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IN RESEARCH FOR DEVELOPMENT

About Partners

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Front cover: Lab technician Tavaita Tinaigata, Fiji National University, tests the acidity of water to determine if the water is suitable for Tilapia fish rearing (page 18). Photo: Lorima Vueti, The Pacific Way.

Back cover: Floating markets, Solomon Islands.

inside

ISSUE ONE 2021 | PARTNERS

From the CEO

Professor Andrew Campbell

In 2021, ACIAR will step into the role of chairing the Global Research Alliance on Agricultural Greenhouse Gases (GRA). It's an honour to take on this role from our friends in Indonesia who will be passing on the Chair baton in March at the first GRA Council meeting for the year.

This is an exciting development for ACIAR because in the past year we established our stand-alone Climate Change Program in line with our 10-year strategy that identifies climate change as one of six high-level objectives.

The incoming commissioners on Australia's Commission for International Agricultural Research have strongly endorsed this new program.

ACIAR has long been investing in climate change adaptation research across our entire research portfolio. We have also been one of the major investors in, and partner with, the CGIAR Climate Change and Food Security program. However, our new Climate Change Program gives this important issue a higher profile and refreshed mandate, with more emphasis on mitigation than previously. This reflects the priorities of our partner countries, many of whom have ambitious Nationally Determined Contributions under the Paris agreement to reduce emissions from agriculture and forestry.

This issue of *Partners* covers a range of our climate change research—both ongoing and new. It also delves into the role of the GRA and Australia's focus on helping the agricultural sectors of our partner countries to adapt to climate change and reduce emissions.

We had hoped that for the March GRA Council meeting, we would be able to welcome our GRA colleagues to Australia to meet farmers who have quantified their own emissions and are seeking to reduce them. Unfortunately, COVID travel restrictions have forced a shift to a webcast meeting. The upside is that we will be able to share a suite of videos with everyone to showcase the on-farm case studies. These will be shared across ACIAR social media accounts.

The meeting will nevertheless be grounded in what real agricultural businesses are doing and practical ways to improve their productivity and sustainability, plus ways they can reduce emissions from agriculture. The formal Council meeting will be preceded by a public workshop organised by the Crawford Fund on farmer-led, science-based greenhouse gas mitigation strategies for Australia and abroad. This is the first of a series of national and international climate change events that we will be joining this year in the lead up to the 26th United Nations Climate Change Convention Conference of the Parties, also known as COP26, in Glasgow in November.

During the GRA Council meeting, we expect that participants will endorse the new GRA strategy for the next three years. For Australia, we will also foreshadow our aim to get greater Pacific island country representation on the GRA, and to ensure that the concerns and needs of Pacific island countries are prominent. More on this is outlined in this issue.

Also, emanating from our interests in supporting our Pacific neighbours, is the ACIAR Pacific Agriculture Scholarships and Support program. It supports domestically-led agricultural research to address the needs of people in the Pacific region by providing scholarships for postgraduate research and support for academics.

The first cohort of scholarship holders—from the University of the South Pacific and Fiji National University—commenced their participation in the program in February this year. I would like to wish them well in their research endeavours.

International collaboration key to emissions success

Among the most significant global challenges in 2021 are two needs that could be seen as competing: feeding an increasing population and at the same time combatting climate change by reducing greenhouse gas emissions.

The Global Research Alliance on Agricultural Greenhouse Gases (GRA) is a unique collaboration that brings countries together to find ways to grow more food without growing emissions.

The GRA has 64 member countries from all regions of the globe, and more than 20 partnerships with key international and regional organisations responsible for research and disseminating knowledge to policymakers, the science community and farming leaders. About 3,000 scientists are involved in GRA-related activities.

Members of the GRA aim to deepen and broaden mitigation research efforts across the agriculture sectors of paddy rice, cropping and livestock, and to coordinate cross-cutting activities for these areas, including promoting synergies between adaptation and mitigation efforts.

New Zealand provides the secretariat for the GRA. Mr Hayden Montgomery, from the New Zealand Agricultural Greenhouse Gas Research Centre, is the GRA Special Representative. Based in Uruguay, his role is to act as an ambassador for the Alliance.

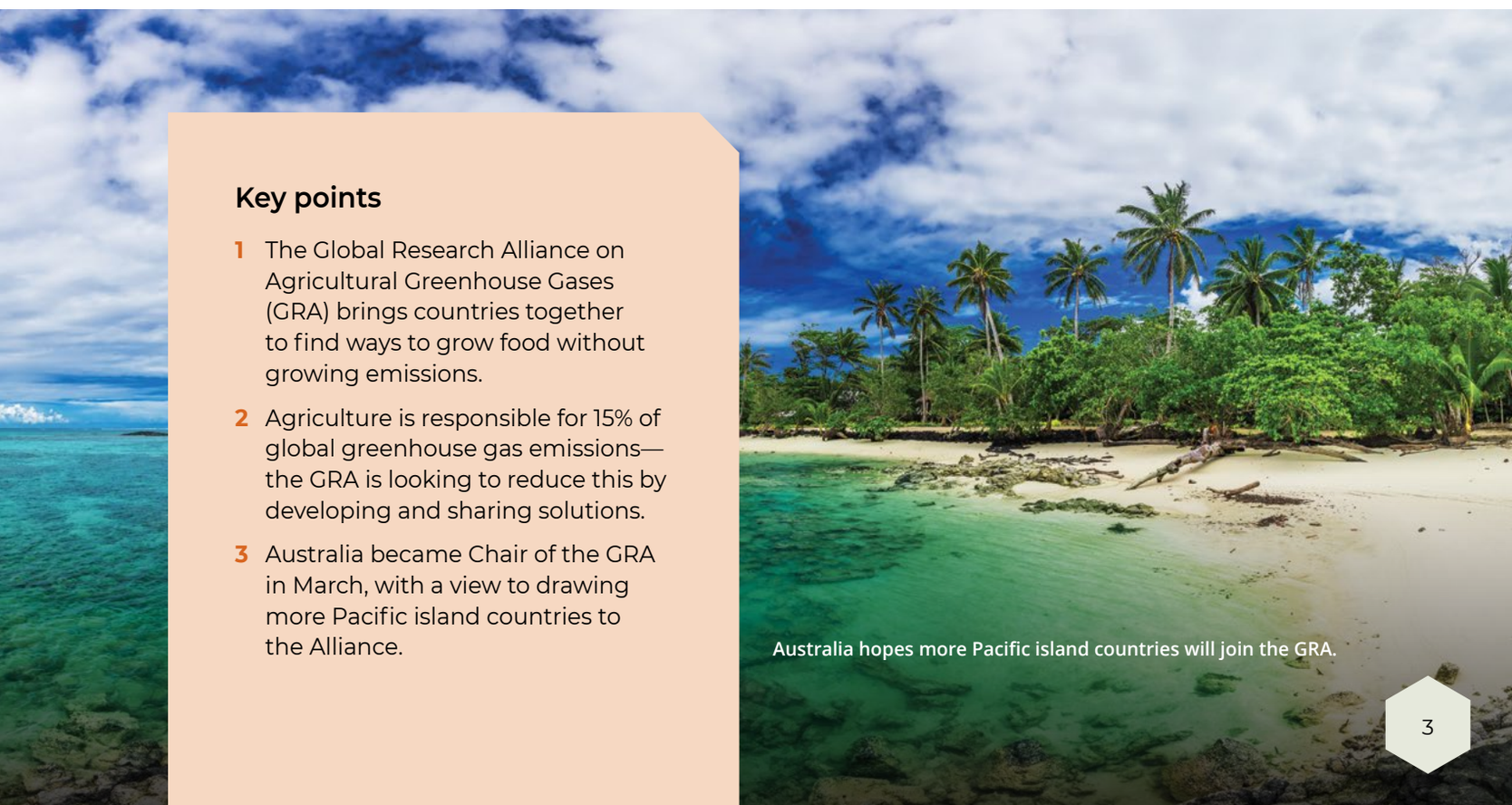
'Agriculture plays a vital role in achieving food security, poverty reduction and sustainable development,' says Mr Montgomery.

'At the same time, the sector is also impacted by climate change and is a significant source of greenhouse gases.

'Despite the challenges, there are many opportunities to reduce emissions and increase carbon sequestration by improving the efficiency and productivity of agricultural systems through better management practices and technologies.'

