represent only one element of the impacts of animal disease on human health and livelihoods.
- 3 A case study in Indonesia will help to develop metrics for the Global Burden of Animal Disease initiative to develop international priorities for animal disease prevention.

Food supply systems in Vietnam were disrupted when traditional markets were closed as part of COVID-19 restrictions. Photo: ACIAR

RMIT University, Australia. His team examined traditional markets in Kenya, the Philippines and Vietnam as case studies.

Dr Bardosh said there is a perception that the wildlife trade is typically the major source for disease risk at traditional markets, but this is increasingly regulated. He said greater health risks come from increasingly

intensified livestock farming systems with little veterinary oversight and from inadequate food safety practices.

Also, many traditional markets have been modernised in recent years, improving their cleanliness and appearance with improved sanitation and waste services. The aim is to improve the customer experience as markets compete with supermarkets and online trading.

'This has an important positive effect on disease control, although it is not the primary objective of the improvements,' said Dr Bardosh. He points out that these upgrades align with an improving socioeconomic trend in a region, which might result from other larger development programs not associated with health measures.

Traditional markets offering access to fresh food social interaction and income and are a source of health, food security and sociocultural wellbeing for many people, rather than a source of risk and disease.



A One Health approach in agricultural research and development considers that the health of people, livestock and the environment are interconnected. Photo: ACIAR

Looking at the impacts of COVID-19 policies, Dr Bardosh said the Philippines prioritised its food systems as an essential service early in the pandemic. Therefore, there were fewer disruptions to markets and food supply systems, despite strict lockdowns across the country.

In Kenya, there were generally fewer restrictions overall, although two lockdowns did disrupt market operations and trade. Vietnam pursued 'zero-COVID' policies, which created significant disruptions to food supply chains. Markets were closed for months at a time, followed by snap closures related to changing COVID-19 case numbers, creating difficulties along the entire food supply chain.

Dr Bardosh also highlighted grey areas between regulations, enforcement and the practicalities of producing and buying food. These include inconsistent enforcement and punitive approaches that can reduce trust and lead people to circumnavigate the rules meant to protect them. Dr Bardosh is now involved in a follow-on ACIAR-supported project, a high-level consortium on global animal health governance, to identify policy gaps and alternative policy approaches.

Global burden of animal diseases

ACIAR is also a partner in an international initiative to determine the Global Burden of Animal Diseases (GBADs). It is modelled on the Global Burden of Disease for human health, which ranks and prioritises human health conditions that have the greatest burden on society, helping to direct international investment to achieve the greatest health outcomes.

The GBADs initiative, primarily funded by the Bill & Melinda Gates Foundation, involves an international consortium, led by the University of Liverpool in the UK. Phase one is developing the metrics to measure which animal diseases have the most economic impact.

ACIAR is supporting a case study in Indonesia to help develop the GBADs assessments. CSIRO livestock scientist Dr Dianne Mayberry is a member of the GBADs executive committee and is leading the Indonesian case study for ACIAR.

Dr Mayberry provided an overview of the project at the international TropAg conference in Brisbane, in November, highlighting the constant pressure on livestock from communicable and non-communicable diseases, inadequate access to feed and clean water, injuries and predation. These all affect the productivity and value of animals and the quality of animal products.

This contributes to declines in human health through the transmission of diseases and foodborne pathogens and malnutrition, as families had less food or were unable to buy food as a result of lost income. There were also many other multiplier effects of animal disease on smallholder households, given the large number of social, cultural and economic roles that livestock play in rural and peri-urban communities.


'At a global level, poor animal health can contribute to climate change and environmental degradation as more resources are required and more greenhouse gases are committed to produce a unit of output,' said Dr Mayberry.

Indonesian case study

The Indonesian case study will focus on poultry and dairy production systems in West Java, beef cattle in East Java and pigs in East Nusa Tenggara, as being representative of the diverse production systems across the country, ranging from smallholder farmers to large corporate enterprises.

At the Indonesian National Research and Innovation Agency (BRIN), Dr Harimurti Nuradji is head of the Research Centre for Veterinary Science, Research Organization for Health and is a partner in the research to fill the knowledge gaps about the burden of animal disease in Indonesia.

