The Crawford Fund
2025 Annual Conference

Crawford Fund FOR FOOD SECURITY

Progress and Prospects for Climate-Resilient Agrifood Systems: Actionable Recommendations for Policymakers and Practitioners

11-12 August 2025

Parliament House,
Canberra, Australia,
and online

Editor: Tania Paul

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The Crawford Fund for Food Security

The Crawford Fund for Food Security was established in 1987 by the Australian Academy of Technological Sciences and Engineering, in honour of Sir John Crawford and his lifelong commitment to international agricultural research.

We are a Non-Government Organisation and charity supported by the Australian Government through ACIAR, and by State and Territory governments, industry, philanthropy, universities, research institutions, and individual experts.

Our purpose is simple. We strengthen Australia's engagement in agricultural research for development. We show why this work matters for farmers, food systems, environments, and economies in developing countries, and why it matters for Australia.

We build capability through focused training and mentoring delivered by Australian and international practitioners. We invest in the next generation through scholarships, awards, and our partnership with the RAID Network.

We support international research partnerships, including the CGIAR, and promote Australian leadership in global agricultural innovation and food security.

Our annual conference brings these ideas into the public arena, each year tackling a central question in food security and the role of research in a more secure world.

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IMAGES – The Crawford Fund for Food Security; and the conference speakers' presentations
COVER DESIGN – The Crawford Fund for Food Security

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Foreword

The Crawford Fund for Food Security, the conference speakers and the delegates acknowledge the traditional owners of the land on which this conference was held.

The 2025 Crawford Fund for Food Security Annual Conference, *Progress and Prospects for Climate-Resilient Agrifood Systems: Actionable Recommendations for Policymakers and Practitioners*, brought together researchers, policymakers, industry leaders, and emerging scientists to address one of the most urgent challenges of our time - ensuring food security in a rapidly changing physical and political climate. The discussions reflected the Crawford Fund's enduring commitment to promoting collaboration, capacity building, and practical action for sustainable agriculture across the globe.

Across plenary sessions and panel discussions, speakers examined how nations can meet the intertwined imperatives of reducing emissions, conserving biodiversity, and sustaining livelihoods. Delegates heard evidence from Asia, Africa, and the Pacific that climate resilience is inseparable from equity, inclusion, and community participation. They also considered how Australia, with its strong record of agricultural innovation and partnership, can lead regional efforts to advance sustainable food systems that are productive, fair, and environmentally responsible.

A defining feature of the conference was the active participation of young researchers whose curiosity, insight, and energy embody the Fund's investment in future capability. Their engagement with mentors and practitioners reinforced that the solutions to complex global problems lie as much in people as in technology or policy.

The recommendations emerging from this conference reaffirm Australia's opportunity and responsibility to champion food security through partnership, research, and advocacy. They call for renewed attention to agriculture in development assistance, stronger regional alliances, and sustained investment in science, innovation, and human capacity. We look forward to reporting progress on many of these actions at our 2026 Conference.

These proceedings capture the ideas, evidence, and spirit of collaboration that characterised the 2025 Conference. They stand as both a record of achievement and a call to action for all who share the vision of a food-secure and climate-resilient world.

Hon John Anderson AC FTSE
Chair, The Crawford Fund for Food Security

Acknowledgements

Chairs/moderators of the conference sessions

Hon John Anderson AC FTSE, The Crawford Fund for Food Security

Professor Wendy Umberger, Chief Executive Officer, ACIAR

Ms Su McCluskey FCPA FTSE Member of the Crawford Fund for Food Security Board of Directors and Former Special Representative for Australian Agriculture

Ms Jennifer Kelly, Senior Innovation Systems Broker, CSIRO Agriculture and Food Sustainability Research Program

Mr Nigel Hart Managing Director, GRDC

Jo Grainger, Acting First Assistant Secretary, Trade and International Division, DAFF

Conference Sponsors

We truly appreciate the support of our sponsors in showing their involvement, interest and support for Australia's efforts in agriculture for development. We would like to offer our sincere thanks to the following supporters of this year's conference:

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AgriFutures Australia

Australasian Agricultural & Resource Economics Society

Australian Centre for International Agricultural Research

Centre for Agriculture and the Bioeconomy, Queensland University of Technology

Australian Centre for Pacific Islands Research, University of the Sunshine Coast

CGIAR

CSIRO Agriculture and Food

Department of Agriculture, Fisheries and Forestry

Department of Foreign Affairs and Trade

Department of Natural Resources and Environment, Tasmania

Department of Primary Industries and Regional Development WA

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The UWA Institute of Agriculture

Scholar Supporters

We would also like to offer our sincere thanks to everyone who has provided support or a donation for this year's conference scholar program. The following have agreed to have their support acknowledged and we are very happy to do so

Lynette Abbott
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Dong Wang
Olivia Woodiwiss
Penny Wurm

SIR JOHN CRAWFORD MEMORIAL ADDRESS

Trade-offs & Tough Choices

The Hon. Joel Fitzgibbon GradCertBA, GAICD

I am indebted to the Crawford Fund for Food Security for many things, but two stand out.

First, I'm grateful for the opportunity to follow the many esteemed thinkers who have previously delivered the *Sir John Crawford Memorial Address*. Each of them brought an expert view on the things that matter most to us at Crawford, and of course, by extension, ACIAR, – global food resilience and security, and all things that might make for a better, more equitable, and sustainable world.

My contribution tonight will be somewhat different to the contributions of previous speakers. And I should say, tonight I speak for myself, not for the Crawford Fund for Food Security or its Board.

Second, I'm grateful for the introduction to the life and work of Sir John Crawford. As a former Agriculture Minister and Shadow Minister, I knew of him, but before joining the organisation named in his honour, I had only a limited appreciation of his legacy and the extent and effectiveness of his public service. He was a great Australian. Of all the things he's known for it was his grasp of the value and importance of soft power that stands out for me.

I thank Denis Blight and Nicholas Brown in particular for helping me to better understand who he was, what he was, and what he achieved. I do wonder what he'd think about the world we now live in, and what advice he would offer. In his book *Homo Deus*, Yuval Noah Harari reminded us that at the beginning of this century, more people died from obesity than starvation, more people died from old age than disease, and more people died from suicide than were killed in war.

It is true that humanity continues to make great progress – we live longer, we're wealthier, and medical technology and procedures continue to improve. Innovation is all around us, and many developing nations continue to make their way towards developed nation status.

However, since Harari made his points, the world has become a less certain place, and less stable place. Distressingly, global hunger has been rising. And despite the heavy hand of government regulation in Western countries, the state of our natural environment continues to decline.

Given all of this, it's no wonder President Trump's promise to disrupt the governance *status quo* was embraced by so many American voters.

The twentieth century remains history's most violent. But the economic progress and the boost to living standards achieved in the period after the end of the Second World War were remarkable.

Led by the United States, the liberal democratic West successfully promoted open trade and built a global rules-based order, which has also delivered relative peace and security. But that architecture is now under pressure, and the dominance of the West is under challenge. Meanwhile, changing climatic conditions are making our quest for greater security – including food security - more challenging

The history of the world is largely a story of the rise and fall of civilisations and great empires. Both the Holy Roman and Byzantine Empires lasted more than one thousand years.

The British Empire – the largest ever by territory – lasted around 400 years. The Qing Dynasty, by the way, lasted less than 300 years, but its legacy – including its territorial expansion, including into Taiwan – continues to have an impact on us today.

Empires decline for many reasons, including but not limited to disease, drought, famine, corruption, invasion, internal dissent, poor leadership, and complacency.

The US-led West is not technically an empire; indeed, 250 years ago, the good people of the American continent successfully fought to free themselves from one. Rather, its model since the Second World War has been not to rule, but to lead and build. To rebuild Europe, to build nation-state autonomy, and to build a rules-based global order to sustain them.

Notwithstanding, it is instructive to compare the longevity of global US leadership and its dominance with the great powers of the past. That architecture is just eighty years old. Yet Western leadership and influence are now under significant challenge. In large part, in my view, due to indulgence, complacency, and dare I say, a failure to adequately reproduce ourselves.

In 2025, we have zero justification for complacency. We are now in phase three of three periods since 1945. The long Cold War, the unipolar moment – during which US superiority was absolute – and now a multi-polar world, which is making its way to a new dichotomy.

On one side is the liberal democratic West. On the other side is a bloc of aligned states which includes China, Russia, Iran, and North Korea. It is clear that our geo-strategic outlook is in decline, and in that environment, we will have less warning of any threat to our sovereignty.

China, of course, is Australia's largest trading partner. Yes, complicated and challenging.

Given this changing strategic dynamic, Australia must do more to build both sovereign capability and the capacity to deter and deny any potential aggressor. That means we need to make some tough policy choices, which in turn will demand some tough trade-offs.

Spending more on our defence capability and strengthening our alliance and partner country relationships is one of those tough choices. In the absence of more courageous revenue-raising measures, cuts in other areas of public spending or significant economic growth-generating measures will require trade-offs. But as tempting as it is, strategic and defence policy are not what I want to dwell on tonight.

Rather, I want to talk about economic strength, partly because you can't have the former without the latter. And more particularly, I believe there is now enough evidence to suggest that our current pathway to net zero emissions is not without its risks, and therefore, we have a responsibility to hedge against those risks by diversifying our approach. Not to do less, but to do more.

On the question of risk assessment, we have to be cognisant of the reality that climate change is pushing us in a number of separate spending directions. We are being pushed to invest more in mitigation, sequestration and adaptation because our changing climate poses many threats.

One of those risks is the enhanced prospects of military conflict and therefore, we are being further pushed to bolster our ability to deter and deny any aggressor. These are all big fiscal burdens.

Of course, to do all of that, we need a strong economy with a strong industrial base.

We can spend more on defence without raising taxes or cutting spending elsewhere, if we bolster economic growth and we spend smarter. But more money won't be enough without the ability to efficiently manufacture, maintain, and sustain defence platforms, and without a full and energetic embrace of artificial intelligence and all it offers.

The latter includes the deployment of policy frameworks that accommodate data centres - planning

policy, industry policy, environmental policy, and energy policy. Reconciling our strategic and economic interests – including our US and China relationships - is no easy task.

Trade-offs and tough choices will be the lot of our political leaders in the years ahead.

While not the world's worst, our public debt is too high, and our demographic challenge has not gone away. Our workforce continues to age, and despite high levels of youth idleness, employment vacancies remain too common. Australia's productivity growth has been too low for too long.

Despite admirable public policy initiatives, we still lack the trades people and other skilled workers we need to lift productivity and to grow our economy, while also keeping downward pressure on inflation and interest rates.

I welcome the Government's decision to tackle our productivity performance as a matter of priority. Plenty of potential solutions will be on offer when the economic roundtable is convened.

But for me, two things should be an immediate priority.

The first is the weight regulatory burden. The second is a more imaginative and creative approach to the climate change challenge. The heavy hand of government regulation is choking Western economies and suppressing growth in capital stock. Growth in our physical stock, and its depth, should be benchmarked not against those of our western partners but rather, the fast-growing countries of our region. Of course, in Budget terms, addressing regulatory burden is a no or low-cost option for lifting productivity. As a non-executive director on an ASX board, I regularly see the problem close up.

Indeed, those sitting in board rooms around the country are hesitating and procrastinating in the face of ESG uncertainties. The haunt of proxy advisors is always with them. Investment in new and more efficient plant and equipment will be a crucial part of building a more competitive economy. Modern manufacturing plants also help reduce our greenhouse gas emissions.

Further, new investment in manufacturing is crucial to rebuilding sovereign capability, a term that has become particularly sexy since the advent of COVID-19. But investment is not flowing as it should because in this regulatory environment, it's all too hard and too risky. High energy prices are also a factor – both for investment in new plants and for decisions to keep existing plants running.

On another front, there is plenty of talk and promise on housing availability and affordability. But despite some policy movement, there remains far too much emphasis on demand-side responses.

Demand-side solutions are also weighing heavily on the public purse. There is too little action on the supply side, and in particular, our land development and building approvals processes. In the absence of significant change, rezoning and housing development approval processes will continue to drag on for years. So too will construction time-frames.