Key points

1. The Global Research Alliance on Agricultural Greenhouse Gases (GRA) brings countries together to find ways to grow food without growing emissions.
2. Agriculture is responsible for 15% of global greenhouse gas emissions—the GRA is looking to reduce this by developing and sharing solutions.
3. Australia became Chair of the GRA in March, with a view to drawing more Pacific island countries to the Alliance.



Australia hopes more Pacific island countries will join the GRA.

GRA members aim to deepen and broaden mitigation research efforts across the agriculture sectors of paddy rice, cropping and livestock, and to coordinate cross-cutting activities for these areas. Photo: International Rice Research Institute.

Building and sharing knowledge to accelerate these opportunities is where the GRA comes in.

'The GRA is not a bricks-and-mortar organisation,' says Mr Montgomery.

'It has no resources of its own to yield or wield, relying solely on the contributions of members and partners. However, it provides the space for research groups and networks to identify the highest priorities shared by members and find concrete research or capability-building activities to meet those needs.

'It's a forum to clarify the priorities and advance those over time.'

Research focus

Because the GRA has such a broad membership, its strength is in being able to address questions that can only be answered by large data sets and by drawing on variability in agricultural systems, learning from that variability and pooling data that no single country could do on its own, according to Mr Montgomery.

'We really look for big flagship projects that draw on many participants to unlock questions that pretty much every country is struggling with on its own. This applies across soil, carbon, rumen microbiology, crops—everything. It's a very challenging research area.'

The aim of the GRA's four research groups is to develop breakthrough solutions in addressing agricultural greenhouse gas emissions. Work plans bring countries and partners together in research collaborations, knowledge sharing, use of best practices and capacity building among scientists and other practitioners.

The Livestock Research Group is focused on reducing the emissions intensity of livestock production systems and increasing the quantity of carbon stored in soils supporting these systems. In one major project, nearly 60 scientists from 14 research organisations across nine countries worked together to conduct a global rumen census on gut microbes in livestock. The results demonstrate that solutions to reduce methane emissions from ruminant animals are feasible, because the microbes causing the emissions are similar around the world. This data can be translated into interventions that are globally useful.

The Paddy Rice Research Group is working to find ways to reduce the emissions intensity of paddy rice cultivation systems while improving overall production efficiency. Trade-offs with emissions of nitrous oxide and changes in the quantity of carbon stored in paddy soils are also being considered.

The Croplands Research Group is looking for ways to sustainably increase production while limiting losses to the atmosphere of valuable carbon and nitrogen from crops and soils, and to transfer that knowledge and associated technologies to farmers, land managers and policymakers around the world.

The Integrative Research Group addresses cross-cutting issues relevant to the other three groups, including soil carbon, and modelling and measurement of greenhouse gases.

The collaborative work of the GRA has resulted in many scientific publications, including in high-impact journals. Making intellectual property open is a priority so that knowledge gained can be shared as widely as possible. Several resources are available via the GRA website.

International influence

Established research priorities extend beyond the GRA to influence the agendas of member countries.

'We know that countries over time have aligned their national research budgets with GRA priorities and have explicitly written GRA into their national research calls,' says Mr Montgomery.

'Canada has stated that priority would be given to those projects aligning with GRA priorities. The European Commission built explicit reference to GRA networks into their calls.'

Participation in the GRA has also strengthened capability internally in member counties, encouraging them to get better organised, according to Mr Montgomery.

'When countries participate internationally and become engaged in this agenda, it compels them to do their homework domestically.

'They also build connections internally, particularly between agriculture and environment ministries. People from the same country come to a GRA event and meet colleagues for the first time. They develop relationships and break down the silos that so often exist—that's so valuable.'

Hopes for Pacific inclusion

Australia has been a member of the GRA since its inception and is represented through ACIAR. In 2021, Australia takes on the role of Chair.

According to ACIAR Chief Executive Officer, Professor Andrew Campbell, one of Australia's aims as Chair is to bring more Pacific island countries into the GRA.

'On the global scale, Pacific island countries are not large emitters; however, forestry, agriculture and fisheries are relatively significant sources of emissions within their own economies,' says Professor Campbell.

'The rationale for the GRA to exist was for countries to share their expertise on how to reduce agricultural emissions. That's more urgent now than ever.'

Professor Andrew Campbell

'Many Pacific island leaders have pledged to reduce their emissions and are very interested in how they can achieve this—particularly where there are co-benefits of food security or better resource management.

'At the end of the day, agricultural emissions are symptoms of a system that is leaking energy, carbon or nutrients. If we can develop more efficient or more productive farming systems that don't leak, in theory we should be growing more food with the same inputs.'

The other priority for Australia is to look at the synergies between adaptation and mitigation, again with an eye on the Pacific as it experiences more extreme and intense weather events. This is indicative of a broadening of the GRA's focus beyond reducing agricultural emissions.

'Countries have to figure out the adaptation challenges, especially when they are getting hit very frequently by these events—it's not optional,' says Professor Campbell.

Australian researchers make a strong contribution to the Alliance, particularly in the areas of livestock methane emissions and soil carbon, according to Professor Campbell. Australian research organisations involved include CSIRO, The University of Melbourne, the University of New England, the Australian National University and Queensland University of Technology.

Australia also stands to benefit from involvement in the GRA.

'The GRA is a valuable mechanism to support our own national efforts to reduce emissions,' says Charlie Prell, Chair of Australian advocacy group Farmers for Climate Action, which represents more than 5,000 farmers.

'As well as sharing our expertise, we can learn from the work of other countries and keep across the latest international developments.'

Australia's first duty as Chair will be to host the GRA annual council meeting from 23 to 25 March—the most important event on the GRA calendar. The meeting will be conducted online and showcase Australian work in emissions reduction through a series of videos.

Pressure increasing on agricultural emissions

'If you look at the global emissions pie chart, the big slices are energy, transport and agriculture—which sit at around 15% of global emissions,' says Professor Campbell.

'With energy and transport now reducing emissions intensity due to the use of renewables, fuel efficiency and electric vehicles, agriculture is on track to be the largest emitting sector.

'The technical challenges are formidable. We're a long way from turning the corner in the emissions intensity of food production.

'The rationale for the GRA to exist was for countries to share their expertise on how to reduce agricultural emissions. That's more urgent now than ever. The value proposition has only intensified. Countries are increasing their ambitions and more pressure is coming to reduce agricultural emissions.

'Countries are asking "How do we do it?" and they're looking to neighbouring countries with strong technical capacity to help them.'

The GRA is well positioned to assist, Professor Campbell says.

'The GRA is not political. It's not about regional blocks or anything like that. It's just about who has expertise in reducing emissions in agriculture.'

MORE INFORMATION: visit www.globalresearchalliance.org.

Australia prioritises climate change in overseas development

In the past five years Australia has invested more than A$1 billion in tackling climate change in overseas development. Why is it such a priority for Australia?

For Australia, addressing climate change is a particular focus of our international agricultural development, says Australia's Ambassador for the Environment, Mr Jamie Isbister.

'Climate change is a critical issue for many people in our region. There are small-island nations, in particular, that are likely to be severely impacted,' he says.

'The majority of people in the Pacific still rely on agriculture and fishing for their livelihoods and food security.

'We will need to look at how we support communities impacted by climate change and how we can help them develop and evolve agricultural practices that are more resilient to factors such as sea level rise, higher temperatures and extreme weather.'

'Helping our neighbouring countries to develop climate-smart agricultural systems will increase resilience, productivity and employment and, potentially, reduce greenhouse gas emissions.'

This focus on climate change was strengthened by Australia's 2015 commitment to invest A$1 billion by 2020 in climate change solutions in developing countries. Australia exceeded this commitment, providing close to A$1.4 billion to support countries in the region, including with investments in the agriculture sector. In 2020, Australia's Prime Minister Scott Morrison announced a new commitment of A$1.5 billion for 2020–25.

Helping international agricultural communities to tackle climate change has benefits for Australia as well.

Australia invests in solutions that help partner countries adapt to climate change. The new Gizo Market, Solomon Islands, is built to resist sea level rises and enables women producers to get back on their feet quickly after disasters. Photo: Linda Roch, DFAT.

Key points

1. Australia committed to invest A$1 billion by 2020 in climate change solutions in developing countries.
2. In agriculture, solutions that reduce emissions and improve outcomes for farmers continue to be the target.
3. Investments are seeing agricultural infrastructure built to withstand extreme weather conditions and rising sea levels.