'I believe biosecurity is the best way to defend against diseases. We have to prevent, rather than control, disease,' said Dr Nuradji. 'We are looking at animal numbers and production systems, the number of diseases, and also the social, economic and political aspects.'

He said the support from ACIAR for the project is providing a valuable exchange of expertise and experience for Australian and Indonesian researchers. 'We can share information and knowledge to prevent disease, not just for us, but for Australia as well, by better understanding the disease systems in Asia,' said Dr Nuradji. 

ACIAR PROJECT: 'Rapid Impact Survey on the role wet markets in Philippines, Kenya Vietnam' (LS2020/204), 'Global Burden of Animal Disease Initiative: Indonesia Health Study' (LS/2020/156)



Honey bee threats on the horizon

Biosecurity is central to the latest ACIAR-supported beekeeping project in Fiji and Papua New Guinea, which builds on more than 30 years of research partnerships to support livelihoods in the Pacific region and protect Australia's honey bee industry.

Until May 2022, Australia was free of the world's most feared threat to the honey bee industry: the *Varroa destructor* mite. Since then, thousands of hives and feral bee colonies in New South Wales, where the *Varroa* mite has since been detected, have been destroyed in an effort to eradicate the pest and protect Australia's \$147 million honey sector and the \$14.2 billion worth of pollination services that bees provide to the agriculture sector.

The eradication campaign is ongoing, but Australia was well prepared in terms of its surveillance, emergency response and the steps that may be needed to live with the pest, should eradication fail. This is in part thanks to ACIAR-supported research in neighbouring countries undertaken over the past 3 decades.

Beekeeper Mr Charlie Mills checks the health of hives in Fiji, looking for signs of pests and disease. Photo: Southern Cross University



The work has helped the Pacific region develop their honey bee industries and provide new livelihood opportunities. It has also informed Australia's National Bee Pest Surveillance Program, which has been credited with delaying what the sector saw as the inevitable arrival of the greatest threat to honey bee colonies globally, *Varroa destructor*.

In neighbouring Papua New Guinea and Fiji, *Varroa* mite was first detected in 2015 and 2018 respectively. Another equally concerning parasitic mite, *Tropilaelaps*, has also been impacting beekeeping businesses in PNG for decades but has not yet been detected in Australia.

Productivity and biosecurity

Fiji and PNG are partners in the latest ACIAR-supported bee project, which aims to help increase the productivity and profitability of smallholder enterprises. Southern Cross University (SCU) in New South Wales is leading the 4-year project, working with industry partners in the Fiji Ministry of Agriculture, the Biosecurity Authority of Fiji, the Fiji Beekeepers Association (FBA), the PNG Coffee Industry Corporation, and the PNG Department of Agriculture and Livestock.

Dr Cooper Schouten, a beekeeping expert from SCU, is leading the project and has said that biosecurity is a crucial element. 'It is critical that our beekeeping industries in the region are able to identify, monitor and manage pests and diseases, understand the reliability and sensitivity of detection methods, and have the capacity to manage honey bee pests and diseases.'

He explained that emerging pests and diseases, such as *Varroa* mite, undermine the industry by reducing the productivity and profitability of beekeeping. Beekeepers need more support to grow their skills and knowledge to



Local beekeepers take part in bee management workshops and experiments in Papua New Guinea. Photo: Southern Cross University

identify and respond to threats. The costs and access to chemical treatments can also be prohibitive.

Varroa mite response in PNG

Mr Shayne Loie Tumae is a second-generation beekeeper from PNG who said when *Varroa* mite arrived in the country, honey production more than halved. Anecdotally, up to 80% of hives were affected.

Mr Tumae has worked alongside Dr Schouten and Dr John Roberts from CSIRO as part of the ACIAR-supported project, conducting mite surveys and management experiments across PNG. He said this had been valuable in identifying the extent of mite infestations and the available management options.

'Many beekeepers did not know why their hives were dying. They would bring out their dead hives to show us,' he said. The ACIAR bee team developed recommendations with the PNG Government and helped to source and secure approval to import a range of miticides to help beekeepers manage *Varroa* mite infestations.