Many of these delays are due to biodiversity constraints. Biodiversity is important, but more sensible, balanced, and creative approaches are needed.

It's not just about providing housing for young families. More housing allows for greater labour mobility, and enhancing labour mobility will provide a boost for our productivity performance as a nation. There can be no doubt, red and green tape are holding back our economy. Just ask those who import and export goods in and out of Australia. Our approvals system is a 20th-century standard at best.

The second thing we need to do urgently is rethink our approach to the climate change challenge. The current framework abounds with green-washing, rent seeking, unrealistic targets, and ultra-optimistic views about emerging technologies. There are a few egos too!

Public trust in Western politicians and public institutions is being further eroded by what appears to some to be one set of rules for the renewables sector and another set of rules for everything else.

Our climate is changing in adverse ways. The evidence is all around us, and no one understands that better than those who work the land. But we don't have to hold our economy back to be a world leader in climate change action. We need to adjust, recalibrate, and broaden our course of action.

Our evolving strategic situation is demanding that we build more sovereign capability, yet our current climate policy pathway is not sufficiently strengthening our capacity to do so.

Our strategic competitors are not making that same mistake. This can and should change. The first thing we need to do is remove the ill-considered prohibitions on nuclear electricity generation.

Arguments that this carbon-free technology is too expensive or too slow to build may be valid. But let's remove the prohibition and let the market decide whether there is a place for it here in Australia. I suspect there is, particularly given the need to host the energy-hungry data centres we'll need to remain internationally competitive and to improve our productivity performance.

Australia has enormous reserves of uranium, and we sell our ore to countries around the world to feed their nuclear energy plants. Yet we are close to generating the same energy here. It's just not rational.

The second thing we need to do is to follow the example of the first Rudd Government and focus more on carbon capture and storage. I am constantly bemused by those who say this technology doesn't work. They say so even though it's already happening both here and in so many parts of the world.

Indeed, in the Moomba Basin, SANTOS recently safely stored its one millionth tonne of carbon. That's the equivalent of closing down a large coal-fired generator for a year. Ironically, the people who say carbon capture doesn't work regularly preach the green hydrogen and green steel gospel, even though the market has recently confirmed neither is yet viable.

The next thing we need to do is get more gas out of the ground. We are endowed with enough gas in Australia to provide for both our domestic needs – residential and industrial – and to sell into lucrative export markets. But we lack the will to fully exploit our reserves.

This makes no sense. Gas can be scrubbed of its carbon, and we desperately need it as a transition fuel. And more carbon scrubbed gas provides the opportunity to produce blue hydrogen, a more viable proposition at this time than green hydrogen.

The next thing we should do is accept that the lives of some of our coal generators will need to be extended beyond what is ideal. It's just a reality of the engineering and physics of our energy system. Meanwhile, both China and India are building new coal-fired generators as I speak.

A stable energy grid will help us accelerate the transition to a lower-carbon world. Globally, there is plenty of emphasis on mitigation but not enough focus on adaptation and sequestration – biological, geological, and technological. We can do so much more in the land sector.

We need to put the "net" back into Net Zero Emissions. The land sector could play a much larger role if given the chance; it can also add to our biodiversity stock. One of the many things that makes government challenging is information or knowledge asymmetry – the information gap between policy makers and the electorate.

Knowledge asymmetry creates an opportunity for those opposed to a sensible initiative to run political interference by peddling misinformation and disinformation. But the key problem with the

land sector is that too few politicians sufficiently understand it.

Until there is a political controversy, it's a policy area left to just a few – usually those with portfolio responsibility or those with a farming background. Of course, geography is just one explanation for this relative lack of focus on one of our most important sectors.

Agriculture is complex, and if you don't understand how a device works, you won't use it, and you'll have limited interest in it. As you all know only too well, smarter farming and healthier soils help to build resilience and food security by sequestering more carbon and holding more drought-proofing moisture.

Yet the regulatory regime remains unfriendly to those hoping to secure carbon credits for improving carbon sequestration in our soils.

Australia has a pretty good carbon trading framework, and yes, we need to protect the integrity of that framework, and we want sequestration to be both meaningful and permanent. But we need to provide more certainty for those prepared to further invest in carbon farming and other food production innovations.

Food manufacturers are doing their bit by working with growers and producers to lift productivity and environmental outcomes. We should provide them with incentives to do even more.

We can also do more in the area of crop-based biofuels produced from non-food cover crops like *Carinata* or *Ethiopian Mustard.* This includes sustainable aviation fuels, which will have the additional benefit of further protecting our sovereignty.

The forestry sector is also part of the solution. To the federal government's credit, some big strides have recently been made. For example, the so-called "water rule" has been removed. This nonsense piece of regulation denied carbon credits for forestry plantations unless they were planted in areas of low rainfall. Rainfall measures so low that establishment was not viable. Land prices are holding tree plantings back. The current government – to its credit – is now issuing plantation grants to lower the investment hurdle. But the private sector could do more if we worked with it to make this asset class better understood.

The less productive areas of farm holdings can be used to plant trees for our housing and other needs. More trees not only means more sequestration, it also means better soil health, better animal welfare, and improved on-farm ecosystems. These opportunities should be central to our aspirations to improve our natural environment.

Trees are our great carbon sink. A native tree slowly ceases to absorb carbon with age. If it dies or is burned *in situ* it releases the carbon back into the atmosphere. A harvested tree used to build the furniture, staircases, and window frames we love so much stores the carbon in that product forever. Another is seeded in its place, starting the photosynthesis process all over again.

Yet two of our states have banned selective and sustainable native forestry harvesting. Victoria closed the industry down, only to import native logs from Tasmania. All in the name of the environment!

The only things the native forestry bans achieved are the build-up of bushfire-promoting undergrowth and greater difficulty for wildlife trying to navigate the forest floor. Closing down our native forestry sector forces us to import our product from countries that do not enforce our high environmental standards. Of course, this also further undermines our sovereign capability. State governments now have the responsibility to acknowledge the greater role forestry can play in our efforts to address our climate change challenges.

Another great opportunity that rarely rates a mention is the quest to reduce the methane emitted

by our cattle herd. *Asparagopsis* is one largely ignored innovation, but for me, our nascent capacity to rapidly accelerate breeding changes is even more exciting.

We now have the technology to accelerate this change at scale. To both reduce methane and lift productivity in both our beef and dairy sectors. This technology would be a gift to the global south too. One Queensland-based company is close to commercialising a platform that would provide every cattle producer and dairy farmer with the tools necessary to achieve affordable, accelerated genetic improvement through the *in vitro* production of embryos.

But you don't read about it or hear policy makers talking about it. Nor are financiers rushing to the door to back the technology. They are too focused on decades-old technologies like wind turbines and solar panels, or the elusive green steel and hydrogen.

It disappoints me that so much public money goes to subsidising what could now be considered legacy technologies, and by comparison, not enough is spent promoting innovation in the production, consumption, and sequestration sides of the equation. A greater role for the land sector in our climate change response should be pushed to the top of the public policy agenda. And our ambitions for it should extend well beyond our shores.

John Crawford would have it no other way. He taught us to be ambitious, energetic, and hard-working. He demonstrated that we have the capacity to shape public policy, research methods, and global research institutions. Indeed, to lead in the development of new institutions both at home and abroad. This, of course, is part of his legacy.

You often hear people say we can't change the climate from Australia. This is no doubt true. Just as it's true we may never realize the dream of being a renewable energy superpower. We can, though, be an energy superpower. We have abundant reserves of oil and gas. And we are blessed with plenty of wind, sunlight, and land. We will never manufacture wind turbines or solar panels in Australia a significant scale. Nor indeed can we manufacture them at a globally competitive price.

But we can be a global leader in soil health and carbon sequestration. We have already demonstrated our forestry sector is the world's best practice, and we can help others develop and follow those standards. We can lead the way in the production of biofuels from non-food cover crops, lowering emissions and strengthening food security, and our broader national security. We can be a world leader in methane-reducing livestock breeding systems.

And beyond the land sector, there are two areas of greenhouse gas mitigation in which Australia enjoys a competitive advantage. The first is blue hydrogen. We are one of only four countries endowed with significant reserves of relatively cheap lignite (or brown) coal. Like few other countries, we can deploy carbon capture technologies before producing blue hydrogen from these extensive reserves.

Second, we have the geological formations to receive and permanently store the carbon captured from the processes of our trading partners. That will be a good thing for the planet, and a good thing for our economy. Wind and solar will continue to play a major role in our efforts to meet our net zero aspirations. But they won't be enough on their own.

They are too intermittent and disruptive. Securing necessary levels of social licence will become harder, not easier, if we continue to pursue greater scale. We are smart enough to walk and chew gum too.

I suspect very few in this Great Hall tonight would consider themselves activists. And for many, activism would not be an appropriate course of action. But we can ramp up our advocacy efforts. I

believe those of us with an interest in agriculture, food and food production processes, have a responsibility to;

1. Take every opportunity to highlight the greater role the land sector can play in our efforts to reduce greenhouse gas emissions. While also reminding people of the great work we do helping others build food security, and

2. to convince others that a science-based approach is always the most efficient and effective approach.

I suspect that's a good note to end on. I thank you all for the wonderful work you do.
I wish you all a productive and successful conference.

The Hon Joel Fitzgibbon, Former Federal Minister for Agriculture, Fisheries and Forestry was first elected to the House of Representatives in 1996, Joel served as Defence Minister and Minister for Agriculture, Fisheries and Forestry in the Rudd Government. He also served as Chief Government Whip in the Gillard Government.

Over the course of his 26 years in the Parliament, Joel held a number of Shadow Ministerial positions including Assistant Treasury, Financial Services, Defence, Mining, Energy, Agriculture, Small Business, Tourism and Regional Australia. He was also the Chair of the Joint Standing Committee on Foreign Affairs, Defence & Trade. Joel retired from the House of Representatives in 2022.

Welcome Address

The Hon John Anderson AC, FTSE
Chair of the Crawford Fund for Food Security

Ladies and gentlemen, thank you very much for the opportunity to say a few words this morning and welcome you to the 2025 conference. We started last night with Joel Fitzgibbon, the former minister for defence, agriculture, forestry, and fisheries, giving a thought-provoking address and perhaps encouraging us to ground ourselves in the realities that confront us.

First, I want to thank everyone who made this conference possible, and also acknowledge organisations like ACIAR and the state and territory governments who provide funding behind the scenes to keep many of our activities running. It certainly makes my job easier.

Today is our opportunity to listen, to challenge assumptions, to seek out the facts, and to start guiding changes in practice, policies, and community development.

I thank all the delegates and particularly our speakers for the commitment of your knowledge, your time, and your perspectives to our discussion today.

This is my last stint as chairman. I've been involved with Crawford since I left this extraordinary place in 2007, after 19 years here. I did not contest that election, but I just want to say that I think Crawford is a remarkable institution. It is about the business of good works, of feeding people.

Nothing engages me more emotionally than the thought of looking into the eyes of a starving child begging for nutrition. As I look at my grandchildren—how well-fed, how fortunate, how they laugh and enjoy everything they have—I think how terrible it is that in a world that has for a long time not produced enough food for every child to eat properly, we still have millions of children who are starving. We still have people who are malnourished, who cannot reach their potential.

The people involved in Crawford, as Tim Reeves commented yesterday, have something of a calling. In a way, it's aid, it's a projection, it's taking Australia forward on the cheap for the taxpayer because of the people on the board. I want to pay tribute to the Crawford Board—colleagues who give their time, energy, and wisdom not for recognition but because they believe in this cause.

If you'll indulge me for a moment, I'd like to name them: Tim Reeves, Tony Gregson (who can't be with us), Dick Warner from Tasmania, Richard Sheldrake from New South Wales, Kay Bashford, Wendy Craik, Mark from Western Australia, Joel Fitzgibbon (our deputy), Sue McCluskey (our new chair), Rosemary Dent, and Professor Kim Anderson from South Australia. And to our younger scholars: look to these people. They may have a few more grey hairs, but they continue to contribute long after many would have stepped back. That is the kind of lifelong commitment we hope you will embrace. Be engaged, have a go, keep contributing while you can in this age of disengagement.

Board, thank you for the privilege of counting you as friends over such a long period of time.