'Supporting overseas development in this space builds Australia's reputation as a leader in science and agricultural research. A good reputation supports long-term trade and investment opportunities,' says Mr Isbister.

'Helping others cultivates our reputation as a "smart agricultural country", which helps us export our knowledge, research and expertise. It's a win-win.'

Reducing emissions overseas

Australia is committed to promoting a shift to lower-emissions development in the Indo-Pacific region. Many developing countries need technical and financial support to reach their climate change goals. Lower economy-wide emissions must be part of successful and sustainable economic development.

Australian investments have helped overseas agricultural communities to reduce their emissions and increase their productivity. Often, this has the added benefit of improving the bottom line for local farmers.

'For example, we've invested in a project in Papua New Guinea with the Australian National University's Climate Change Institute,' says Mr Isbister.

'We are working with smallholder coffee growers to look at ways in which more carbon can be sequestered. The aim is to help the coffee sector improve production practices and reduce emissions, and enable coffee growers to access the carbon market.'

Emissions are often a waste product from the production process. So, it's no surprise that reducing emissions can lead to productivity improvements, and vice versa.

'Another project we are supporting in Vietnam is called AgResults. Through AgResults we work with the private sector to develop new tools and technologies to reduce emissions in rice production. Some 23,000 smallholder farmers have been involved,' he says.

'The issue for paddy rice production is that poor on-farm fertiliser and water management lead to high emissions of methane and nitrous oxide—powerful greenhouse gases.

'The AgResults project works with the private sector to scale out simple changes to farm practices that tackle this problem, resulting in a 10% emissions reduction as well as increasing rice yields by 8%.'

Helping neighbours adapt

Australia's international efforts to reduce emissions are supported by its work to help developing nations adapt to climate change. For many small island neighbours, climate change and the associated rising sea levels, temperatures and the rising frequency of extreme events represent a significant threat. There is ample opportunity to utilise Australian research and expertise to mitigate climate change impacts.

'In the atoll states of Tuvalu and Kiribati, we are helping rural farmers adapt to increasing soil salinity caused by rising sea levels. By adopting new raised garden beds and turning organic waste into fertile compost, farmers are now able to continue to grow traditional crops including taro,' says Mr Isbister.

Investments in the Pacific region have also seen agricultural infrastructure built to withstand extreme weather conditions and rising sea levels.

'In Gizo, Solomon Islands, we funded the construction of a new food market which sits well above projected sea level rises. And thanks to the Australia Pacific Climate Partnership Support Unit it has been designed to withstand a Category 5 Hurricane,' adds Mr Isbister.

The market provides secure facilities for women to sell their produce, enabling them to engage in the formal economy and improve the livelihoods and health of their families. The design also includes a sustainable water supply and sanitation facilities, ramps for disability access and an affordable, secure clean energy supply. Even in the face of a disaster, the market is equipped to enable women producers to get back on their feet quickly and re-engage in their livelihoods.

Looking ahead

Climate change has exponential impacts. As more of these impacts in the next decade occur, the challenges for agriculture will become more difficult.

'We'll have to be looking at how we ensure developing communities have the latest technology to keep pace with climate change. Also, the Asia-Pacific is the most disaster-prone region in the world so we'll need to develop strategies to help countries ravaged by disasters to build back better,' says Mr Isbister.

And there are strategies that could turn these challenges around.

'First would be uncovering cheap, clean hydrogen energy which accelerates the transition from fossil fuel systems to a zero-emissions system. That's a game-changer,' he says.

'The other big breakthrough would be finding a way to improve transportation of agricultural products. The logistical element, including cold chains, can be an expensive and highly emitting part of the sector. This is where clean hydrogen energy will also help. If we can move to a future with ships, trains and trucks powered by clean hydrogen fuel cells, the agriculture sector can meet its transportation needs without emitting carbon.'

Tackling climate change demands two-pronged approach

By Dr Veronica Doerr, Research Program Manager Climate Change, ACIAR

Climate change has emerged as a systemic risk, with interconnected and cascading impacts across every aspect of livelihoods and food systems. But it's also an opportunity to reduce poverty and create thriving new food systems, more sustainable relationships with our lands and oceans, and greater equity across societies.

Action is required on two fronts. Globally, we must 'mitigate'—to slow and eventually halt the rate of climate change we must reduce the volume of greenhouse gases we put into the atmosphere. Just as importantly, we must 'adapt': find new ways to produce food and sustain livelihoods in a world that will inevitably experience further climate change.

The challenge

Tangible options that help farmers cope with climate change, like new climate-resilient crop varieties and water-saving technologies, are easy to understand and may be readily adopted. Yet most of these approaches help producers cope with only a relatively small degree of climate change—a slight reduction in rainfall or a few more hot days in the growing season.

Key points

1. Tangible options to adapt to climate change must be complemented by supporting the development of new approaches to problem-solving.
2. Changing how people work together and solve problems is key to creating transformative and lasting change to help agriculture adapt to a changing climate.
3. The new ACIAR Climate Change Program complements existing ACIAR research by focusing on how to take transformative action.

Many communities and governments are interested in taking more ambitious action on both mitigation and adaptation because they are already experiencing more severe impacts. They recognise that prolonged droughts, greater coastal inundation and growing salinity intrusion are not readily addressed with incremental technological improvements.

Increasingly, societies need to find the game-changing approaches that can transform how they produce food and sustain livelihoods in ways that produce less greenhouse gas emissions and are more adapted to the ongoing and increasing disruptions of climate change.

Transformation is about people

Action-based research on climate transformation is still in its infancy. Yet, already a key lesson has emerged that accomplishing transformation may be less about technological innovation and more about social and institutional innovation.

Farmers, community leaders, business owners, governments and providers of climate finance all need to be pulling in the same direction to create a deliberate transformative change. Fishers in Solomon Islands who depend on coral reefs cannot respond individually if 70–90% of coral reefs decline as anticipated under a 1.5°C increase in average global temperatures. The new production systems, policies, markets and investments that enable fishers and the broader communities to respond to such disruption must come together.

Extensive cooperation like this depends on changing in ways we can't touch or see—changing the way in which people use and share information, make decisions, collaborate and learn.

In contrast, agricultural research is usually associated with very technical and tangible solutions. Social science and economics are included, but often to define the context within which the technical solutions must fit. Yet climate change demands that we research how to change these contexts—how to reshape the systems and processes that govern societies and their collective decisions and actions. This may feel less tangible—less like agricultural research. But without it, the ability to adopt the technical solutions—particularly at large scales—will inherently be limited.

Don't just adapt, be adaptive

Another reason climate transformation research needs to focus on people is that climate change is ongoing. There is no stable future climate to adapt to. The technical solutions that are appropriate now may not be useful in 10 years' time, and what works in 10 years may no longer be helpful in 20 years. Thus, it may be more important for people to have the tools, skills and foundational building blocks to be adaptive—to more rapidly assess changes in climate, develop innovative ideas, trial and compare options, and evaluate and adjust.

In fact, in the scientific literature, terms like 'resilience' and 'adaptation' actually refer to the capacity to change and the processes used to do so, rather than to specific end points. It's like the old adage, 'Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime'. Specific tangible changes on farms and in livelihoods and food systems are necessary, of course. But research also needs to focus on how to support farmers, communities, businesses and governments to build the capacities and the processes to be more adaptive—to work together on locally-led solutions.

Adapting to climate change requires more than simple solutions for individual farmers and fishers to adopt—it requires transformative change and adaptable mindsets.

Creating this ability to be adaptive would be transformative, creating benefit not just for now but for the long-term, as further changes and disruptions arise.

There is a great deal we don't yet know about how to do this in an action-based practical way, especially for the benefit of millions of small-scale farmers. It's such a new area of work that all countries, regardless of their current level of development, are still in the beginning stages. This also makes it an ideal opportunity for Australia and our partner countries to learn and progress together, and hence for the strong partnership model of ACIAR to contribute.

Climate change at ACIAR

Supporting and learning with our partners to address climate change is not new for ACIAR, but having a focus on transformation is.

The new Climate Change Program was created in late 2020 to complement existing work on climate change across the rest of the ACIAR portfolio. The new program deliberately concentrates on how to take action on the kinds of transformations discussed here—fundamental shifts in how livelihoods and food production, and the social and institutional systems that sustain them, are organised and able to be adaptive.

Yet not every situation requires transformation. A diversity of approaches is still needed to match the scale of impacts experienced and anticipated by our partners.