'The nationwide treatment has really helped to drop the numbers of mites in the hives, so the farmers get a good crop of honey. It's been a good opportunity for me to learn more too,' said Mr Tumae.

Key points

- 1 ACIAR-supported research in the Pacific region contributes to active monitoring of evolving honey bee pests and diseases that threaten Australia's honey production and pollination-dependant horticultural industries.
- 2 Addressing threats in partner countries helps to protect livelihoods and informs biosecurity planning in Australian and partner countries.
- 3 Monitoring and managing honey bees to ensure they remain healthy is essential in preventing the spread of pests and diseases.



Management options

Miticides are being used in conjunction with other chemical free and no-cost husbandry practices, which have been adapted from other countries as part of the 'tool-box of management options' the project is developing – options Australian beekeepers could also make use of.

Creating a temporary break in the bee breeding cycle by caging or removing a queen bee, or triggering a new swarm, removes the 'brood' of developing bees that the mites attach themselves to and feed on. This effectively reduces both *Varroa* and *Tropilaelaps* mites.

The project is also trialling new bee genetics, bred for both improved productivity and tolerance to *Varroa* mite.

The Biosecurity Authority of Fiji worked closely with key industry stakeholders, the Fiji Ministry of Agriculture and the Fiji Beekeepers Association to allow them to receive Australian-bred queen bees earlier in 2022 through the ACIAR-supported project. PNG will receive new queens within the next 6 months. FBA president Mr Nilesh Kuma said members were excited to test the productivity of the new queens in Fiji conditions. He is hoping the new queens will contribute to a more resilient and productive beekeeping industry in the country.

Bee health and surveillance

Apart from mites, the project is also working closely with industry stakeholders to enhance honey bee biosecurity capacity and programs to prevent, respond to and recover from pests and diseases.

These include American foulbrood disease, a fatal disease of honey bees that is endemic to Australia and found in Fiji, but is not yet in PNG. The small hive beetle (*Aethina tumida*) found in Australia also presents a significant threat to the Pacific region, which is still free of this pest.

As more people become interested in beekeeping in the Pacific region and in Australia, they are also challenged by these pest management issues.

Papua New Guinea beekeeper Ms Henao Longgar holds a frame of honey while conducting a full hive inspection for pest and diseases. Photo: Southern Cross University.



Dr Schouten emphasised that bees, like other livestock, require attention to nutrition, genetics and pests and diseases to be healthy and productive. Otherwise, poorly managed hives represent an ongoing biosecurity risk for other beekeepers and for pollination-dependant industries that rely on bees to produce crops.

ACIAR Research Program Manager, Livestock, Dr Anna Okello, said the incursion of *Varroa destructor* serves as a poignant reminder of the need to invest in regional biosecurity capacity.

'The *Varroa* mite incursion, while tragic, is just one of several biosecurity threats endangering the livelihoods and food security of millions of people throughout the Pacific region,' said Dr Okello.

'Australia's biosecurity capacity is world-class. Our expertise and knowledge are vital in helping our partner countries manage pests and diseases in agrifood systems.

'It's also very much in Australia's interest that our regional neighbours have the scientific and policy capability to manage these threats.'

'It's also very much in Australia's interest that our regional neighbours have the scientific and policy capability to manage these threats.'

ACIAR-funded projects enable Australian agricultural and biosecurity experts to investigate and help our partners to address emerging regional threats before they reach Australian shores.

Other pests and diseases posing a threat to regional health and food security and Australia's agricultural industries (including Panama disease, fall armyworm, zoonotic malaria, Japanese encephalitis and African swine fever) have also been the focus of ACIAR-funded research in recent years.

'Responses to biosecurity incursions need to be rapid. If you haven't already invested in efforts to understand how to manage the threat before it arrives, it's already too late,' said Dr Okello.

'There's a strong need for greater regional collaboration and long-term partnership fostering people-to-people technical linkages.

'Deep partnerships and mutually beneficial regional networks are a tremendous asset in developing pre-border biosecurity for Australian agricultural industries.'