I could talk forever about previous board members, but time is a constraint. Sean, thank you for your very long-term involvement with Crawford. You took over at a moment of instability for the fund a couple of years ago, in circumstances that reflected very well on your character and your commitment to what we do. With the help of Sarah Paradice, Sue Faulkner, Larissa Mullot, and Bronwyn Refshauge, you have manned the place and taken Crawford to a new level. I will be forever grateful for the reflected glory you give me.

Cathy, I mentioned last night, you've done a fantastic job over a long period of time. I can't believe it's been 37 years. Thank you for everything you have done. Lucy Broad takes over, and Lucy will do a fantastic job.

I just wanted to pay tribute to the marvellous team I've worked with and had the privilege of being part of for a long time. Neil Andrews, a previous chair, and John Kerry, who remains committed, are here today. It's terrific to see you.

Let me encourage us all to zoom out and recognise the remarkable achievements of the last 80 years. It's estimated that the world's farmers have provided enough food for 10 billion people for each of the last ten years. The fact that people go hungry has more to do with broken infrastructure and political corruption—and, let's be honest, food waste in wealthier parts of the world—than with a lack of food. We've lifted an estimated 5 billion people to better nutrition over the last few decades. The progress has been extraordinary, but it doesn't happen in a vacuum.

I am deeply concerned about global instability, and I want to mention it today because we need to be aware of it. Western nations are complicit because we've lost touch with our core values—the things that drove us to create a better world.

As Joel said last night, the 20th century was a shocker. After WWII, the Allies were determined: no more world wars, no more Holocaust, no more turning our backs on less fortunate peoples who needed nutrition and opportunity.

Under that liberal global order, with the Americans as global police, we've had 80 years where the things we're concerned about have been taken forward. You need global stability to help people in need. You need research and development in great universities, with great academics and thinkers.

Just talking to a couple of wonderful researchers here today, doing incredible work in Canada, taking that work forward doesn't happen in a vacuum. It happens in an environment with structures that provide stability and possibilities. You also need affordable and available energy.

As a farmer, I urge you not to overlook this. The end of fossil fuels is not here. We do not have the alternatives yet. My family runs a reasonably sized farming operation with over 30 internal combustion engines—no obvious replacements for them yet. We use a great deal of fertiliser—no obvious replacements for that yet. There's a lot of work to do, and we need to be careful about the trade-offs.

Agriculture and the business of feeding people is far too dependent on fossil fuels. There are all sorts of reasons to pursue technology and innovation, but let's remember: there's nothing more

destabilising, nothing worse for humanity, for peace, and for the environment than reversing decades of progress in lifting people out of poverty.

Tim Reeves quoted the old saying: If you don't put food into people's hands so they can feed their families, someone else will put a rifle in their hands. That's an important concept.

I want to mention the next generation—our conference scholars. You're here to experience our conference and get special mentoring, networking, and learning activities. Thank you to those mentoring them. As you work with young people, think about their skills and capabilities, and encourage them to pursue pathways forward so they can one day do what our board members are doing. Network members have helped with the scholar program, and we have a diverse group: DFAT, Australia awardees from Indonesia, and students from Western Sydney University.

If all our next-gen attendees would stand for a moment, let's give them a round of applause. You are the future!

For those new to our venue, we're here to capture the attention of legislators and decision makers. Agriculture is disappearing from the national agenda, and that's disappointing. Nothing is more important than feeding people, and no country does it better than Australia.

Where is our food security package? Where are our reserves of fuel, fertiliser, and chemicals? 70-80% of our ag chemicals are imported, and we don't have the recommended reserves of fuel.

Unfortunately, it's not a sitting week, so we don't have MPs and senators here to interact with. But it's a challenge for the future, and I know Crawford will continue to advocate.

We're grateful that the Honourable Kate Thwaites, Special Envoy for Climate Change Adaptation and Resilience, has recorded a welcoming video for us.

Thank you for indulging me. Special acknowledgment to ACIAR and Wendy Umberger for all your work. Thank you all for being here, for your commitment, and for making this conference—and Crawford—so special.

> John Anderson has been a long-serving member of the Board of the Crawford Fund for Food Security and has been Chair of the Board since 2017. He was appointed Companion of the Order of Australia (AC) in the Queen's Birthday 2022 Honours List for eminent service to rural and regional development, to leadership in international agricultural research and food security, to social commentary, and through contributions to not-for-profit organisations.
> John Anderson is the former Deputy Prime Minister and Leader of the National Party of Australia (1999-2005); Minister for Primary Industries and Energy (1996-1998); Minister for Transport and Regional Development (1998-2005); served on Expenditure Review (Budget) Committee, National Security Committee and Standing Environment Committee while in Cabinet. He was the member for Gwydir, New South Wales 1989 to his retirement in 2005. John has returned to farming and is also active in the not-for-profit sector.

A special message from The Hon Kate Thwaites

Special Envoy for Climate Change Adaptation and Resilience

I begin by acknowledging the traditional custodians of the land on which this conference takes place – the Ngunnawal and Ngambri peoples – and I pay my respects to Elders past and present. It's a delight to be here and welcome you to Parliament House this morning. I am sorry I can't be with you today in person.

Thank you to the Crawford Fund for Food Security Chair, The Hon John Anderson for the introduction. I wish to acknowledge all Crawford Fund for Food Security board members, including The Hon Joel Fitzgibbon, former Minister for Agriculture, Fisheries and Forestry and the Fund's patrons in the audience, The Hon Margaret Reid and The Hon Neil Andrew. And I also acknowledge Professor Kadambot Siddique, recipient of the Crawford Fund Medal.

Congratulations to the Crawford Fund for Food Security for its annual conference – Australia's key food security event - which has been bringing national attention to key food and nutrition security issues since 1992.

Identifying and bringing together experts and practitioners from around Australia and the globe is a testament to your network. My respect goes to the passionate people involved in your efforts, through collaboration, partnership and training, to achieve more productive and sustainable agriculture, less poverty and hunger, and a more secure world despite so many challenges including climate change, conflict and economic shocks.

A special thank you to those speakers who have travelled from afar, Prof Glenn Denning from the USA, Dr Aditi Mukherji from Kenya, Prof Graham Sem from PNG, Selane Tairea from the Cook Islands, Dr Ando Radanielson from the Philippines, Dr Purnima Menon from India and Acacio Sarmento da Silva from Timor Leste.

And I am delighted to know there is such a large group of young people here with the Crawford Fund's NextGen program, including the conference scholars and members of its RAID Network.

As Australia's Special Envoy on Climate Change Adaptation and Resilience, it's my pleasure to welcome you all on behalf of the Australian Government to an event on a topic that resonates so strongly with me.

We cannot talk about food security without talking about climate change. Re-designing the food system to be healthy, sustainable, and more resilient to climate change no doubt consumes many in the audience.

Locals in the audience will be acutely aware that here in Australia, we are witnessing the impacts of climate change on food security. Extreme weather events have, at times, caused fruit and vegetable shortages, increased prices, and severely strained supply chains. When we apply what

we've experienced here to an international context, we know that the threats of not acting and adapting only amplify.

I note that this year's conference aims to identify the issues and solutions for transforming agrifood systems in response to climate change, addressing the trade-offs between food production and net-zero targets, pursuing sustainable intensification, and promoting inclusivity and equity.

This is so important as we move towards COP30 this year and onto COP31.

I am impressed by the number of case studies being presented by our overseas partners and leading Australians and particularly want to note the work of ACIAR – the Australian Centre for International Agricultural Research – as our specialised agency that brings together Australian and partner country expertise to address and build capacity for the similar challenges we all face to mitigate and adapt to climate change and implement more resilient agricultural practices – improving food security and livelihoods.

All the very best for fruitful discussions today. From the case studies on show, it would seem that are many proven, scalable technologies and practices to reduce greenhouse gas emissions and help Australian and partner country farmers adapt to climate change to build resilience for food security and I look forward to hearing from the Crawford Fund for Food Security on the 'actionable recommendations for policymakers and practitioners' that may well be the real challenge of your deliberations.

Kate has served as the Federal Member for Jagajaga in Melbourne's north-eastern suburbs since 2019.
Kate is currently the Special Envoy for Climate Change Adaptation and Resilience. Previous roles she's held in Government include Assistant Minister for Social Security, Ageing and Women, and Chair, Joint Standing Committee for Electoral Matters.
She is the author of 'Enough Is Enough', about making the Australian Parliament and community a safer place for women, written with former MP Jenny Macklin.
She holds a BA (Journalism) and a Master of International Development. Prior to entering Parliament Kate worked as a journalist, as well as in international development, and the public service.
Kate lives in Jagajaga with her husband and two children.

CRAWFORD FUND FOR FOOD SECURITY MEDAL for 2024

Acceptance speech, 12 August 2025

Professor Kadambot Siddique AM CitWA FTSE

The Honourable John Anderson, Chair, The Crawford Fund for Food Security and Former Deputy Prime Minister, Mr Shaun Coffey, Chief Executive Officer, The Crawford Fund for Food Security, distinguished guests, esteemed colleagues, ladies and gentlemen.

I am deeply honoured to receive the 2024 Crawford Fund Medal. This recognition reflects not only a personal milestone but also the vital role of international collaboration in advancing agricultural science and food security. It also recognises the legacy of Sir John Crawford and The Crawford Fund for Food Security leadership in supporting impactful agricultural research worldwide.

Thank you to The Crawford Fund for Food Security, Shaun Coffey, Cathy Reade, WA Committee Chair Dr Mark Sweetingham, Emerita Professor Lyn Abbott, and all involved in selecting me for this medal. It was a great surprise when Shaun and Mark contacted me on this.

I would like to congratulate previous recipients of The Crawford Fund Medal—some of them are here today—including Dr Tony Fischer, Emeritus Professor Kym Anderson, Dr TJ Higgins, Dr Brian Keating, Professor Lindsay Falvey, Dr Bob Clements, Dr Meryl Williams, Associate Professor Robyn Alders, Emeritus Professor Bob Gilkes, Professor Lester Burgess and Dr John Schiller.

My journey in agricultural research and education began over four decades ago, driven by a simple but powerful mission: to improve food and nutritional security through science and technology. From the State of Kerala in India, ICARDA in Syria, Western Australia's grain belt to smallholder farms in Asia, China, India, the Middle East, and Africa, I have had the privilege to work alongside committed scientists, students and farmers.

Since 1999, I have served on The Crawford Fund for Food Security WA Committee and led projects funded by ACIAR, CGIAR, GRDC, ARC and the UN FAO, working in the areas of crop physiology, agronomy, farming systems, genetic resources, and breeding cereals, grain legumes, and oilseeds. Mentoring numerous PhD and postdoctoral researchers from around the world—many now advancing agriculture in their own countries—has been one of the most rewarding aspects of my career.

Climate change, resource limitations, and evolving geopolitical landscapes mean that global food and nutritional security continue to be some of our most pressing challenges. However, they also present significant opportunities—if we commit to investing in science and technology, supporting our farmers, building capacity and promoting the free exchange of knowledge across borders.

I sincerely thank The Crawford Fund for Food Security, my colleagues at The University of Western Australia, my students, my collaborators, and my family, especially my wife Almaz (she is here today) and the children for their unwavering support.

Thank you.

In awarding the 2024 Crawford Fund Medal, we recognise the more than 35 years of eminent service by Hackett Professor Siddique AM CitWA FTSE in agricultural research, teaching and management in Australia and overseas, especially in the context of international agricultural research for development.

Professor Siddique has served on the Crawford Fund for Food Security WA Committee since 1999 and has led and co-led numerous international projects funded by the Australian Centre for International Agricultural Research (ACIAR) and the United Nations (UN) Food and Agriculture Organisation (FAO).

Professor Siddique has made an outstanding contribution in the fields of crop physiology, production agronomy, farming systems, genetic resources, breeding research in cereal, grain legumes and oilseed crops. He's maintained a focus on addressing food security through high-quality science and the training and development of other scientists from Australia and around the world.