Where impacts of climate change are relatively small, a range of ACIAR programs support farmers, agribusinesses and governments to absorb these impacts through more efficient use of resources like fresh water which are becoming scarcer or more variable under climate change. Where impacts are intermediate, our programs support strategic adaptation—shifts in livelihood and food systems including the types of food produced and how, the ways that risk and finances are managed, and interactions with market chains.

The articles in this issue of *Partners* showcase different responses: absorb, strategically adapt and transform. The transformation work and the Climate Change Program itself are just beginning. We certainly don't have all the answers yet, but this is precisely why we do research.

ACIAR PROGRAM: Climate Change Program.

Vietnam is taking action to reduce greenhouse gas emissions such as by planting short-duration rice. Together, Vietnam and Fiji are building and sharing knowledge on how to measure and report efforts to reduce emissions.

Inventory 'cart' to come before mitigation options

Because greenhouse gases can't easily be seen, it's hard to know where a country's emissions are really coming from. A foundational step is to have a national system of measurement, reporting and verification upon which mitigation options can build and policies can be established to help small-scale producers participate and benefit.

This is a top priority of the Global Research Alliance on Agricultural Greenhouse Gases (GRA), which ACIAR will be chairing on behalf of Australia for the next year. To help contribute to the goals of the GRA, ACIAR is collaborating with the New Zealand Ministry of Primary Industries to co-invest in a project to help four different countries develop and use their measurement, reporting and verification systems and support and learn from each other.

For the past two years, Australian researchers have been helping Vietnam and Fiji to identify the potential contribution that their agricultural sectors can make towards their Nationally Determined Contributions (NDCs). The experience has given Australian researchers pause for thought, as they recognise the need to first establish a comprehensive National Greenhouse Gas Inventory in both countries.

'As soil and agricultural scientists we're used to focusing on mitigation and emission-reduction options, but we quickly realised that a lot of work is needed to complete Vietnam's and Fiji's national inventories of greenhouse gas emissions from

agriculture,' says Dr Natalie Doran-Browne, research scientist at The University of Melbourne.

'Until you have a lot of confidence in the data and the processes used to collect it, then it's putting the cart before the horse—you need solid baseline figures before mitigation can commence.'

Under the United Nations Framework Convention on Climate Change (UNFCCC), countries are required to submit their NDCs: the contributions they can make to reduce greenhouse gases to achieve a global goal of climate change mitigation.

The inventory and reporting system was established by the United Nations to facilitate common responsibilities across countries, including to enable developing countries to access the climate finance needed to create the significant changes that may be required.

While the team has identified promising agricultural mitigation options for both countries, the ability of Fiji and Vietnam to make commitments to the United Nations, report on them and attract finance may now depend on strengthening the agricultural aspects of their national inventory systems.

This is why the team has commenced a subsequent project to identify and fill the most critical gaps for agriculture in these two national inventory systems. Joining forces with the New Zealand Agricultural Greenhouse Gas Research Centre, who have been conducting similar research in Indonesia and Kenya, provides a key opportunity for developing countries to learn from each other to help accelerate the process of inventory improvement.

Key points

1. Before a country can embark on reducing its greenhouse gas emissions it needs a system to measure, report on and verify its emissions.
2. ACIAR partners are establishing and supporting processes for measuring, reporting and verifying agricultural emissions.
3. This work aims to identify the capacity gaps in each countries' GHG inventory for agriculture emissions and the most promising mitigation options.

A solid knowledge base

Luckily, Dr Doran-Browne and her colleague, Queensland University of Technology research associate Dr Elaine Mitchell, have found a substantial amount of work has already been done by a number of organisations to quantify greenhouse gases (GHGs) in Fiji and Vietnam, which has resulted in three national communications to the UNFCCC.

'We chose the two countries because although they might look different, with Fiji in the very early stages of developing an inventory and selecting mitigation options and Vietnam much further down the path, we could see how the process would be similar,' says Dr Mitchell.

'Both countries are extremely cognisant when it comes to analysing the options for smallholder farmers. They realise that it's not just the reduction of GHGs to consider; they must take into account the range of co-benefits associated with mitigation that include profitability and productivity, and soil health and food security for sustainable systems moving forward.

'There are developed countries that could learn a lot from the dedication that both countries have to reducing GHGs—particularly Fiji, which has only a small amount of emissions from agriculture.'

The project has already developed a governance checklist that outlines the institutional framework required for implementing agricultural mitigation options and provides guidance that will promote equitable outcomes for smallholder farmers.

Fundamental to this is the establishment of centralised data points and regular collection of information, says Dr Doran-Browne.

'They have an agricultural census every 10 years, but if we want to implement an inventory of GHG emissions that's updated every two years and submitted every four years, then the figures really need to be gathered annually.

'There's a big emphasis on collaborating with global experts through the GRA and with in-country colleagues to identify what data they need to start collecting more regularly and storing in one place, so that it's updated centrally rather than in a piecemeal way.'

Vietnam and beyond

Vietnam submitted its new NDC in September 2020 with increased targets for GHG reduction. Actions to reduce emissions from agriculture include replacing long-duration rice varieties with short-duration ones; increasing areas of integrated cropping; reducing the rate of field burning of rice straw from 90% to less than

30%; and collecting and treating organic livestock waste to make it into fertiliser.

Le Hoang Anh, Senior Officer at Vietnam's Ministry of Agriculture and Rural Development, says the project has provided valuable information for policymakers and scientists to consider when developing NDCs for agriculture, despite the setback of the COVID-19 pandemic having limited face-to-face interaction.

'This has given us the opportunity for deeper discussion on managing emission reduction options for agricultural landholders in Vietnam, especially if the project provides more technical support for local experiences and field studies in the second phase,' she says.

'It will help us to understand and prioritise better the most promising mitigation options for cropping and livestock industries and show us the capacity gaps in the GHG inventory for agriculture.

'Our two countries are active in emphasising the importance of agriculture and food security in the climate change agenda through the UNFCCC's Koronivia Joint Work on Agriculture, and we would expect that the outcomes of this project would be adopted by countries in South-East Asia and the Pacific region that are also very active in this area.'

Dr Doran-Browne says understanding and developing relationships both with the two countries and within them is critical.

Vietnam has a large bureaucracy with many levels but is very efficient, very organised and quick to respond, she says, whereas Fiji has a much smaller, more laid-back system of government that means senior bureaucrats are always available. They have an equal number of experts in the climate space.

'To make a lasting impact we need to address the governance side so that when we're looking to reduce GHG from the agriculture sector we can recommend specific mitigation practices.

'But in order for that to be reflected in the national inventory, there needs to be connections in particular departments—the Ministry of Agriculture needs to liaise with the division that manages climate change, for example—and all these connections have to be made for research on the ground to go through to policy level.'

Future options

The potential to implement some of the processes used to offset greenhouse gas emissions from Australian agriculture are still a way off, says Dr Mitchell.

'To implement a Carbon Farming Initiative with credits like Australia's we need firstly a baseline set of measurements and then a rigorous measurement, reporting and verification system to ensure the delivery of credits over the project period. We have that policy framework but there are many steps that need to occur before that can even start.'

There are also geographic and climatic differences to contend with.

'Vietnamese agriculture in particular covers many ecological zones and the climate has a big impact on GHG outputs, so if you're using generic emission factors across the whole country, they need to be further refined to reflect what's happening in different zones,' Dr Doran-Browne explains.

'Sometimes the data is there but it hasn't been processed through government levels and delivered to the Intergovernmental Panel on Climate Change to have it recognised.'

'Until you have a lot of confidence in the data and the processes used to collect it, then it's putting the cart before the horse—you need solid baseline figures before mitigation can commence.'

Dr Natalie Doran-Browne, The University of Melbourne

Both countries are committed to the project and keen to formulate their own inventories, she says.

'The National Greenhouse Gas Inventory of non-OECD countries is usually assessed by an international consultant but there is a strong desire in these countries to be independent—to do the initial work themselves before the audit.'

Initial project workshops in Hanoi, Vietnam, and Suva, Fiji, were well received but the COVID-19 pandemic put a stop to in-country visits in 2020.

'We've had a really good reception from people and our in-country farmers to what we're trying to do but, while we can communicate well through online meetings, we're hopeful of holding more workshops and bringing some people to Australia to meet the National Inventory team in the future,' Dr Doran-Browne says.