ACIAR PROJECT: 'Increasing the productivity and profitability of smallholder beekeeping enterprises in PNG and Fiji' (LS/2014/042)



Protecting bananas for food security in eastern Africa

A new ACIAR-supported project is working with researchers and smallholder farmers in Mozambique and Tanzania to protect essential banana production systems from the deadly *Fusarium* wilt TR4 disease that has devastated plantations around the globe.

Cavendish dessert bananas are widespread in southern Africa. This high-yielding export variety dominates production in countries such as Mozambique, South Africa, Malawi and Zimbabwe. But smallholders in Africa also grow many other local banana varieties for eating fresh, cooking and brewing beer – varieties that are unique to Africa.

In eastern and central Africa, particularly in eastern African highland countries such as Tanzania and Uganda, local cooking banana varieties are essential to food security. More than 100 million people rely on them as a primary source of carbohydrates and nutrient-dense calories, with an average of more than 300 kilograms being consumed per person a year.

A new ACIAR-funded project is investigating the risk that banana production systems in eastern Africa face from *Fusarium* wilt tropical race 4 (TR4; also known as *Fusarium* wilt or Panama disease). This is a soil-borne fungal disease that is impacting Cavendish bananas in major production areas outside of Africa.

The fungal pathogen that causes the disease, *Fusarium oxysporum* f. sp. *cubense*, affects a wide range of other banana varieties; the project will assess if Africa's local banana varieties are also vulnerable.

The project focuses on two countries. The first is Mozambique in southern Africa, where *Fusarium* wilt TR4 was first detected in 2013. The second country is neighbouring Tanzania in eastern Africa, the continent's second-largest producer of bananas and, so far, free of *Fusarium* wilt TR4, although feared to be at high risk of infection.

The TR4 pathogen is moved from place to place in infected plant material, contaminated soil or water. There is no treatment and infected plants eventually die.

Leading the project for ACIAR are Stewart Lindsay and Ingrid Jenkins from the banana production systems team at the Queensland Department of Agriculture and Fisheries.

Mr Lindsay said most existing biosecurity and management resources regarding *Fusarium* wilt TR4 have been developed for Cavendish plantations and do not necessarily reflect the inherent risks in smallholder production systems in Africa, or for local African bananas.

Mapping production systems

Globally, Cavendish is commonly grown in monoculture plantations, but in Africa it is often part of a mixed crop system. Most smallholders farm less than one hectare and grow several crops at once, such as bananas, coffee, beans, yams and vegetables.

Researchers will work directly with smallholders in Mozambique and Tanzania to identify what aspects of their production systems present the greatest risk of TR4 infection. The researchers also aim to develop practical and culturally appropriate biosecurity practices to help reduce the risk of infection.

Mr Lindsay said his experience with a previous ACIAR-supported project in the Philippines in 2014 highlighted the importance of taking local cultural and social conditions into account. This required working with not just smallholder farmers, as originally planned, but also the corporate organisations they supplied. ACIAR now has a follow-up project underway in South-East Asia working across the supply chain.

Overseeing the new project in Africa is Professor Altus Viljoen, a plant pathologist at Stellenbosch University who verified the first known outbreak of TR4 in Mozambique in 2013.

Professor Viljoen said surveillance in Mozambique and neighbouring countries, based on visual inspections of plantations and tissue samples, has not found any further spread from the 4 plantations initially infected. 'But we are extremely concerned about this,' he added.

'The ACIAR-supported project will help by trying to bring some biosecurity measures not for commercial growers,



Key points

- 1 The spread of *Fusarium* wilt TR4 in banana production systems in Africa poses a major threat to food security and livelihoods.
- 2 An ACIAR-funded project will work with smallholder farmers in Mozambique and Tanzania to identify practical biosecurity approaches.
- 3 African banana varieties will be screened for resistance to the *Fusarium* wilt TR4 pathogen.

but for smallholders, who dominate banana production in Africa,' said Professor Viljoen.

'I think the technologies and the approaches we develop through this project will be applicable beyond the borders of the two countries.'