Professor Siddique was the 2023 Scientist of the Year at the Western Australian Premier's Science Awards, became a Fellow of The World Academy of Sciences in 2024, and was appointed Special Ambassador by the United Nations FAO for the International Year of Pulses in 2016, underscoring the global impact of his research and his national and international reputation in agricultural science. He is a Fellow of the Australian Academy of Technological Sciences and Engineering, and a Foreign Fellow of the Indian National Academy of Agricultural Science, the Pakistan Academy of Science and the African Academy of Sciences. Professor Siddique received the Friendship Award in 2019 – the highest recognition for a foreign expert from the Chinese Central Government, acknowledging two decades of contributions to agriculture in China.

Professor Siddique has pioneered research on chickpea, contributing enormously to the Australian chickpea industry. He has bred and commercially released 13 grain legume cultivars (chickpea, lentil and grasspea). This work is crucial in the context of global warming.

Professor Siddique was ranked 6 in Australia and 37 in the world in 2025 for his publications and citations in Agronomy and Plant Science. Based on the Thomson Reuters/Clarivate Analytics he is a highly cited (Hi Ci) researcher in both Agricultural Sciences (2019 – 2023) and Plant and Animal Science (2021 – 2023).

KEYNOTE ADDRESS

Achieving Universal Food Security in an Adversely Changing Climate

Professor Glenn Denning
School of International and Public Affairs
Columbia University

Abstract

Achieving universal food security — healthy diets for all, from sustainable food systems — will require a comprehensive investment strategy that increases food supply, enhances distribution and access, reduces food losses and waste, and improves nutrition for all, while addressing and mitigating climate change. Despite increases in agricultural productivity and a sharp reduction in the proportion of undernourished people over the past 50 years, universal food security remains elusive. About 673 million people — 8.2 percent of the world population — are undernourished, and almost three billion people cannot afford a healthy diet. Our food systems are vulnerable to climate change while contributing one third of greenhouse gas emissions. Conflict and trade disruptions further compound the challenge and undermine past successes. Yet, we are incongruously underinvesting in agricultural improvement and food systems transformation, beginning with woefully inadequate support for international agricultural research: the foundation for more productive and resilient food systems. Food security has emerged as a geopolitical priority across the Indo-Pacific region.

Leaders of China, India, ASEAN nations, the Pacific, and beyond have raised alarms and are looking for actionable policies and investments. In this address, I will outline a set of practical actions that Australia could take to advance food security in the Indo-Pacific region. Stepped-up action and investment by Australia in support of agricultural research and development would be widely welcomed in the region. As a nation, we have exceptional expertise and well-established partnership models in agriculture and food security that, if better supported and deployed, could serve our collective desire for regional peace and prosperity.

Introduction

Thank you to the Crawford Fund for Food Security for this opportunity. Let me begin by inviting you to imagine a world without hunger or malnutrition, where the food that sustains us is produced and distributed in ways that are both sustainable and resilient. That vision—what I call universal food security—is at the heart of my remarks today.

Food is a human right, enshrined in the Universal Declaration of Human Rights (1948) and reinforced in global agreements since. The 1996 World Food Summit defined food security as

access to safe, adequate, and nutritious food for all people at all times. The 2015 Sustainable Development Goals went further, declaring that hunger must end, and that no one should be left behind.

Universal food security means ensuring that every person enjoys a healthy diet derived from sustainable and resilient food systems. But how close are we to that goal?

Global Food Security Challenges

The numbers are sobering. Today, 673 million people go hungry. Around 150 million children under five are stunted, and 43 million are wasted. More than two billion people suffer from micronutrient deficiencies, while 2.5–3 billion are overweight or obese. Almost half the world's population is not consuming a healthy diet, and 2.8 billion people cannot afford one.

One driver is the rising cost of food. The FAO Food Price Index remains about 60% higher than in 2006, shaped by financial crises, conflict, and pandemic disruptions. These realities underscore that hunger is not just about availability - it is about affordability, equity, and resilience.

Figure 1 The FAO Food Price Index using real prices, 1961 to mid-2023

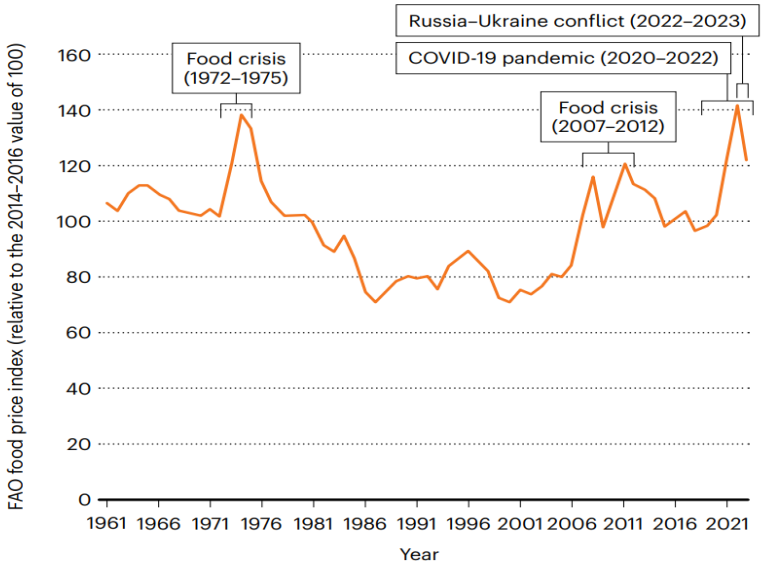


Fig. 1 | The FAO Food Price Index using real prices, 1961 to mid-2023.
Credit: World Food Situation FAO Food Price Index.

Source: Denning and Jayasuriya (2023) https://www.nature.com/articles/s43016-023-00826-6

Governments and institutions are responding. Indonesia's school meal program will soon reach 83 million children. ASEAN, the Pacific, Brazil through the G20, and the UN Food Systems Summit all highlight food security as a global priority. Xi Jinping has even described agriculture as a matter of national security. The message is clear: food security is no longer peripheral; it is central.

Climate and Food Systems

Yet food security comes at a price. Humanity's footprint is immense—deforestation, water scarcity, pollution, biodiversity loss, and greenhouse gas emissions. One-third of global emissions stem from the food system, with agriculture itself responsible for about half of that share.

This dual role—food systems as both casualties and contributors to climate change—demands a twofold response: **adaptation** and **mitigation**. Farmers have always adapted to survive, but mitigation requires broader support, because the benefits are collective and long-term.

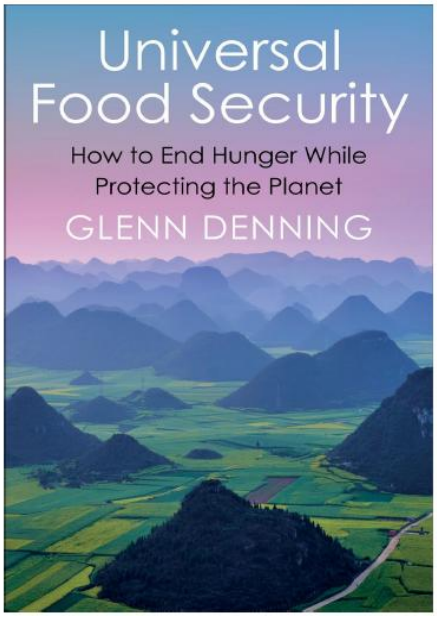
Pathways to Universal Food Security

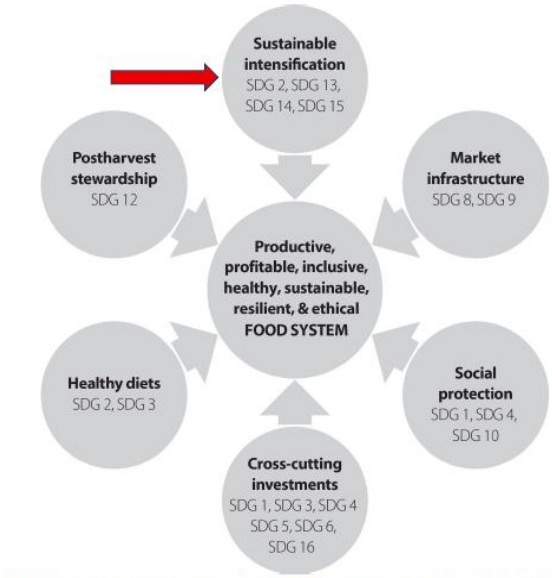
After decades of work and research, I see five big investment areas that, together, can transform food systems:

1. **Sustainable intensification** – producing more food while reducing environmental impact.
2. **Post-harvest stewardship** – cutting the one-third of food that is lost or wasted.
3. **Market connectivity** – ensuring farmers can link production to consumers.
4. **Dietary shifts** – promoting healthy, sustainable diets.
5. **Social protection** – ensuring the most vulnerable have access to nutritious food.

These five areas must be integrated, context-driven, and underpinned by good governance, women's empowerment, and investments in health and education.

Figure 2: Food Systems Transformation Strategy: The Big 5 Investments





Key investment areas and related Sustainable Development Goals for transforming the global food system. Source: Denning (2023), p. 179.

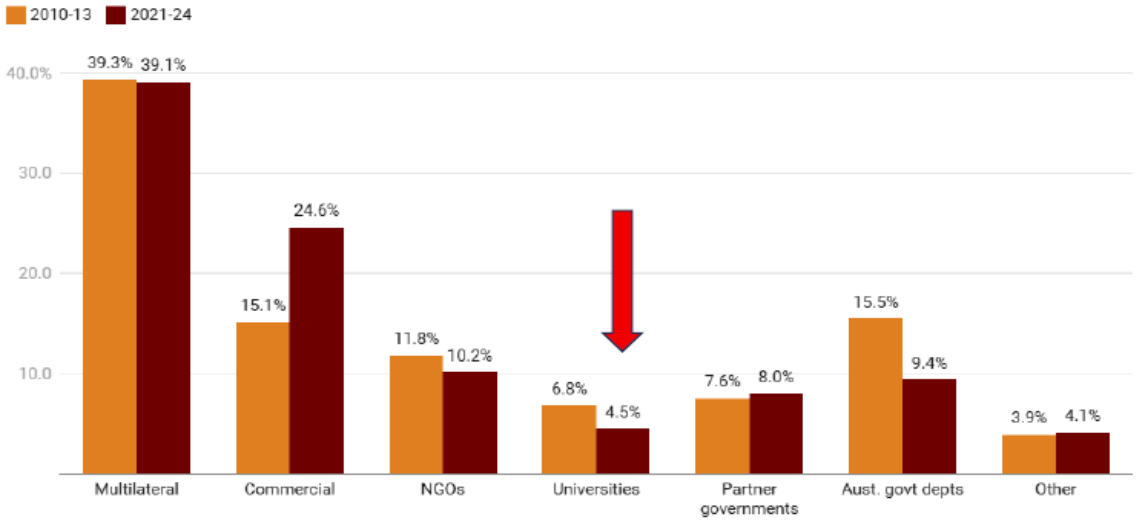
On sustainable intensification, I emphasize this is not about intensifying every plot of land. Rather, it is about tailoring strategies: increasing yields in some regions, maintaining output but lowering footprints in others, restoring abandoned lands, and protecting remaining ecosystems. The "net result" must be more food with less environmental harm.

Australia's Role

This brings me to Australia. I believe Australia can and should be a regional leader on food security. We have the expertise, the credibility, and the track record—decades of agricultural innovation in harsh climates, extensive development cooperation across Asia-Pacific, and world-class universities and research institutions.

Yet our current investments remain small. Agriculture represents only about 8% of the ODA budget, with universities attracting just 4.5%. The Australian Centre for International Agricultural Research (ACIAR) does excellent work on a modest budget—less than A$120 million annually. But given the scale of the challenge, surely more is required.

Figure 3: Share of the aid program allocated to different delivery partners, 2010 and 2024



Three year averages are used to reduce volatility (2010-11 to 2012-13 and 2021-22 to 2023-24).
Source:DFAT Statistical summaries

Source: Howes (2025) 2025 Australian aid update. https://devpolicy.org/2025-australian-aid-update

My actionable recommendations are:

- Raise the profile of agriculture and food security within Australia's ODA portfolio.
- Support the **G20 Global Alliance against Hunger and Poverty**.
- Rejoin the International Fund for Agricultural Development (IFAD)
- Expand partnerships with multilateral development banks like the Asian Development Bank (ADB).
- Revitalize **university-to-university cooperation** in the Asia-Pacific.
- Strengthen support for the **Crawford Fund for Food Security**, which is unique in the world.