ACIAR PROJECT: Agriculture-based emission reduction options to support NDCs in Vietnam and Fiji, LWR/2017/029; Defining GHG inventory system priorities for agriculture, CLIM/2020/211.

Rising sea levels, pressure on soils and major losses from diseases in taro, are placing pressure on Tonga's taro farmers who are now looking for new solutions. Photo: Leo Gaggl.

Pacific farmers fulfil conservation agriculture 'dream'

Farmers in Tonga and Samoa are all set to be part of a ground-breaking new ACIAR activity to test conservation agriculture and sustainable intensification (CASI) in the Pacific region, alongside partners The University of Melbourne, Lincoln University New Zealand, The University of the South Pacific (USP) and the Pacific Community (SPC).

'This has been a dream of the farmers for a long time,' says Research Fellow at USP, Lau Viliamu Iese.

Key points

1. Pacific islander farmers have welcomed a new ACIAR-supported project investigating conservation agriculture and sustainable intensification (CASI).
2. The project aims to improve farmer profitability, adaptability and resilience against a changing climate.
3. Adoption of CASI practice has improved crop yields, increased net economic returns, and reduced greenhouse gas emissions in other parts of the world and it is hoped the same benefits can be found in the Pacific region.

'They have been crying out for help to analyse their systems at a farm level to see how to increase food and incomes and, at the same time, improve soil health and water management and address the changing climate.

'We are small island developing states with high climate-change vulnerability, increasing populations and limited land availability, so our land is being cropped over and over. Farmers are torn between the need to use more fertiliser and the need to improve soil health for the long term.'

Exploring the potential for CASI in the Pacific region has been the goal of a Small Research Activity (SRA), which is now informing the final proposal for a larger project.

Sustainable intensification is considered a pathway to more restorative and regenerative agriculture, with CASI bringing together conservation agriculture, soil health, water management, integrated pest management and improved genetics.

Project leader Professor Tim Reeves from The University of Melbourne says while systems incorporating CASI practices have provided clear benefits in South Asia, there is a major knowledge gap about the potential for CASI in the Pacific region.

'A 2020 meta-analysis of CASI research in South Asia reported improvements in crop yields of 5.8%, a jump in net economic returns of 25.9% and reductions in greenhouse gas emissions of 12–33%,' says Professor Reeves.

'We are optimistic that appropriate CASI systems can deliver a win-win for Pacific island countries too, and we will also be modelling the factors affecting future scaling-out, such as technologies, input availability, labour and knowledge networks.'

Farmer support

Lau Viliamu Iese says farmers in Samoa and Tonga are already very engaged with the project and keen to take part in farm-based trials as part of the larger project.

'The first time I explained the benefits of the project to members of the Pacific Island Farmers Organisation Network in Tonga, they had immediate buy-in,' he says.

'We have already held meetings with Project Advisory Groups in both countries involving partners like MORDI (Mainstreaming of Rural Development Innovations Tonga Trust)—an NGO that works with all farmers through community development activities.

'They don't have a research arm but they have a research dream. These trials will provide the facilities, capacity and finance to fulfil and realise that dream, and hopefully by gathering evidence on the ground we can tap into a huge "copycat" culture to disseminate the information.'

Some 40 farmers in each country will be approached to answer comprehensive questionnaires in the local language to provide some of the farmer-focused data to assess strengths and weaknesses of CASI in each system and its capacity to reduce threats from the changing climate.

Options for integrating livestock and cropping systems to embrace conservation agriculture principles are being explored through an ACIAR-supported project in Samoa. Photo: Michael Coghlan.

Solutions that fit

The SRA has reviewed agricultural systems, identified their key features regarding climate, and proposed a typology of systems to be used for prioritising future conservation agriculture-based sustainable intensification, transformational climate adaptation and mitigation research.

In the larger project, CASI principles will be applied in several different farming systems in each country—in Tonga, in the traditional farming system and the commercial or monocropping system, and in Samoa, in the integrated livestock/cropping system and taro farming system.

Professor Reeves says Pacific island farmers face real concerns about climate change, with rising sea levels, pressure on soils and major losses from diseases in taro and some other root crops, combined with the challenge of producing more from a finite area of land already being cropped.

'For Pacific islanders, listening and understanding creates a strong partnership and this has been a very respectful collaboration that recognises local mechanisms and capacity and leadership on the ground,'
Lau Viliamu Iese.

But the project won't be instigating unrealistic changes, he says. Researchers will work with farmers to integrate improved technologies to benefit the whole system rather than replace their traditional methods.

'Sustainable intensification is about producing more with fewer inputs, and this project provides the perfect opportunity for farmers to try to increase production levels and deal with the stressors brought about by the change in climate conditions,' explains Professor Reeves.

'Soils are the engine room of productivity, so reduced cultivation, more mulch and the use of legumes for biologically fixed nitrogen are expected to be critical. If the soil holds more water and there is better root and plant growth and nutrient recycling, plants are more resilient to climate shocks.

'Improved water management and more judicious use of pesticides through rotation and greater diversification should mean less herbicide-resistant weeds or resistant pests, and improved genetics may mean farmers can source a crop variety that is more heat and drought tolerant, for example.'

Setting up for more

Researchers are hoping to perform trials on several commercial farms and NGO lands in both countries, as well as at USP's campus in Tonga, USP's Samoa campus of the School of Agriculture and Food Technology and government research stations.

'At a national level the Ministry of Agriculture, Food, Forests and Fisheries is also excited because Tonga is the only Pacific island country that includes agriculture as a mitigation sector in its Nationally Determined Contribution ,' says Lau Viliamu Iese.

While the SRA has been serving as a scoping analysis to assess the strengths and weaknesses of CASI in the Pacific islands, it also provides the business case for the larger ACIAR project expected to commence in the next 6–12 months.

'We are setting up research partnerships for the future but the relationship between farmers and our partners in ACIAR and the universities, SPC and NGOs goes much further than that,' Lau Viliamu Iese says.

'For Pacific islanders, listening and understanding creates a strong partnership and this has been a very respectful collaboration that recognises local mechanisms and capacity and leadership on the ground.

'We have been trusted to strategically lead the on-ground negotiations, engagement, who to bring to the table, even the selection of the farming systems, which is very welcome.'

The benefit of CASI, he says, lies in the fact that its combination of systems taps into the traditional cultural values of farming in the region.

'In the Pacific islands, farmers may only have half an acre (2,000 square metres) or up to eight acres (3.24 hectares), but the land has a very special meaning—it's part of their identity, the land their forefathers farmed.

'They have excellent awareness of soil health but are torn between the need for increased production in the short term to feed more people and the awareness that traditional agriculture was based on long fallow periods to allow the land to recover.

'This project is about making Pacific island communities more profitable, resilient and adaptable, and leaving a lasting legacy of improved health and wellbeing of our people and the environment.'

ACIAR PROJECT: Conservation Agriculture and Sustainable Intensification of Smallholder Farming Systems in Pacific Countries as a Pathway to Transformational Climate Change Adaptation and Reducing GHG Emissions, CROP/2020/185.

Tony York: a true believer in R&D

When it comes to research and development (R&D), Tony York is a true believer.

Tony York is a new member of Australia's Commission for International Agricultural Research.

'As a farmer, I'm a practical demonstration of how an efficient farming business operates in Australia and all the benefits to be gained from trusting and investing in R&D,' says Mr York.

'My trust and belief in the benefits of good R&D for grassroots farmers is based on a long history of being engaged in R&D, particularly for growing perennial pastures on dry, saline soils.'

This 'history' includes hosting pastures research by the CSIRO, The University of Western Australia, and the Western Australia Department of Primary Industries and Regional Development on his farm

Mr York is a third-generation farmer near the central wheatbelt town of Tammin in Western Australia, where his family farms more than 10,000 arable hectares of wheat, barley, canola, various legumes, a Merino-based sheep flock of 5,000 head and 4,000 hectares of salt-affected land.

He is also a new commissioner on Australia's Commission for International Agricultural Research. The Commission provides expert, strategic advice to the Australian Minister for Foreign Affairs, Senator the Hon. Marise Payne, on priorities for Australia's international agricultural research program—particularly the work of ACIAR.

'I'm a product of what can be achieved with R&D,' says Mr York. 'As a commissioner I hope to demonstrate that and encourage other farmers to participate in R&D so they benefit, too. I believe Australian farmers don't realise how unique our R&D expertise is and that the process can be shared with many others in the regions without being a trade threat; in fact, it's likely to enhance our opportunities.'