In Mozambique, there are about 70,000 hectares planted to bananas, of which about 6,000 hectares are larger commercial plantations. Tanzania has more than 550,000 hectares of bananas and millions of smallholder farmers. Cavendish makes up a substantial portion of total production, but it is the local bananas that form the basis of daily diets across the region.

Project partners in Mozambique include the Ministry of Agriculture and Rural Development, and the Mozambique Institute of Agricultural Research. In Tanzania, partners include the International Institute of Tropical Agriculture, the Ministry of Agriculture and the Tanzania Agricultural Research Institute (TARI).

A new research project in Africa will help smallholder banana growers develop biosecurity practices they can use to protect their crops from *Fusarium* wilt. Photo: Conor Ashleigh

Support for local farmers

TARI's national banana research coordinator Dr Mpoki Shimwela said with the threat of TR4 on the border, the emphasis is on raising awareness among farmers, especially along the border with Mozambique.

'We want to train farmers on how to identify the disease, because most of them don't know what it looks like, and to help identify biosecurity measures they can apply.'

As there are many women farming in Africa, Dr Shimwela highlighted the importance of ensuring that women farmers are involved in mapping farm systems, creating awareness of the disease and developing biosecurity practices.

The project will also increase the capacity of project team staff and organisations in technical aspects of *Fusarium* wilt TR4 research and effective biosecurity extension and communication methods. This project is funded through the ACIAR Horticulture Program and runs until the end of 2024. 🌱

ACIAR PROJECT: 'Developing a biosecurity system for small banana growers resilient to *Fusarium* wilt TR4 in southern and eastern Africa' (HORT/2020/128)

Arming the Pacific region against pests and disease

Networks developed through the ACIAR Pacific Plant Biosecurity Partnership program continue to help strengthen capacity in the prevention of the spread of pests and disease in crops throughout the region, despite COVID-19 disrupting the program.

Mr Abel Ximenes has worked as a plant pathologist in Timor-Leste's Ministry of Agriculture and Fisheries for 15 years. He has contributed to several scientific papers on disease in crops and is an active collaborator with the Northern Australia Quarantine Strategy.

But even with his considerable experience, he said being involved in the ACIAR Pacific Plant Biosecurity Partnership program was invaluable.

Through the program, he learned new techniques in surveillance and diagnostics as well as processes to assist in safe trade. And he built relationships that continue to enhance his work in biosecurity, long after the program officially ended.

'Meeting people and developing networks was important because those connections have given me very good information on plant biosecurity and how to handle disease and pest issues,' said Mr Ximenes. 'We have a WhatsApp group and when I share a picture, members of the group give me feedback.'

This peer network provides smaller, resource-poor countries such as Timor-Leste with diagnostic support, but also builds real-time knowledge around biosecurity threats throughout the region.

'It's a strong network,' said biosecurity specialist Mr Bill Magee, who co-managed the ACIAR-funded program modelled on successful ACIAR capacity-building work in Africa.

The Pacific Plant Biosecurity Partnership program began in 2019, providing fellowships for 19 participants working in plant protection organisations from 9 countries across the Pacific region: Fiji, Kiribati, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu and Vanuatu.

Mr Magee said participants developed their network during the 2 weeks of workshops in Brisbane looking at in-country control processes, trade and communication. New relationships were also formed with Australian biosecurity researchers and service providers during 3 weeks of placements with agencies for practical training.

Participants were embedded in government departments, universities and industry bodies focused

on their nominated priorities including quarantine processes, plant risk assessment and diagnostics.

'It was really hands-on, intensive, on-the-job training,' said program co-manager Mr Rob Duthie, CEO of Pacific biosecurity specialists Kalang Consulting Services. The placements also worked as a two-way exchange, he said.

Australian host institutions gained valuable insights into operations, processes and people involved in biosecurity in neighbouring Pacific countries. And this understanding and relationship building ultimately leads to strengthened biosecurity in the region and safer trade.

For example, Mr Ximenes was placed with the New South Wales Department of Primary Industries (NSW DPI), gaining insights to improve his surveillance methods to detect pests and disease and learning how to use molecular tools to diagnose disease. He now regularly sends samples to Australia for testing through contacts he made in the program. Meanwhile, NSW DPI staff gained an understanding of the biosecurity challenges facing Timor-Leste through a presentation and insights Mr Ximenes provided during his placement.