Source: M S Swaminathan Research Foundation

Conclusion

Universal food security is achievable—but only through an integrated, multi-level, cross-sectoral approach. We cannot simply produce our way out of hunger; we must transform food systems holistically. That requires investment, innovation, and leadership.

As Professor M.S. Swaminathan once wrote, *"If synergy can be created among scientific know-how, political do-how, and farmer participation, it should be possible to achieve the goal of overcoming chronic and hidden hunger."*

I believe Australia, working in partnership across the region and the world, has both the responsibility and the opportunity to help make that vision a reality.

Source: M S Swaminathan Research Foundation

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List of Figures

Glenn Denning is Professor of Professional Practice and founding Director of the Master of Public Administration in Development Practice (MPA-DP) at Columbia University's School of International and Public Affairs (SIPA). Prior to joining SIPA, Denning held senior management and research positions at the

International Rice Research Institute, the World Agroforestry Centre, and Columbia's Earth Institute.

Denning contributed to the design and establishment of the Global Agriculture and Food Security Program (GAFSP) and served on GAFSP's Technical Advisory Committee (2010-14). He also served on the founding board of the Institute of African Leadership for Sustainable Development (UONGOZI Institute). Denning has advised the Asian Development Bank on aligning its strategy and operations to the 2030 Agenda and the SDGs.

In 2000, Denning was recognised by the Government of Cambodia as Commander of the Royal Order of Sahametrei. In 2014, he received the Columbia University Presidential Award for Outstanding Teaching. He won the Global Australian of the Year Award for 2023, recognising his efforts to end global hunger and promote sustainable development. And in 2024, Denning was honoured as Alumnus of the Year by the University of Queensland.

Denning obtained his BAgrSc and MAgrSc from the University of Queensland, his PhD from the University of Reading, and his MPA from the Harvard Kennedy School.

Denning is the author of Universal Food Security: How to End Hunger While Protecting the Planet (Columbia University Press, 2023).

KEYNOTE Q&A

Chair: Su McCluskey FCPA FTSE

Member of the Crawford Fund for Food Security Board of Directors
and Former Special Representative for Australian Agriculture

Chair:

I might kick it off with a question for Professor Denning. I was really fascinated by what you talked about. Neighbours seeking support is something that I saw in my last role, and that Australia can really be a global leader. Picking up on the comments around soft power and diplomacy, the one thing that I saw when I went around to many different countries and markets was that there is no one-size-fits-all solution.

So, how do you build a flexible, outcomes-based food system that is actually fit for purpose for different markets? And how do we help those countries? By listening to what they want rather than trying to tell them there's only one way. We have to listen. We have to listen and listen to the priorities.

Professor Glenn Denning:

I think we have great ideas. We have great concepts. We have great tools, we have expertise. But wherever it is, it needs to be adapted and made appropriate to local circumstances. The best way to do that is the model that ACIAR developed. It's to do it in partnership with national researchers.

Having that relationship, especially at the policy level, I'd really like to see more of that. I think as I've travelled around the region engaging researchers at the policy level, that's not easy to do, and you need help in getting that done. The second thing is building local capacity.

At the end of the day, what you want is a strong national system of research and development. My work in Cambodia was exactly to do that, as Cambodia was recovering from war. Building national institutions was part of it. It wasn't simply getting rice seeds and technologies and so on. For the farmers. It was about building national capacity, and we worked for almost 20 years, trying to build that up, supported by ACIAR or others. So, building local capacity, I think, provides that local nuance. That's important.

Unknown participant:

I've come from Geneva for this event with colleagues from around the world, in Africa, Asia, Australia and in Europe. We've worked with the Club of Rome to redesign the business models and the financing modalities. But I've heard very scant reference to that from any Australian representatives in Geneva over the last 15 years. It's certainly not visible in any of the impact investing events, of which there are many that I go to.

So my question is: How do we bring organisations into the room and move on from the discussion to where the money is, and we can only do that if we present investible proposals. We have an initiative which we call Advance Australia Fair, because underneath all of the

discussion so far is our having resiled over the years from this fundamental commitment that all life on the planet deserves respect.

Professor Glenn Denning:

Thanks for that point. I didn't talk about the partnerships with businesses. I threw that under the umbrella of multisectoral approaches. The idea is that all hands need to be on deck to achieve what we're talking about here. Partnership with businesses often doesn't come easily from researchers. It doesn't come in many countries, and it doesn't come easily from governments. They distrust the private sector.

I've made this argument at the level of the UN. I've sat around tables at the UN headquarters with the Secretary General at the top of the table, all of the UN agencies talking about food security and hunger and not a business in sight. It struck me as odd because it seems that the sorts of understanding of markets, delivery mechanisms and the like could be harnessed to do a better job of delivering food security across the world. So, I mentioned in the book that a structural change at the level of the UN, but also at the country level, bringing groups together is needed.

It's not just about bringing all the ministries together around a table, but about what businesses can we bring to the table, and nonprofits and others to contribute a voice, not just to share their opinions, but to actually help with implementation?

Maximus Pollard University of Sydney, studying agricultural economics:

My question is: how can young people like myself and the other scholars push the government into taking more practical steps? And how can we push agriculture more in the mainstream of things, these young people?

Professor Glenn Denning:

Well, it starts with being better informed. I think the first thing is to make a commitment to being better informed. There's so much rubbish out there about the world, about understanding how it works, how agriculture works, the importance of nutrition and so on, and getting through that and appreciating the role of agriculture, the importance of sustainability and resilience, and the like is important.

It's hard work because it's easy to just follow the loudest voice and say everything must be regenerative. The first question you should ask is, What do you mean by regenerative? Can you just lay that out? Of course, good farming should be regenerative, right? We want it to be regenerative.

So I think understanding is number one. Number two is clearly the extent to which you can become active, as we see a lot of young people are active in the climate agenda. I think they need to be just as active in the food agenda as well. Food security and linking it to the climate agenda.

Being politically active, influencing your political leaders, your local leaders, your politicians and volunteering your support to organisations that are doing good work in this area. But the ultimate, of course, is to pursue a career in this area. And that sounds like that's what you've

you've planned to do.

We need to make agriculture more attractive. There's no doubt I've been talking to universities and they're struggling with the numbers, particularly at the undergraduate level within Australia. I think more of us need to work hard to understand how interesting it is to work in food systems transformation, with all of these great innovations around digital agriculture and artificial intelligence is going to play a massive role going forward.

And as was mentioned, you don't necessarily only end up as a researcher. You can be in the business sector, or you can be an entrepreneur. There are many places in the ecosystem where you can work. And underpinning all of this is an understanding of how important, as our speakers have already mentioned, how important food security is for human security.

Remind people that it's not just about farming. It's a much bigger picture. It's about our security, our national security and our regional security. Thank you. Great question. Quite often, I say we speak to rooms of the converted, and we need to get mainstream on board.

John Anderson:

Congratulations, Glenn. It's great to see you here. Great speech, great book, and congrats on all your contributions over the decades. I've got one comment and one question. The comment is, we really need to keep in the front of our minds how to unbundle these generic universal food security challenges across very different environments, different farming systems, different policy and institutional settings.

Irrigated lands are totally different from arid lands, and what can be achieved. That's the first comment, but second, the question, the really important question is, how do we unbundle the messages to different key actors? How do we talk differently to federal politicians, to state politicians, to the private sector, to district-level officials and to farmers' groups? How do we unbundle all of that?

Because they have different interests, different reasons to improve the systems and different incentives. So that's what we don't do often enough; unbundle the messages. And to the first point, the unbundling and the disaggregation and understanding of the variation across ecosystems, the fantastic work you've done over the years - we need to do more of that.

Professor Glenn Denning:

I think we've got tools to do things much better and much faster than we have ever had. So hopefully that will be something that the next gen can work on, the messaging. The problem here, I think, is that many of us grew up and worked and studied in science areas, but weren't necessarily good messengers of our own stories.

I don't know how many of you who are taking ag science have also taken courses in communications, political science and other relevant disciplines. That will give you the capability to be able to understand the political economy of what we're all trying to do.

You're thinking, well, who's going to buy into this? And who's upset by this? Who's going to walk away from the table if we present this? So having that political savvy, and you can study

that and you can learn that. It needs to go side by side with all the wonderful digital approaches that we're all learning now.

You're going to have to have people who can translate those great ideas into something that's important for political leaders, for the general public to buy into this idea. And I think the messages I heard this morning, which I fully support, are that the kind of work that ACIAR does and the Crawford Fund for Food Security does in the region is actually critically important for national security here.

Having peaceful, healthy, secure neighbours is important for our own security. It's in our self-interest to understand that as we go out and do our best to change the food system. Nuanced communication, I think, is the key

Sam Coggins Anu Agri Food Innovation Institute.

My question really builds on John's question and Max's question. The quote you gave got me really excited about clarifying the need for synergy of policymakers or politicians, as well as researchers and farmers' participation. Curious to hear more of your reflections on the common mistakes that you see researchers make in trying to engage in these collaborations with farmers and policymakers? And on the flip side, you've already partially answered this question, but what do you see the most savvy researchers doing in terms of engaging effectively with all these different actors?

Professor Glenn Denning:

You know, I when it comes to engaging with farmers we could probably pull out a few of the old books that came out in the 60s and 70s, Robert Chambers and others who I'm not sure if that's read these days in ag science, but the idea is that it starts with the farmer. I remember reading a few books from the AVRDC that was called “Why Do Farmers Do What They Do”? More of us need to be engaging with farmers, understanding why they're doing what they're doing.

I wrote something about 30 years ago called Farmers as Customers, a new way of thinking about research institutions drawing on service management from the business sector, the idea from the Harvard Business School service management, where you focus on the customer. So who are your customers? What do they value? As a researcher, your question should be: what will these farmers value, what does that person value? What is useful to him or her? I think starting with that approach, wherever you are working in that ecosystem, is extremely important.

It's not what I can do for you, here is the wonderful tool I have. But how can I help you? What are you interested in? What's your vision? What's your goal? Why haven't you adopted these fantastic varieties that we've had all these years?

Harry Campbell Ross, Federal Department of Agriculture and ANU student

You've mentioned institutions a couple of times, and you mentioned in your address that you feel that institutions aren't fit for purpose. I'm just wondering if you can unpack that a little further and mention which sort of institutions you're talking about and how they're not fit for purpose.

Professor Glenn Denning:

I won't name any specifically. I could start from the top with the United Nations, but what I am getting at is that I don't think there's a clear institutional framework for achieving universal food security. There are lots of pieces of that puzzle being implemented, but bringing the stakeholders together should be part of the UN Security Council. It's not on the agenda. Every now and then, there is a special one-day event on food security at the UN Security Council. But this should be part of the Security Council because of the strong connection between food and human security and political stability in the world.

I also think it's important that there's coherence at the national level. In many of the countries that I work in, the kinds of activities that could improve food security are managed by many different ministries and are very focused on their own budgets and how those budgets are protected and how they're implemented.

So new mechanisms to bring them together are needed. High-level leadership is important. I'd love it if the Prime Minister and the foreign minister would speak about food security more often. We've got to make that happen somehow. So again, without going into great details, I think the one thing I probably would say is that getting research institutions to engage more concretely with development partners, be they development banks, aid or normal aid agencies, or the private sector is key. Working more in ways that hold ourselves accountable for the delivery of impact. I think more of that would be useful, including at the level of the CGIARs and national research institutions. That was the basis of my recommendation about ACIAR for example, really developing some strong partnerships with regional development banks like the ADB.

Tim Reeves Crawford Fund for Food Security Board.

I just wanted to make a comment and then a question, relating to listening to farmers and to working with farmers. If you ask me what the greatest agricultural innovation in Australia has seen in the last 50 years, a lot of people would say zero till, mulch and better ways of moisture conservation, AI technologies, all of those sorts of things. Now, I think the greatest innovation in Australian agriculture in the last 50 years is that we have just changed the model from top down to bottom up. The prevalence and the importance of the farming groups in Australia are absolutely critical, but not unique. But it is certainly a great example. So my question is, with cultural differences, what are you saying about that sort of approach with farmers, and then them being able to drive the priorities?