Like those farmers in low-resource settings who benefit from the work of ACIAR partners, Mr York is no stranger to growing food in a difficult environment. He describes farming at Tammin—noted for its saline soil and low rainfall (275–300mm annually)—as 'agriculture in the margins'.

Nor is he a stranger to the impacts of climate change on food production. Tammin is 180kms east of Perth in south-west Western Australia: a recognised hot spot for climate change. The net productive capacity of Mr York's land has declined in the past

30 years due to a 10% drop in winter rainfall and a rise in temperature. Both are directly linked to the changing climate.

Greenhouse gas emissions (GHGs) are a major cause of climate change. Agriculture is the source of 14% of total GHGs globally. So, as the world looks to grow 70% more food by 2050 without growing GHGs, Mr York sees R&D playing a key role in farmers meeting this challenge.

'We definitely need to reduce our greenhouse gas emissions. I know that from first-hand experience. Yet, in dealing with climate change we need to keep things in perspective,' says Mr York. 'We're not the only sector contributing to the problem; however, we need to do our bit.

'For farmers, on one hand this means continuing to be more efficient. It means using proven R&D to improve our carbon efficiency, improve our energy efficiency and improve our productivity. Generally, these all come together to achieve mostly the same result: reduced emissions.

'On the other side of things, we do our bit by getting involved in carbon sequestration. We can make a positive contribution by sequestering carbon in pastures, trees and soils.'

Mr York is on the board of the body representing Australian farmers, the National Farmers' Federation (NFF). The NFF wants a target of net zero carbon by 2050 for the Australian economy.

Every farmer worldwide stands to benefit from a reduction in GHGs, Mr York says.

'I'm a dryland farmer. I depend on the climate. The biggest unknown for me is the uncertainty of the climate and the weather. I want a more predictable, less volatile climate. A more predictable climate enables me to make more decisions with more confidence.

'Globally, of course, we all have to be reducing GHGs. When we have a more reliable, more predictable climate and weather it means every farmer around the world can become more efficient and more selective about what they do and what they're best at doing in their environment, and we can be more confident about our farming systems.'

'I'm a product of what can be achieved with R&D. As a commissioner I hope to demonstrate that and encourage other farmers to participate in R&D so they benefit, too.'
Tony York

As Mr York sees it, the biggest challenge for ACIAR is helping farmers in the nations with which ACIAR partners adapt their production systems to resist the impacts of climate change.

'Some of the regions where ACIAR and its partners operate, such as the Pacific island states, are not really contributing much, if anything, to the problem (of climate change),' Mr York says. 'Their priority will be adaptation. We're going to have to help them work out how they can adapt.'


Tony York and his son Oscar inspecting saltbush on their farm in Western Australia.

Transforming Pacific food systems

There's a sense of urgency underpinning the newest ACIAR project to transform coastal food systems in the Pacific region. With parts of low-lying islands becoming permanently flooded, coral reefs declining and human populations increasing, pressure is mounting on fisheries productivity.

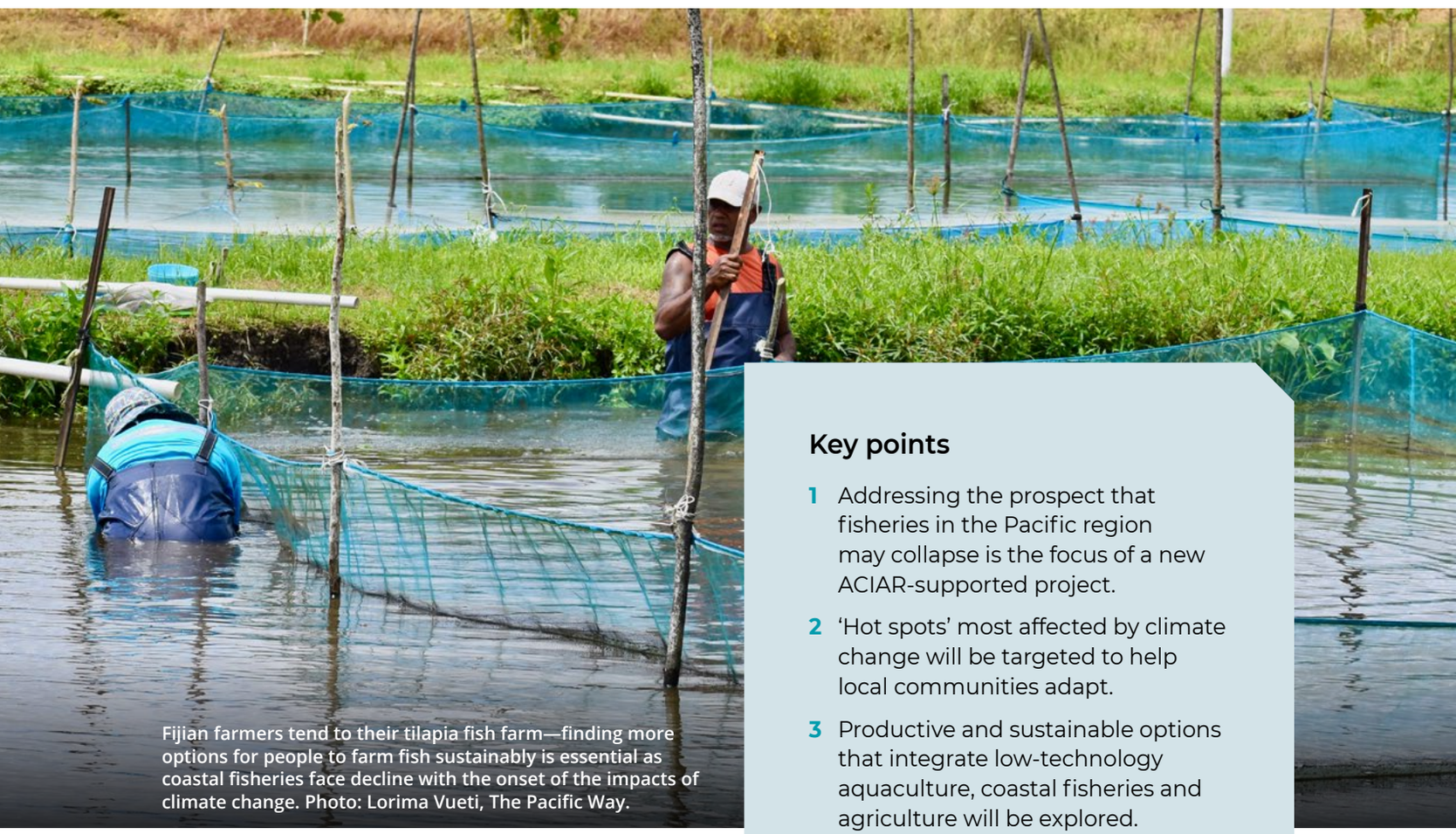
Local authorities forecast a supply deficit in the region's fisheries of 115,000 tonnes/year in the next 10 years.

In preparation for a larger project, a multi-stakeholder Small Research Activity (SRA) will identify 'hot spots' where the impact of climate change will be most severe and develop decision-making tools to enable local communities to adapt.

Having already tackled aspects of this challenge in Solomon Islands, Papua New Guinea (PNG) and on islands in the Torres Strait, CSIRO Land and Water's Dr James Butler is under no illusion that the process will be simple.

'It sounds relatively straightforward to find a process that enables people to plan for future food security, but everyone has busy schedules and there's only time to think about putting food on the table tonight,' says the project leader.

'Few research projects have explicitly considered the risk of fisheries collapse and the need for innovations that can increase coastal food production in the context of climate change.



Fijian farmers tend to their tilapia fish farm—finding more options for people to farm fish sustainably is essential as coastal fisheries face decline with the onset of the impacts of climate change. Photo: Lorima Vueti, The Pacific Way.

Key points

1. Addressing the prospect that fisheries in the Pacific region may collapse is the focus of a new ACIAR-supported project.
2. 'Hot spots' most affected by climate change will be targeted to help local communities adapt.
3. Productive and sustainable options that integrate low-technology aquaculture, coastal fisheries and agriculture will be explored.

'We want to integrate different forms of knowledge to anticipate this complex problem, find solutions and scale that process out across the Pacific, as well as encourage communities to drive the changes they want to secure a positive future for themselves. There is a lot of enthusiasm for this.'