Key points

- 1 Biosecurity has been strengthened in the Pacific region through the Pacific Plant Biosecurity Partnership program.
- 2 Participants from 9 Pacific countries have developed their skills, networks and capacity to facilitate trade and prevent the spread of disease.
- 3 Relationships and resources created through the program continue to provide support for information-sharing around plant pests and diseases to aid food security.



Participants at the Pacific Plant Biosecurity Partnership convened in Brisbane in 2019 for 2 weeks of workshops that covered technical skills and a communications masterclass. Photo: Kalang Consulting Services

Building capacity

Mr Duthie said collaboration in the region is critical for managing biosecurity risks that are growing with an increase in agricultural trade and tourism and the impacts of climate change that are aiding the spread of new pests and diseases.

Biosecurity threats include African swine fever moving from Indonesia into Papua New Guinea, coconut rhinoceros beetle incursions in Vanuatu and the spread of ant species through the Pacific region that can threaten exports.

Building skills in trade negotiation around biosecurity issues to support greater market access and ensure safe imports was a key component of the workshops. Participants took part in a trade simulation exercise replicating the negotiation and advocacy process on biosecurity protocols for safe trade. In Timor-Leste, Mr Ximenes used these new skills to inform protocols and increase exports of coffee beans and copra (dried coconut flesh).

As part of the project, the Crawford Fund supported a masterclass in communications strategies for a variety of audiences, such as those looking for guidance when informing the public and those wanting to have greater influence within their organisations.

'They went back armed with specific communication plans and a strategy for change in-country, which was great,' said Mr Duthie. The program has also aided their careers.

On their return, program fellow Tongan Mr Semi Hausia was appointed to the team negotiating a free trade agreement in the Pacific region. With new skills in surveillance and monitoring, Vanuatu fellows

Ms Sylvie Boulekouran and Ms Touasi Tiwok became heads of the response team against the coconut rhinoceros beetle. And Ms Talei Fidow-Moors, a Fijian who was working in quarantine services in Samoa, now has a high-ranking position with the New Zealand Ministry for Primary Industries.

Model for the future

Although COVID-19 travel bans forced the cancellation of follow-up workshops in-country, the program was successfully completed via a remote model – a success aided by the strength of the online relationships the program had already fostered.

The resulting 'learning management system' comprises a range of online training modules on topics including monitoring and surveillance systems, diagnostic techniques and technologies, and risk assessment programs for imported products. This training package remains an enduring resource for future use.

Ms Irene Kernot, ACIAR Research Program Manager, Horticulture, said other projects including the Pacific integrated pest and disease management project led by Professor Michael Furlong at the University of Queensland (HORT/2016/185) are also realising the importance of informal networks to complement formal interaction. During the COVID-19 pandemic, regular meetings have built a strong community of practice integrating biosecurity into a broader pest management community. 🌱

ACIAR PROJECT: 'Improving plant biosecurity in the Pacific Islands' (FR/2021/039)



Biosecurity collaboration is a cornerstone in food security

The participation of ACIAR in the Plant Biosecurity Research Initiative brings valuable international insights to Australia's biosecurity research collaborations.



By Dr Jo Luck,
program director,
Plant Biosecurity
Research Initiative

Biosecurity is one of the crucial intersections for research collaborations between Australian agricultural researchers and ACIAR-supported activity in partner countries. This is an increasingly vital area for research and extension to control the spread of pests and diseases within and between countries. It is also often a determining factor in global food security and being able to trade farm goods.

Effective biosecurity is a focus for all cropping industries supported by Australia's Rural Research and Development Corporations (RDCs) and their research partners in the Department of Agriculture, Fisheries and Forestry; Plant Health Australia; CSIRO; state agencies; universities and the private sector. In 2018-19, for example, the plant RDCs alone invested \$118 million in biosecurity research.

However, an intergovernmental review in 2017 found that it was often the same research being delivered by the same research providers for single industry outcomes. This lack of coordination was not only costly but also posed a risk to effective disease protection and response.