Professor Glenn Denning:

I think historically that's been fairly weak in many of the low-income parts of the world. Simply because of basically poor communications infrastructure and limited capacity, which was then taken on as being: Well, we'll have to do it for you. Governments know best, right? So this idea of farmers as customers is something that I truly believe in.

I think now, with the spread of social media and access to mobile phones and so much better communication capabilities, there are more opportunities whereby farming groups and individuals can have a stronger voice, politically, and get their representatives in front of the decision makers so that budgets are allocated and programs are planned according to their

needs. Much more could be done. Aid agencies, development banks all go and have consultations at the highest level of government, and they all agree on things. And there's sometimes a token farmer and or farmers organisation in the room. I think as development professionals, we have to just keep insisting and asking: are we really reflecting the needs of those in most need? The smallholder farmers, women farmers, and indigenous communities that may not be in the face of the political leaders.

We've all got to work harder to make that happen. And again, I say go back and read some of Robert Chambers' work in the 60s and 70s.

Name unknown, University of the Sunshine Coast.

Thank you very much for the great presentation. I just have one question regarding private sector engagement. We often see public funding for agricultural research and activities about the food security effort. But we rarely see private sector investment for agricultural research. People often say it's very difficult to find the same interest between the research institute, researchers and private sector actors because they may have several different standpoints. Do you see any actionable recommendations or potential approaches to find the same interest between the 2 or 3 parties if we involve the government as well?

Professor Glenn Denning:

So it's about finding the common interest between them and to engage the private sector more in agricultural research for development.

I think the best investment that could be made to support the private sector is coming from government funds. We've got to think about the public good. We've got to think about research as a great example of that. Investing in research in ways that would open opportunities for the private sector to expand and market and have an impact, I think, is important. The second thing is infrastructure. And especially as I look around the region, one of the greatest constraints to functioning agribusinesses is infrastructure. So it's roads, it's energy, it's telecommunications.

Once you support that, and there's an important role, particularly in terms of transport and energy infrastructure, governments can create a much better environment for the private sector, along with regulatory policies that make it easier for the private sector to appropriately take advantage of the R&D investments. Thank you for your questions.

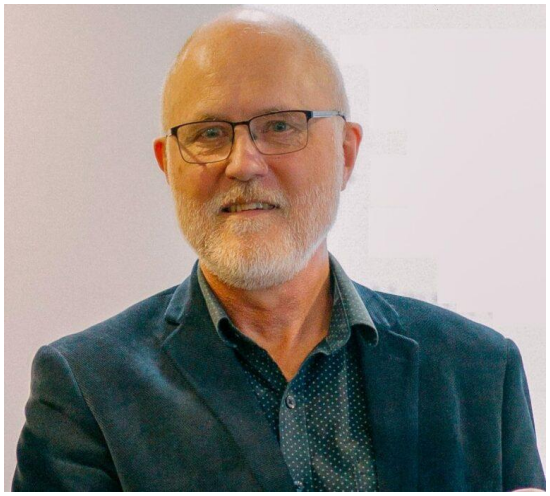
Chair

Thank you, Professor Denning. What a marvellous way to start the conference today with that keynote. Food security is a national security issue. It's a global security issue, and it should be front of mind for all of us. Would you please join me in thanking Professor Glenn Denning.

SESSION 2 OVERVIEW

Can we feed the world with net zero emissions?

Professor Richard Eckard
Professor of Carbon Farming at the University of Melbourne and Zero Net Emissions Agriculture CRC Program Leader



Abstract

Agriculture produces between 12 and 14% of global greenhouse gas (GHG) emissions, excluding transport and processing. While there are options to reduce GHG emissions from agricultural production, food security could also be considered the most legitimate form of GHG emission. The main GHG emissions from agriculture are methane, associated with rice and livestock production, and nitrous oxide associated with nitrogen inputs. Agricultural land can also sequester carbon in soils and trees and, while this is an important contribution, it is perhaps only reversing the land use change disturbance created for agriculture in the first place.

A recent assessment by the Net Zero Australia plan concluded that current reliance by the large industrial emitters on the land sector to provide their offsets are questionable, as agriculture on its own will struggle to meet its stated value chain targets, including insetting all available sequestration. Reducing livestock numbers has often been touted as an overly simplistic solution to reducing agricultural GHG emissions, forgetting that most livestock exist in lower socio-economic regions and are integral to their food security and livelihoods.

Taking a more multi-functional perspective of livestock in subsistence agricultural systems shows that the GHG emissions attributable to meat or milk can be much lower than those of industrial farming systems. Livestock are integral to a largely vegetarian diet in subsistence agricultural systems, without which industrial fertilisers and diesel would be required to produce crops. The production and use of industrial fertilisers contributes approximately 5% of global GHG, but almost half of the world's population is dependent on industrial nitrogen for their food security. Options are emerging to reduce enteric methane by more than 80% and estimates show that improving nitrogen use efficiency can reduce nitrous oxide emissions by over 50%. However, few of these options are profitable, and even less are relevant to extensive or subsistence agricultural systems. While some agricultural systems can achieve net zero GHG emissions, there are inevitable GHG emissions associated with agricultural production. However, the land use sector also manages significant natural resources and perhaps the future lies in striking a balance between biodiversity and mitigation in a more integrated approach.

Introduction
Agriculture is different from energy or transport. We cannot simply switch off biological processes. Methane from ruminants, nitrous oxide from soils, carbon dioxide from fossil energy use — these are built into the system. So the aim is not *absolute zero* but *net-zero*. That means reducing emissions wherever possible and balancing the rest through sequestration and other strategies.

The Nature of Agricultural Emissions
Globally, agriculture contributes around 12–14 per cent of greenhouse gas emissions. If we include the broader food system—processing, refrigeration, and transport—that share rises to about 26 per cent.

The main culprits are well known:

- Methane, from ruminants and soils.
- Nitrous oxide, from nitrogen inputs.
- Carbon dioxide, mostly from fossil energy inputs.

Because these emissions come from microbial processes, we cannot eliminate them entirely. The challenge is to minimise them and find smart ways to compensate.

The Limits of Sequestration
Sequestration in soils and trees is often presented as the big solution. But it is limited. Soil carbon can be increased with better management, yet it stabilises at a new equilibrium and is heavily influenced by rainfall. Tree planting, as seen in projects like Jigsaw Farms, can deliver neutrality in the short term, but once trees mature, sequestration slows or stops.

Sequestration buys us time — it is breathing space, not a permanent fix.

Livestock, Diets, and Fertilisers: Complex Realities
It is fashionable to target livestock in the climate debate. But reality is more complex. In many developing countries, livestock are essential for food security: they provide manure, traction, milk, and income. Studies even show that some multifunctional systems in Africa have emissions intensities per litre of milk as low as the best dairy farms in the world.

Calls for global vegetarianism overlook affordability and context. Only about 8–16 per cent of the global population can afford to make such choices. Reducing livestock numbers cannot be our central solution.

The same goes for fertilisers. Synthetic nitrogen, made through the Haber-Bosch process, sustains half the world's population. Eliminating it, as Sri Lanka's failed experiment showed, risks food security crises. The better pathway is innovation — for example, on-farm fertiliser production using renewable energy.

Emerging Mitigation Pathways
There are real opportunities emerging, including:

- On-farm renewable energy and biofuels.
- Better manure management in intensive systems.
- Optimised rice cultivation to cut methane.
- Fertiliser inhibitors that can halve nitrous oxide emissions at low cost.
- Feed additives, such as seaweed-based supplements, to reduce methane from cattle.

Taken together, these could reduce emissions by up to 45 per cent. But many remain too costly for extensive or subsistence farming systems.

Economic and Structural Challenges
Most mitigation strategies impose extra costs on farmers without delivering direct returns. Expecting them to shoulder the burden alone is unrealistic. Shared business models are essential. Supply chains, banks, processors — those who set net-zero targets — must be part of the solution.

We also need to be careful with carbon credit schemes. Incentivising tree planting on farmland might look good for offsetting, but it risks undermining food production. The world cannot afford to trade calories for carbon credits.

Balancing Emissions, Biodiversity, and Food Security
Agriculture is about balance. High-input cropping may deliver low emissions per tonne but very little biodiversity. Extensive rangelands may support rich biodiversity but also high methane emissions. A practical future requires trade-offs. We need to think holistically: emissions, biodiversity, and food security must all be weighed together.

Conclusion
Agriculture cannot reach absolute zero emissions. But through smart mitigation, realistic use of sequestration, and shared responsibility across the food system, we can move significantly toward net-zero.

Key messages are clear:

- Mitigation technologies exist, but they require incentives and cost-sharing.
- Sequestration is useful but temporary.
- Fertilisers and livestock are essential to food security and cannot simply be abandoned.
- Food production must not be sacrificed for carbon offset schemes.
- Trade-offs are inevitable, and balance is essential.

Ultimately, agricultural emissions are the most legitimate form of emissions, because they are inseparable from the task of feeding humanity. The challenge is not to erase them, but to manage them responsibly while sustaining food for a growing world.

Richard's research focuses on carbon farming and accounting towards carbon-neutral agriculture and options for agriculture to respond to a changing climate. He has developed the first greenhouse gas accounting tools for all sectors of agriculture in Australia, which now form an agreed national standard for agriculture.

Richard is a science advisor to the Victorian, Australian, New Zealand, UK and EU governments, the International Livestock Research Institute and the UN Food and Agriculture Organization on climate change adaptation, mitigation and policy development in agriculture.

Richard was recently named on the Reuters list of the world's 1,000 most influential climate scientists.

SESSION 2: CASE STUDY 1

Low emissions rice and the way forward

Dr Ando Radanielson,
Senior Scientist
International Rice Research Institute

Abstract

Rice consumption is expected to increase by up to 50% from 2010 levels by 2050, with demand largely in Asia and, more recently in Africa. Rice-growing areas will need to intensify and expand in these regions. Conventional intensified irrigated rice systems have been critical in ensuring global food security. They are also among the major sources of anthropogenic Greenhouse gas (GHG) emissions, particularly methane and nitrous oxide. Practice changes towards climate-smart agriculture and low-emissions management, such as direct seeded rice (DSR), alternate wetting and drying (AWD), short duration variety and improved straw management, have led to increased yields, reduced inputs use and cost of production, and GHG emission reductions averaging from 7% to 30% across different regions. These benefits are site-specific and depend on the local context of production, requiring strategic packaging and targeted implementation. This presentation will provide an overview of our current understanding of the impacts and co-benefits of proven low-emission practices as well as the challenges to their scalability. We will also explore emerging technologies such as varietal improvement and soil health engineering that present potential for emission reductions. Finally, we will discuss how these solutions can accelerate the system transformation and how partnerships and collaboration among development organisations, private and public institutions can co-create ethical and sustainable impact for rice farmers, consumers and the planet at scale.

Introduction

Rice is more than just a crop — it is life for nearly half of humanity. It grows on around 10% of the world's cropland and underpins food security across Asia and beyond. By 2030, the world will need to feed another 135 million people, largely with the same land we farm today. That means we must grow more food without expanding land use — and we must do so sustainably.

But rice is also a significant contributor to greenhouse gas emissions. Globally, rice is the second-largest source of methane, after livestock (FAO, 2021). In countries like Vietnam and the Philippines, rice is the single largest source of methane, even exceeding the transport sector. For these countries, reducing rice-related emissions is not only a sustainability question but also a food security imperative.

Rice and the Transition to Net-Zero

Rice offers a paradox. It contributes substantially to emissions, yet it also provides some of the most immediate and technically feasible mitigation options in agriculture. Unlike fossil fuels, where technological transitions take decades, rice already has solutions that can reduce emissions today.

Estimates suggest that rice has a mitigation potential of up to 36% of its total emissions, making it nearly as significant as livestock in absolute terms but proportionally even more impactful (IPCC, 2019). This positions rice as a key sector in the global transition to net-zero, supporting the broader climate commitments such as the Paris Agreement's goal of limiting warming to well below 2°C.