ACIAR has enlisted New Zealand's Cawthron Institute (which specialises in aquaculture research and marine and freshwater resource management) and AgResearch New Zealand to undertake a desktop review of options for integrating coastal food systems such as aquaculture, fisheries and agriculture to increase productivity and ensure sustainability.

The project will consider the future implications of climate change and COVID-19 impacts, combined with trends in population dynamics and diet, to identify where food and nutrition deficits are likely to be greatest and assess the capacity for transformation in these hot spots.

Dr Butler says a 'food gap' now exists in the Pacific region, where demand is exceeding local supply, prompting the growing population to rely on imported processed food that is low in nutrition and contributes to a rise in diseases such as diabetes and obesity.

'We are investigating circular bioeconomy principles that involve recycling organic waste to create inputs for production and more efficient nutrient cycling, as well as developing metrics to measure and communicate the benefits of different combinations for social outcomes, to align with the United Nations Sustainable Development Goals.'

Other SRA partners are the Pacific Community (SPC) and the University of Technology Sydney.

Outcomes of the project will be used to design a larger multi-stakeholder project supporting local communities with decision-making processes and information about transformative options. The goal is to enable them to identify and act on the steps needed for a transformative change.

In particular it will build on two current ACIAR projects. The first is testing decision-making tools to plan food system transformations. The second looks at agriculture and fisheries for improved nutrition, taking into account assessments of current food system vulnerabilities for Fiji, Kiribati, PNG, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

Finding key leaders and champions at a local level will be integral to the follow-on project's success.

'We have to engage with those who have the most influence at a community level—for example, clan chiefs in Solomon Islands,' says Dr Butler.

'There is also a big "youth bubble" that is coming through and they are tech-savvy, so it would be good to get them involved in the process of thinking about how to transform the growing and selling of food for their futures.

'We need to build up our cohort of knowledge brokers or agents of change who have the skills to broker these processes in our absence. Their role is absolutely critical post-COVID as they'll carry the torch to influence people and do things we can't do.'

Senior lecturer at Solomon Islands National University, Dr John Fasi, is already a knowledge broker in the region. He says local people in low-lying communities are seeing once-dry coastal areas inundated with sea water during high tides, and sometimes permanently.

'We must address land issues, agriculture practices and the issues around the population influx into inland areas from affected coastal areas and low-lying islands,' Dr Fasi says.

'Agricultural practices will need to produce more food so that means looking at alternative crops such as salt-tolerant species like swamp taro, for example, or crops that can grow in less fertile soil and are highly productive over a shorter period.'

A key factor outside the remit of the project that Dr Butler says will have a major impact on transformation is land tenure.

As the sea level rises on some of the Pacific's coral atolls, conversations are being held about where to relocate displaced communities, but in most cases available land is already owned by customary landholders.

'To move somewhere or grow food in new locations, they need someone else's land; the problem is that this aggravates historic tensions over land tenure that have never been properly resolved,' says Dr Butler.

'We can provide a framework for planning and implementing transformation and adaptation for food but there are underlying systemic issues which must also be resolved to avoid conflict and open up opportunities for change.

'This requires our project to partner across multiple sectors of government, landholders and non-governmental organisations so that issues that are not directly about food production can also be addressed.'

> **ACIAR PROJECT:** Transforming Pacific coastal food production systems, FIS/2020/108.

Blueprints for the future

Her experience in an ACIAR capacity-building program for women has led Dr Suci Wulandari to explore the potential for women and smallholder farmers to benefit from agricultural value chains that are more sustainable, equitable and climate-ready.

Dr Suci Wulandari.

Dr Wulandari is one of 19 alumni from the first cohort of women researchers to take up Meryl Williams Fellowships in 2020.

A researcher specialising in agricultural socioeconomics, Dr Wulandari works with the Indonesian Center for Estate Crops Research and Development, part of the Indonesian Agency for Agricultural Research and Development within Indonesia's Ministry of Agriculture.

The Meryl Williams Fellowship is an ACIAR capacity-building program for women that aims to redress the gender imbalance in leadership within the Asia-Pacific's agriculture-related research sectors.

Within six months of commencing the fellowship last year, Dr Wulandari had already presented four single-authored and six co-authored research papers at virtual international agricultural conferences, resulting in an award for best paper and one for best presenter.

'Before I took part in the fellowship, I did not imagine I could do this,' says Dr Wulandari. 'The fellowship not only provided training for leadership and capacity building but also provided a mentoring program.'

The mentoring component has enabled Dr Wulandari to connect with 2020 fellows from Indonesia, including Nur Fajrina, who works for East-West Seed Indonesia; Dr Diana Chalil, a senior lecturer at University of Sumatera Utara; and Dr Melinda Moata, a senior lecturer at Kupang State Agricultural Polytechnic. Plus she has developed a connection with Dr Romana Roschinsky from the University of New England, who acts as her mentor.

'We need to develop a specific model for transfer of technology and knowledge to the women... If we want more women to participate in the integrated farming business model, they need to have a more entrepreneurial orientation and capacity-building opportunities.'

Dr Suci Wulandari

The fellowship also strengthened her collaboration with Professor Renato Villano from the University of New England, which is delivering the program on behalf of ACIAR. Dr Wulandari has been working with Professor Villano to develop strategies aimed at increasing women's participation in agricultural value chains.

Smallholder opportunities in integrated farming

A key theme running through much of Dr Wulandari's research is the development of innovative agribusiness models for integrated farming systems—such as grazing cattle in oil-palm estates, or grazing cattle or small livestock in coffee plantations.

Dr Wulandari sees integrated farming as a more sustainable and equitable alternative to monoculture,

or single-commodity agricultural enterprises, for feeding Indonesia's rapidly growing population of more than 270 million people. Integrated farming also presents new business opportunities for local farm communities.

As coordinator of socioeconomics and business modelling in the PalmCow component of the ACIAR IndoBeef program, Dr Wulandari and team have been developing business models to identify such opportunities, for smallholder farmers in particular.

Cattle in Indonesia are mostly farmed by smallholders who have limited access to land and stockfeed, constraining national beef production. Palm/cattle integration, however, offers cattle farmers access to additional grazing land and the 'weedy' understory of oil-palms as forage.

As well as reducing the need for herbicide use in plantations, integrated farming offers other shared benefits including the replacement of chemical fertilisers with manure (which can also be sold as organic fertiliser to external crop growers), and the 'recycling' of oil-palm harvesting and processing residues as animal feed.

Dr Wulandari's interest is not so much in the 'hard' science behind integrated farming but in the social dimensions and impacts of research in terms of regulation and policy that will support smallholder farmers with more opportunities to generate income and improve their quality of life. 'This is why I enjoy being a researcher,' she adds.

'In the context of a system, providing technical and technology support must run alongside providing institutional support.'

Gender sensitivity reshapes cultures

While Dr Wulandari says she appreciates the benefits of the fellowship program in helping her develop more effective leadership, communication and management skills, the real game-changer for her was the new perspective she gained on gender-equity issues for women in agriculture.

As she explains, in Indonesia most women face legal and cultural barriers that typically reduce their participation in education, the workforce and land ownership.

She says more needs to be done to facilitate women's participation in the agribusiness labour force outside the home—for example, by employers offering more flexible working hours to enable women to work.

Ensuring agricultural agencies use gender-sensitive language and awareness in planning and communicating research proposals, methods, surveys, operations and outcomes is also important.

Through the PalmCow project, Dr Wulandari hopes to encourage more women to take up business opportunities—such as marketing and selling manure as organic fertiliser. She has also been collaborating with other sectors to develop business models encouraging women's participation in the coconut, vanilla, nutmeg and pepper value chains.

'We need to develop a specific model for transfer of technology and knowledge to the women,' she says. 'The model needs to focus on entrepreneurship: how can we help women to become more proactive, take risks, collaborate and network with other stakeholders?

'If we want more women to participate in the integrated farming business model, they need to have a more entrepreneurial orientation and capacity-building opportunities. If we can develop the capacity of women, it will have a positive effect for their children as well.'

Fellowships during COVID

The Meryl Williams Fellowship program's lead coordinator, Dr Rebecca Spence from UNE, says she is in awe of the tenacity and dedication shown by all 2020 Meryl Williams Fellows during a year in which the program, like many others, has been severely interrupted by the COVID pandemic.

'We are engaging in some online activities with the 2020 fellows, particularly looking at leading with resilience because it's so relevant,' says Dr Spence.