Collaborating across borders

In 2017, the Plant Biosecurity Research Initiative (PBRI) was established to remedy this. Through the PBRI, RDCs, government departments and research bodies come together to coordinate and co-invest in research, especially for large, complex projects. Since November 2020, this collaborative approach to biosecurity research has included ACIAR, through a Memorandum of Understanding.

International fruit-fly experiences have been shared through the Plant Biosecurity Research Initiative.
Photo: ACIAR



The ACIAR–PBRI relationship is particularly significant and unique because it allows Australian researchers to work with ACIAR in a partner country where there is a disease that Australia does not yet have. It allows us to provide research support that extends knowledge and capabilities in that country and also gives Australian researchers experience that better prepares Australian industries for any pest or disease incursion.

The PBRI and ACIAR are exploring common areas of biosecurity research and extension in which to collaborate.

The PBRI has established a formal Biosecurity Extension Community. This community comprises about 110 members from all of our plant industries and the honey bee industry. We have quarterly online meetings at which we also have an expert speaker. Having ACIAR as a partner broadens the scope of the information we share through this community.

Shared information to better prepare

Our September 2022 Biosecurity Extension Community meeting provided a briefing on fruit-fly extension in Indonesia, an ACIAR-supported project, and we were able to complement this with the fruit-fly extension work through the National Fruit Fly Council in Australia. The gathering allowed participants to learn about different extension tools and initiatives and identify gaps that could be remedied through PBRI and ACIAR research support.

Key points

- 1 The Plant Biosecurity Research Initiative aims to coordinate biosecurity research efforts in Australia.
- 2 Since 2020, ACIAR has participated in this initiative, allowing Australian researchers to work with ACIAR partner countries on improving Australian biosecurity efforts.
- 3 This helps foster professional development and capacity for the next generation of biosecurity researchers.

So even though we work in different industries or different countries, we are able to identify and use common threads. We envisage scientists or biosecurity practitioners from a region coming to Australia and working in laboratories here, and vice versa, with Australian scientists gaining in-field experience of pests in a regional setting.


Establishing relationships and sharing biosecurity expertise is important, particularly given Australia's reputation as a world leader in biosecurity research. We have a lot to offer in sharing the way we prepare for incursions. Investing in preparedness activities before a disease or pest arrives is a key strategy that highlights the importance of the ACIAR partnership.

PBRI members have a record of effective biosecurity responses. We saw an example of this with the collaboration across RDCs, CSIRO and ACIAR in response to the arrival of fall armyworm in Australia in 2020. Fall armyworm caterpillars can devastate subtropical crops like maize and sorghum. Australian researchers have been studying the pest's genetic code to identify which pesticides and other practices are the most effective. This knowledge will help farmers in Africa and South-East Asia as well as Australia.

Connecting with students

The PBRI is also playing an important role in fostering professional development and capacity building among the next generation of biosecurity researchers. We recently formed a plant health network for students whose studies include biosecurity, created by the PBRI-supported Ritman Scholars. We promoted the network on social media and received 210 responses from all over the world.

The network will meet each quarter to provide a community for students to connect, collaborate and share research updates and a forum for professional development and career pathway discussion.

The students have created a Slack channel to connect and have global conversations about plant biosecurity research. This has been a fantastic initiative, driven by the students, and shows we can be confident about the expertise coming through for the future and that Australia and our partner countries will continue to have the biosecurity research and capabilities so crucial to our food security. 



The official delegation visiting the refurbished SunRice Lap Vo rice mill in Dong Thap Province, Vietnam. Photo: ACIAR



17th CGIAR System Council members in Brisbane. Photo: ACIAR

Assistant Minister for Trade launches Mekong Rice Project

Australian Government Assistant Minister for Trade, Senator the Hon Tim Ayres officially launched the A\$5 million Mekong Rice Project in Vietnam’s Dong Thap province in October 2022. The project aims to establish a productive, sustainable rice value chain in the region and is the first public-private partnership co-funded by ACIAR and the Australian company SunRice.