Defining Low-Emission Rice Systems

Low-emission rice systems are not about sacrificing yield. Smallholder farmers, who dominate rice cultivation, cannot afford to reduce productivity. Instead, these systems integrate practices that sustain or increase yield while improving resource efficiency and reducing emissions.

Examples include:

- **Improved straw management**: Incorporating rice straw earlier can reduce methane by 10%; removing or repurposing straw can cut emissions by 15–50% (Yadav et al., 2019). Repurposing straw is an alternative to burning, though adoption requires labour, logistics, and incentives.
- **Short-duration varieties such as Hybrid**: Can lower emissions by 7% while increasing yields by 20% compared to traditional varieties (Peng et al., 2021).
- **Improved water management**: Alternate wetting and drying (AWD) can reduce methane by 30–50% and lower water use by up to 30% (IRRI, 2019).
- **Direct-seeded rice**: Expanding rapidly in India, this practice reduces water use and labour needs while lowering emissions by 25% (Chauhan et al., 2015).

Individually, these technologies have a significant impact. When combined, they could reduce rice emissions by as much as 65%. But adoption is uneven and often driven by goals like water savings or yield improvement, rather than explicit climate mitigation.

Incentives and Carbon Markets

The challenge is scaling. Practices like AWD or direct seeding require farmers to deviate from traditional methods, facing risks like weed pressure or upfront equipment costs. Incentives are essential. Carbon markets are emerging as one pathway to support the adoption of low-emissions practices. In rice systems, AWD has been recognised as the Clean Development Mechanism since 2015 and for voluntary markets like Gold Standard and Verra for carbon claim (Choudhury et al., 2022). Carbon credits can provide financial rewards, but they require robust monitoring, reporting, and verification systems — a major challenge to implement in small holding systems, such as in many rice-growing regions.

Challenges and Trade-Offs

Despite promising technologies, several challenges hinder the scaling of low-emissions rice systems:

- **Access to required machinery and infrastructure** remains limited for many farmers,

- There remains **limited understanding of how various mitigation strategies interact** when applied together, complicating integrated approach development. Most are tested in isolation.

Some promising emerging approaches include:

- Biochar applications, potentially reducing emissions by 11% (Jeffery et al., 2017).
- Chemical amendments and biostimulants, offering 20–25% reductions while further validations may be needed.
- High-yielding, climate-resilient varieties, with site-specific impacts considering the greenhouse gas intensity indicator. s

However, we lack a clear understanding of how these interventions interact when combined. Developing integrated technology packages will be critical for practical adoption. Addressing the above challenges and gaps are essential for establishing comprehensive and scalable solutions in rice systems.

The Way Forward

Low-emission rice systems represent both a challenge and an opportunity. They are essential for sustainable intensification, meeting the rising demand for rice, and contributing to global climate goals.

To advance, we must:

- Package technologies into site-specific, farmer-friendly solutions.
- Build transparent monitoring and verification systems.
- Provide incentives, especially through carbon finance.
- Strengthen partnerships among universities, research institutes, governments, and development organisations.

Net Zero Rice production may not be the ultimate goal in transforming rice systems towards sustainability outcomes, but reduced and lower-emitting rice systems can help drive the global transition to net-zero, providing immediate and scalable mitigation while sustaining the food security of billions.

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Dr Ando Mariot Radanielson is a senior scientist at the International Rice Research Institute (IRRI) with expertise in climate change adaptation and mitigation. She is currently leading a project on reducing methane emissions from rice, the REMET Rice project aiming to advance the understanding of processes and mechanisms of methane emissions from rice systems to inform the design of low-carbon rice systems with positive outcomes towards sustainability. Ando is a PhD graduate from SupAgro Institute in Montpellier, France on integrative plant biology and an adjunct senior lecturer of the University of Southern Queensland, Toowoomba in agricultural systems modelling. She has more than a decade of experience in cropping systems modelling and has contributed to different advancements of the agricultural system modelling platform APSIM and ORYZA v3 for climate adaptation. Ando has pioneered different initiatives supporting the education of the next generation of agricultural scientists and their access to opportunities for professional and personal growth such as women in STEM mentorship, seed grant program, student supervisions and crop modelling training program.

SESSION 2: CASE STUDY 2

Convergence: The potential legal implications of juggling environmental responsibility with economic ambition

Ms Caitlin McConnel
Australian Farmer & Lawyer

Abstract

Since ratification of the Paris Agreement in 2015, the development of policy aimed at building climate resilience has largely focussed on holding the increase in global temperature average whilst making finance flow consistent with a pathway towards low greenhouse gas emissions and climate-resilient development; with buzzwords such as 'ESG', 'net zero', 'climate-smart' and 'natural capital' now common in day-to-day vernacular.

Whilst the emergence of these terms has coincided with statutory obligations to report on sustainability initiatives or climate risks, as well as investment opportunities in renewable energy projects or alternative food production technologies, it is arguable that such terminology demonstrates a continued focus by government and business to value natural assets and food security through a numerical lens of economic growth and development. Although placing a numerical value on nature and food production can help promote innovation or incentivise environmental protection; it is a little-known fact that the Paris Agreement was entered into in pursuit of the United Nations Framework Convention on Climate Change (UNFCCC), which both reiterate that:

- increasing our ability to adapt to climate change, foster climate resilience, and reducing greenhouse gas development must be done in a manner that does not threaten food production, and

- when taking action to address climate change, parties must consider:

    - their respective obligations on human rights, and
    - the fundamental priority of safeguarding food security, food production systems, and Mother Earth.

Furthermore, few decision-makers are aware that courts of law across multiple jurisdictions are now scrutinizing the alleged failures by government or business to consider the aesthetic and spiritual value of nature in the context of human rights through climate litigation; in a real-time convergence demonstrating the importance of returning to the first principles of ecologically sustainable development.

Introduction

As a farmer, I am acutely aware that policy and common sense rarely go hand in hand. However, given my experiences as a lawyer, today I am grateful for the opportunity to demonstrate that the answer to effective policy may be easier than expected.

Language, and the use of accurate terminology is crucial, and is the key to understanding why the opportunities and risks associated with climate change mitigation begin, and end, with only two topics:

- The rule of law; and
- Food security.

Significantly, answers to effective policy and fundamental behavioural shifts may be easier than expected.

In setting the scene, I am yet to come across another quote that can eloquently describe the juncture we currently face than one made by a British farmer & social scientist:

"If the idea that you can lead a modern, high-energy, zero-carbon lifestyle in the city, eating manufactured food that tastes as good as or better than its farmed predecessors, while protecting wildlife and making room for Indigenous and peasant farmers to follow traditional livelihoods in the countryside sounds too good to be true … that's because it is."

In legislation and in judgment writing, the choice and placement of words are paramount and always backed by legal reasoning.

Climate Change Threatens

In the first case of its kind in the world to challenge the day-to-day operations of two agricultural companies and five companies involved in the business of fossil fuels, and their respective impact on humans, and the environment, the NZ Supreme Court held in 2023 that:

> *Climate change threatens human well-being and planetary health. The choices made, and actions implemented, in this decade will have impacts both now and for thousands of years.*

Here, it can be interpreted that the Court specifically chose to place human well-being before planetary health, in the context of climate change threats, because human well-being - and human rights - are inherently at the core of all legal policy about ecologically sustainable development.

Climate: Opportunity

Since ratification of the Paris Agreement and the adoption of the SDGs in 2015, the development of policy aimed at building climate resilience has largely focused on holding the increase in global temperature average, whilst making finance flow consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Australia's Statutory Approach

Using Australia as an example, we now have:

- Statutory obligations on the government and business to adopt and report on sustainability initiatives.

- Plans and strategies aimed at targeting investment in research and development, or capacity building to support the uptake and adoption of low-emissions innovations and technologies; and
- Roadmaps and statements aimed at encouraging change in land or water use through renewable energy projects or alternative food production technologies.

This is an approach I consider can be interpreted as demonstrating a continued focus by government and business to value natural assets, and opportunities associated with building climate-resilience, through a numerical lens of economic growth and development.

Particularly when having regard to some of the buzzwords now common in day-to-day vernacular, such as 'net zero' and 'natural capital', which I think it is crucial to identify as being terms that are not legally defined in Australia and are often misunderstood or misused, particularly by policymakers.

Whilst I appreciate that placing a numerical value on nature can help incentivise ecologically sustainable development, it is a little-known fact that this approach only takes two of the three limbs of the Paris Agreement objective into account.

Climate Litigation

Astonishingly, policymakers and investors are arguably blissfully unaware that we are currently facing a real-time convergence of legal opportunity and legal risk never seen, whereby government and business across multiple jurisdictions – including Australia - are now increasingly exposed to strategically targeted allegations of climate harm; not only in the context of emissions reduction, but significantly, human rights. Key trends include:

- Claims challenging the ambition of a government's overall climate policy responses, or a failure to integrate climate considerations into decisions on a given project or sectoral policy.
- Litigation attributing personal responsibility by individual decision-makers within government or businesses for failing to adequately manage climate risks in corporate governance and decision-making.

Australia is a jurisdiction maintaining one of the largest volumes of climate litigation in the world; and much like a deer in the headlights, government and business are painfully susceptible to allegations of breaching international law, particularly in the context of the human right to food.

Climate risk

There are 29 fundamental human rights that are to be universally protected, and form the basis of various legally binding international treaties, including the International Covenant on Economic, Social and Cultural Rights, which stipulates that government and business must:

- *'recognise the right of everyone to an adequate standard of living';* and
- *'avoid infringing on the human rights of others'.*

Significantly, human rights already underpin legislation in Australia, with examples including the Fair Work Act, Modern Slavery Act, and the Environmental Protection and Biodiversity Act.

Whilst the human right to an adequate standard of living, which including the right to food, water and shelter, is not yet enshrined in law in Australia; or in the handful of state & territory based

legislation; the May 2024 report following the inquiry into Australia's Human Rights Framework set out reasoning, and provided a draft bill, as to why all 29 human rights should be protected nationally; so it may only be a matter of time.

How did we get here?
So, what type of thinking, or decision-making, got us to this concerning juncture?

We are here because of our desire to narrowly interpret nature, and its role in society and the environment, which can be eloquently demonstrated by the following quote from a US environmental economist in 2012:

> *"(V)erbal rhetoric … steeped in beauty and ethics is **impotent against the numerical** rhetoric of growth and development."*

When considered only through the lens of modern economics, this interpretation could be argued as being common sense, as it is indeed the way in which we have placed value on natural assets over thousands of years.

Pre-trade hunger
In 1940, English botanist Sir Albert Howard described this shift through the "hungers" of which our soil, lakes, rivers, and oceans had to feed. Prior to the development of currency by the Mesopotamian civilisation in the 7th – 5th millennium BC, the main source of hunger the environment had to appease was the stomach.

Industrial hunger
However, it was because of the Industrial Revolution that competition for our natural resources began to impact the way in which we use the environment.

And why a subsidiary hunger for trade and manufacturing evolved for the purposes of feeding the economic machine.

In 1979, a US farmer opined that because of the industrial revolution, "rural wealth and materials and rural people were caught within the gravitational field of the industrial economy and flowed to the cities from which comparatively little flowed back in return."

Climate Treaties
In the context of agriculture and food security, it's appropriate to surmise that from the early 1990's, Member States of the United Nations – including Australia – made similar observations as to our impact on the environment, which subsequently led to the ratification of various climate change treaties.

However, rather than fundamentally shifting the way in which we value and use natural assets, I am of the view that we have continued to focus on nature as a commodity used in the attainment of sustainable development.

Current Hunger
Some 85-years since Sir Albert Howard's description, I've gone a step further to demonstrate that we as individuals are now not only hungrier for food, trade and manufacturing; but our soil, lakes, rivers, and oceans are now having to appease our hunger for increased urban development.

And our hunger for wealth generation through sustainable, green development, which is arguably coming at the expense of our ability to produce food and fibre, in circumstances where our approach to land and water use is currently determined by “either/or” considerations.

That is, what sustainable development activity - be it food production, green energy production, or sustainable housing - is going to be the best decision to not only derive economic viability but also appear to satisfy environmental goals.

Significantly, it is this narrow interpretation through existing and emerging policy that is placing Australian government and business at risk of breaching international law.

Why?