'Suci is a really dedicated researcher—research is her passion, and she has been constantly seeking opportunities to collaborate and extend her research networks, as well as bring a gender focus to her work.

'She has really seized the opportunity.'

Key points

1. Meryl Williams Fellow Dr Suci Wulandari is supporting the advancement of women farmers in Indonesia.
2. Women in agribusiness need knowledge, support and opportunities to help them adapt to climate change.

Developing crop and soil management options to support agricultural production on salt-affected land in Vietnam is part of a new ACIAR-supported project to help farmers. Photo: Trần Duy Khánh.

Salty land turns productive in the Mekong

Saline water is creeping further inland in the Mekong Delta, threatening the livelihoods of millions of farmers and, more broadly, food security in Vietnam's critically important 'rice bowl'. While the Delta's coastal region and surrounding areas have, to varying degrees, been subjected to and hence adapted to salinity over the years, there was never such a problem in the areas further inland. That is, not until recently.

'The Delta has 19 million people there who produce 50% of the country's food,' says Dr Jason Condon, a senior lecturer in soil science at Charles Sturt University. 'As it salinises, the food production of the country suffers.'

Dr Condon leads an ACIAR-supported project that aims to equip local stakeholders with the best soil management and alternative crop options to grow during the dry season when the threat of salinity is greatest. The five-year project started in January 2020.

'Farmers know things have changed and they want to work with us to help find the best way forward,' says Dr Condon.

Salinity is increasing in the Delta for several reasons, including because there's less fresh water flowing downstream to the Delta and more saltwater intruding into the system. The year 2016 was a particularly bad year. Farmers who had never experienced saline conditions before were suddenly forced to grapple with up to 70% of their rice being

affected by salt and 30% of their crops dying, yielding no grain. Last year, 2020, also brought severe drought and salinity events amidst the global COVID-19 pandemic. That year the Vietnamese Government estimated production losses to be roughly 460,000 hectares and approximately 200,000 households lacked safe water for domestic use.

To help farmers adapt to these new conditions, Dr Condon is working with his project partners across Australia and Vietnam.

Field trials and glasshouse experiments have also been launched to identify suitable crops and soil management practices. The researchers are looking for crops like quinoa, tomatoes, beetroot and soybean that have most, if not all, of the following three main characteristics: efficient water use to minimise the need for irrigation, salt tolerance, and a shorter growing period so that the crop can quickly be harvested before salinity issues inevitably set in.

In terms of soil management strategies, the researchers are looking at both improved irrigation methods and mulches which can minimise evaporation, keeping the soil wetter for longer and reducing damage to crops even if there is salinity. The researchers are also testing the timing of sowing with a few different crops. One of the big challenges farmers are facing is changing the timing of cropping events so that production can be optimised, says Dr Condon.

Key points

1. Climate change is exacerbating the issue of salinity in the Mekong Delta, threatening food production and food security in Vietnam.
2. An ACIAR-supported project is exploring crop and soil management options for farmers affected by salinity.
3. As sea-level rise and saltwater intrusion continue to increase, larger transformative changes may be needed, which the new ACIAR Climate Change Program will explore.

But, once data has been gathered on current and future predictive levels of salinity, potential alternative high-value crops and effective soil management options, Dr Condon says private-sector investment and government interest will grow, resulting in larger socio economic benefits for the overall Delta.

'That sort of information is useful to the private sector because it gives it confidence in investment in the supply chain of new crops. The information is also useful to the government in terms of policy changes so it can look at incentives for companies to come into the areas,' says Dr Condon. 'Providing crop options that foster investment into rural communities helps provide opportunities for locals so the young people don't have to migrate to the city to look for work.'

In order to make the supply chain sustainable, one thing the team has observed from its past work in the Delta is the need for post-harvest production facilities, such as mills or canneries, which can extend the life cycle of any alternative high-value crops, thereby flattening the supply curve.

While the project was not designed to create post-harvest products, Dr Condon says thinking about it is important because it tests some of the project's key research questions, mainly: What crucial factors must an industry have for it to be successful and sustainable in the Delta? To help answer this question the researchers are analysing the strategies of successful local companies like the Loc Troi Group, which specialises in plant production services for horticultural crops and rice, and ANTESCO, a fruit and vegetable producer and exporter.

The researchers are also putting a strong emphasis on gender—specifically, the role gender plays in the gaining and transfer of knowledge that can possibly lead to changes in farmer practices. In Vietnam, men and women on farms play different roles, with women being much more market focused. 'So, they probably are more receptive to changes in cropping patterns and post-harvest production,' says Dr Condon.

Still, not all Vietnamese farmers believe there's a problem with salinity. The project covers four provinces in the Delta, out of which some farmers have been hard hit by salinity and are very concerned about the issue, while many of those residing furthest inland have yet to be impacted by salinity and therefore don't view it as a problem.

'There's a bit of a disconnect there,' says Dr Condon, 'and local farmers generally don't plan past three years into the future.' So the researchers intend to take those living inland to see the challenges

downstream areas are facing. 'One province can hopefully learn from the next, because the future's just downstream,' says Dr Condon. This idea of a field visit—like many others in the project—originated from the Vietnamese Department of Agriculture and Rural Development.

Climate change will require even bigger changes in food systems in parts of the Mekong Delta as a consequence of the increasing intensity and frequency of extreme weather events resulting from climate change. Aware of this issue, ACIAR recently launched a new Climate Change Program dedicated to creating the pathways for transformation.

'To date, ACIAR projects like Dr Condon's have largely been focusing on incremental changes or strategic diversification in current food and livelihood systems to cope with current climate change,' says Dr Veronica Doerr, the Research Program Manager for Climate Change at ACIAR. 'But as salinity increases and parts of the Delta go under water, we need to think about the very different food and livelihood systems needed and start the transition for how to get there.'

Mulching can minimise evaporation, keeping the soil wetter for longer, reducing damage to the soil even if there is salinity and allowing crops to be grown successfully. Photo: Trần Duy Khánh.

Dr Doerr says what's important about transformation is a shift from asking questions like 'How can I do what I'm already doing better?' towards questions such as, 'How can I do something quite different to match the environment that's coming my way?' In the Mekong Delta, this includes identifying and seizing new development opportunities associated with sustained salt and brackish water, as highlighted in the new draft master plan for the Mekong Delta 2021–30 and vision to 2050. Dr Doerr says it is essential to plan these bigger shifts early but use monitoring and learning to adjust adaptively over time.

'Often we're not really monitoring the right things to know when a big change is needed, and our cycles of learning take a very long time to play out,' says Dr Doerr. 'The data we collect influences policy sometimes 30 years into the future. We need to reduce that time window a great deal.'

'Providing crop options that foster investment into rural communities help provide opportunities for locals so the young people don't have to migrate to the city to look for work.'

Dr Jason Condon.

As for Dr Condon, he says new dry season crops can be a critical stepping stone on the way to transformative changes. Learning can also be accelerated by sharing lessons with other countries like Bangladesh that are experiencing similar climate impacts.

'In as far as the problems of sea-level rise and climate change impacting farms go, the Mekong is probably one of the worst deltas so we are ahead of the game in a way,' says Dr Condon. 'We should take this opportunity to show other countries what their future's going to look like.'

Dr Condon and his colleagues plan to hold a symposium in Vietnam so that relevant stakeholders from countries around the region can visit the project's field sites and learn best practices from the project's local partners. 'That way the Vietnamese researchers become the South-East Asia experts on the topic. There's a lot of learning to be had from Vietnam and other places.'

ACIAR PROJECT: Farmer options for crops under saline conditions in the Mekong River Delta, Vietnam, SLAM/2018/144.

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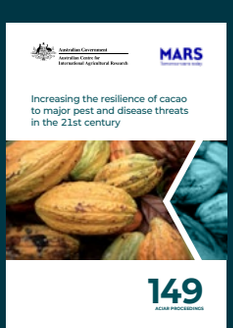
Sharing knowledge, information

Proceedings from a cassava research symposium that shared knowledge across the public, private, research and development sectors in Vietnam, Indonesia, Laos, Cambodia and Myanmar.

Scaling and policy of CASI

A report on conservation agriculture-based sustainable intensification (CASI) scaling and policy in rice-wheat farms of the Eastern Gangetic Plains.



Increasing industry resilience

A compilation of the latest research in cocoa pest and disease management, to increase the resilience of the cacao industry to these threats.

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