At the launch, senior representatives from Vietnam included the Chancellor of Vietnam National University-Ho Chi Minh City and chairman of Dong Thap Province. Assistant Minister Ayres also visited the SunRice Lap Vo mill, where a Centre of Excellence will be built, providing a capacity-building platform for researchers. 🌱

Leaders converge in Brisbane to solve global food insecurity

More than 100 international agricultural research leaders gathered in Brisbane in November to discuss the future of sustainable and resilient food systems.

The week-long program of events began with the TropAg International Agricultural Conference, followed by parallel meetings of the governing body of the CGIAR, the System Council, and the Commission for International Agricultural Research and the Policy Advisory Council, which both advise the Minister for Foreign Affairs, Senator the Hon Penny Wong on food security and agricultural development issues.

Delegates joined field trips to research facilities in Queensland, meeting several ACIAR project leaders and teams. Australian



ACIAR/CGIAR plenary session panel at the TropAg Conference, from left, Professor Ramesh Chand, Dr Ruben Echeverria, Dr Segenet Kelemu, Dr Claudia Sadoff, Mrs Fiona Simpson, Mr Sunny Verghese. Photo: ACIAR

Government Minister for Agriculture, Fisheries and Forestry, Senator the Hon Murray Watt and the Queensland Government Minister for Agricultural Industry Development and Fisheries, Mark Furner MP, welcomed the international delegates as part of the events. 🌱



JDF Fellows gathered in Rajendrapur, Bangladesh. Photo ACIAR

JDF Fellows meet in Bangladesh

As part of the John Dillon Fellowship (JDF) program, future agricultural leaders of Bangladesh met in Rajendrapur in November to share ideas on how to improve the country’s agriculture sector.

The 3-day workshop saw 12 Bangladeshi researchers present innovative concepts and learnings from their recent visit to Australia. They were supported in their projects by 2 fellows from Australia and one from India.

The closing ceremony was attended by Md Ruhul Amin Talukder, Additional Secretary, Ministry of Agriculture, Bangladesh; Professor Lutful Hassan, Vice-Chancellor, Bangladesh Agricultural University; and Jiban Krishna Biswas, Executive Director, Krishi Gobeshona Foundation. 🌱



ACIAR at COP27 in Egypt

Research Program Manager, Climate Change, Dr Veronica Doerr led ACIAR engagement at the recent COP27 in Sharm El Sheikh, Egypt.

Dr Doerr hosted an event to share four ACIAR-supported projects working towards implementing food systems change. She also teamed up with Clim-Eat to organise and present a PechaKucha event – talks with 20 images for 20 seconds each – to paint a picture of what transformative adaptation could look like if implemented at scale.

The events showcased partnerships with WorldFish; World Agroforestry (ICRAF); Africa's Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN); Australian National University; the CGIAR; the World Resources Institute; and the Commission for International Agricultural Research. Also joining the COP events were 2 scholars from the University of the South Pacific who are part of the ACIAR Pacific Agriculture Scholarships and Support and Climate Resilience (PASS-CR) Program. 🌱

Above: Dr Veronica Doerr (second from left) in action at COP27 joining a panel about transforming food systems to be more adaptive and resilient to the impacts of climate change.

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ACIAR 10-Year Strategy 2018–2027 2nd edition

An update of the ACIAR 10-Year Strategy 2018 to 2027 has been published to take into account the changing circumstances and priorities mid-way through the life of the strategy. These factors include rapid social, economic and political changes within partner countries, and an increasingly variable and changing climate.



ACIAR Annual Operational Plan 2022–23

The ACIAR Annual Operational Plan outlines the objectives and operating environment for ACIAR in 2022 to 2023, and describes the aims and activity of 172 projects, in 32 countries, in partnership with almost 400 research and industry organisations.



ACIAR Annual Report 2021–22

The ACIAR Annual Report is prepared for our Minister, for tabling in the Australian Parliament. It reports on our performance from 1 July 2021 to 30 June 2022 across our 3 key areas of work: global research collaborations, bilateral and regional research partnerships, and scientific and policy capacity-building activities. It also reports our performance against the legislation under which ACIAR operates.

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