Framework

Because the Paris Agreement was entered into in pursuit of the United Nations Framework Convention on Climate Change, which both maintain an underlying objective to increase our ability to adapt to climate change, foster climate resilience, and lower greenhouse gas emissions in a manner that does not threaten food production.

And when taking action to address climate change, the cumulative effect of these treaties provides that parties must consider:

- their respective obligations on human rights, and
- the fundamental priority of safeguarding food security, food production systems, and Mother Earth.

You heard me correctly.

Our obligation to consider food security in the context of climate change mitigation is written in black and white in the very manual – or climate treaties – policymakers are required to use when enshrining climate adaptation into law.

And last month, the International Court of Justice opined that the ‘obligations of conduct and obligations of result’ are ‘mutually supportive’; and compliance of the parties with the obligations of the Paris Agreement is assessed on whether the party in question ‘exercised due diligence and employed best efforts by using all the means at its disposal in the performance of those obligations’.

Much like driving a tricycle with only two wheels, it is clear to me that policymakers – particularly in Australia - are failing to exercise due diligence by neglecting our clear obligation to prioritise food security.

Sustainable food production

Indeed, last night Joel rightly concluded that the agriculture sector is one often overlooked in policymaking; despite food being the one topic that transcends culture, race, politics, or gender.

It is a recognisable foundation of our culture, our economies, and our relationship with the natural world; but much like a valuation of nature, it is too often only considered in the context of production and export capabilities, despite being recognised by the UN as having an essential role to play in the solution to existing challenges associated with climate change.

Food Security

Whilst the definitions of food security and the human right to food differ, there is a crucial overlap at law.

In accordance with the International Covenant on Economic, Social and Cultural Rights, in order to satisfy food security as a precondition to human rights:

- **Availability** of food means that food should be available from natural resources or available for sale in markets and shops.
- **Accessibility** requires that economic and physical access to food be guaranteed, in that:
    - the minimum wage, social security benefit and infrastructure is sufficient to meet the cost of nutritious food in all areas.
- **Adequacy** means that food must satisfy dietary needs and be culturally acceptable; with examples of inadequate food including:
    - energy-dense and low-nutrient food, which can contribute to diet-related illness.

Since time immemorial, and as the atrocities in the Northern Hemisphere are demonstrating, hunger has always been a powerful weapon of war.

And despite our abundance here in Australia, it is due to our collective shortcomings when considering food security in its broad definition, that I share the sentiments shared by John and Joel last night that we are now in our most precarious era.

Valuing Nature through Food Security

How then can we fundamentally shift our decision-making to mitigate the risk of breaching international law?

Multiple Values

In 2015, the Millennium Ecosystem Assessment Board opined that:

> *"To protect 'natural capital assets' … we must put value on nature in all its multiple roles in human life, from the economic to the aesthetic and spiritual."*

Whilst placing an aesthetic and spiritual value on nature in the context of ecologically sustainable development may appear to be an exercise in futility, it is one that the IPCC demands of us.

Interdependent Hunger

As in 2023, it identified that the implementation of the Sustainable Development Goals

> *'require climate resilient development that treats climate, ecosystems and biodiversity, and human society as parts of an integrated and interdependent system'.*

When having regard to international law, and extrinsic materials including IPCC reports or UN guiding principles alongside domestic plans, roadmaps, and Ministerial statements; I think it is arguable that a court of law would consider an integrated and interdependent system is one that ensures that our finite natural assets are used to appease the main hunger of the stomach of humans, flora and fauna, first and foremost.

With all subsidiary hungers as being complementary.

Indeed, this is the very task currently before the Supreme Court of New Zealand in the case of Smith v Fonterra & Ors.

Rather than waiting for the inevitable filing of legal proceedings to spur the fundamental behavioural shift in policy and decision-making required in Australia – or indeed any jurisdiction – there is a simple way in which we can:

- demonstrate best practice when striving to adhere to the strict legal obligations we have under international law; and
- juggle environmental responsibility with economic ambition.

Food Security Pyramid

Rather than the usual silos of science or economics, this action is based on the rule of law, which is the very reason we are having this discussion.

Through statutory interpretation, and arguably common sense, food security underpins all international climate change treaties, and guiding pillars of sustainability.

As set out in my submissions to this very Parliament through our inquiry into food security in Australia a few years ago; there is economic, scientific, and legal-based evidence identifying that food security underpins not only our national strategy for ecologically sustainable development, but significantly, each one of our government portfolios.

So, instead of taking a piecemeal approach to policy development within the silos of government, I consider that an overarching human rights policy requiring government and business to consider human rights in each decision should be enshrined in law.

UHNCR Guiding Principles

I am not reinventing the wheel, but am instead taking guidance from the instruction manuals, which we are bound to consider, which reiterate that:

- States must protect against human rights abuse.
- Business, at a minimum, must respect the International Bill of Human Rights.
- And States must take appropriate steps to protect against human rights abuse by ensuring access to effective judicial, administrative, or legislative remedies.

Unlike the carve-out seen in Queensland legislation, enshrining human rights in law must include the Human Right to an Adequate Standard of Living, which encompasses the Human Right to Food.

And what I consider to be a final guiding tool; our definition of food security must be broadened in keeping with guidance by the United Nations in recent years to accurately reflect not only our obligations at international law, but arguably what should be common sense for all.

Case Study: Cressbrook

Last night, John asked us to mentor this year's scholars by providing them with the ideas to lead in this space. Whilst advocacy and research are crucial, I hope that through my active choice to leave work last year at a national law firm to instead live and work on farm demonstrates the importance of leading by example.

Whilst the net revenue of my business and minute land holding would arguably place me in the "hobby farm" definition of modern economics; I am confident that if judged by a court of law, my operation would demonstrate that I am standing on the shoulders of land management decisions

made by generations of my family in conjunction with the local Dungiburra tribe, to continuing to evolve our stock, land, water, and energy management techniques to ensure that both human and environmental health continues to prosper.

Indeed, the question at the heart of each decision I now make on farm is not “what is the highest and best use of our land in order to reduce greenhouse gas emissions as all costs, whilst also remaining profitable business”; but rather, “what actions can I take will ensure there is no hand-to-mouth existence for our environment, or my family”.

This is arguably a commonsense mindset for a farmer, but it is somewhat fortuitous that my opinion does not come from a place of personal pontification, but rather, an example of the conclusion made by the International Court of Justice, which concluded last month, that the right to a clean, healthy and sustainable environment results from the interdependence between human rights and the protection of the environment.

Conclusion

In conclusion, through legal interpretation it is my sincere hope you can now see that whilst solving the issue of food security should not be placed solely on the shoulders of primary producers and landholders; it is clear that in accordance with the strict obligations of international law, we – and the human right to food - must be placed at the core of every economic, social, and environmental decision.

Perhaps, too, we can all agree that having farmers and lawyers at the table as part of policymaking is just common sense.

Thank you

Caitlin McConnel is a sixth-generation farmer, legal strategist, and prominent agribusiness leader based at Cressbrook Station in Queensland’s Somerset Region—the oldest identified family business in the state. A passionate advocate for sustainable land stewardship and regional resilience, Caitlin combines deep practical experience on-farm with a strong legal and governance background.

She currently serves as Chair of the Queensland Rural and Industry Development Authority (QRIDA), having been appointed in April 2025 by the Hon. Dale Last MP. Caitlin is also actively involved in national industry conversations through roles with Cattle Australia, the Queensland Law Society, and the Department of Primary Industries ESG Working Group.

SESSION 2: CASE STUDY 3

Boosting Agricultural Resilience to Climate Change

Dr Leanne Webb
Science Lead, Asia-Pacific Climate Intelligence, CSIRO

Abstract

Over the recent few years, two research projects were separately undertaken to support Australia's and Vanuatu's agricultural sectors, demonstrating how the provision of climate services can help producers identify and understand future challenges. Both projects explored climate change-related impacts for different crops, assessing production suitability under current and future climates. Here, we consider both the commonalities and differences in the approaches and outputs in providing climate information to farmers in each country. For example, while the web interface of My Climate View (Australia) and the Van-KIRAP climate change portal (Vanuatu) were both designed for sectoral users to access, the Australian project was location-specific and Vanuatu's output was more regional. We also consider the strengths from both projects and provide actionable recommendations that can be implemented in similar projects going forward.

Introduction

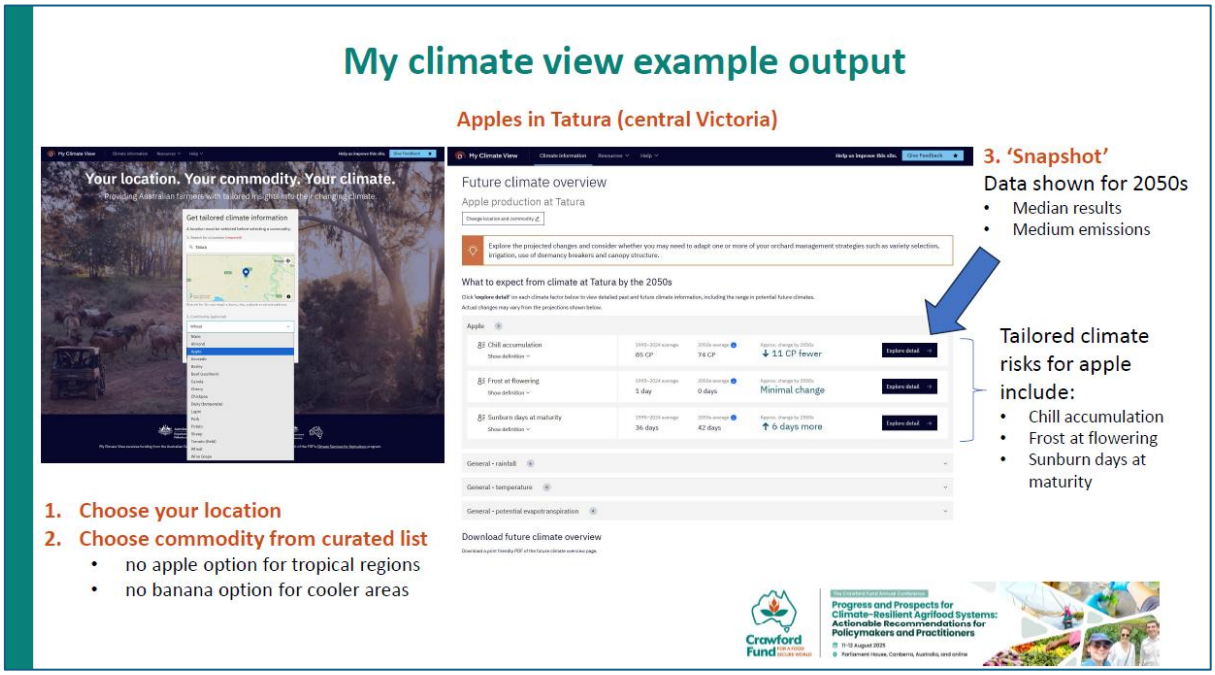
My name is Dr. Leanne Webb, and I work with CSIRO in Australia. Alongside my colleague Dr. Rebecca Derbyshire (CSIRO), we've been leading projects that aim to boost agricultural resilience to climate change. Today I want to share insights from two of those projects: My Climate View in Australia (CSIRO and Bureau of Meteorology, 2025), and Van-KIRAP in Vanuatu. A summary of both projects is shown in the below table

	My Climate View	**Van-KIRAP**
Country	Australia	Vanuatu
Target audience	Farmer and farm advisors	Sector decision makers
Location specific	Choose a location	Regional
Multiple commodities	22 (crops and livestock)	5 (crops, not livestock)
Target	Mainly about **how** it grows	Mainly about **where** it grows

'User' dial-up input	Limited	Yes, explore another crops' suitability
Timeframes	Observed past changes, future	Past, future
Adaptation advice	No	Yes, limited / with caveats
Output (as shown)	Data and graphs of production metrics	Case studies, mapping tool
Support etc.	Train the trainer, field days, industry events	Workshops, fact sheets, video (in Bislama)

Both projects are about helping farmers, advisors, and decision-makers understand how climate change will affect agriculture — and how we can plan more effectively for the future.

My Climate View: Supporting Farmers in Australia



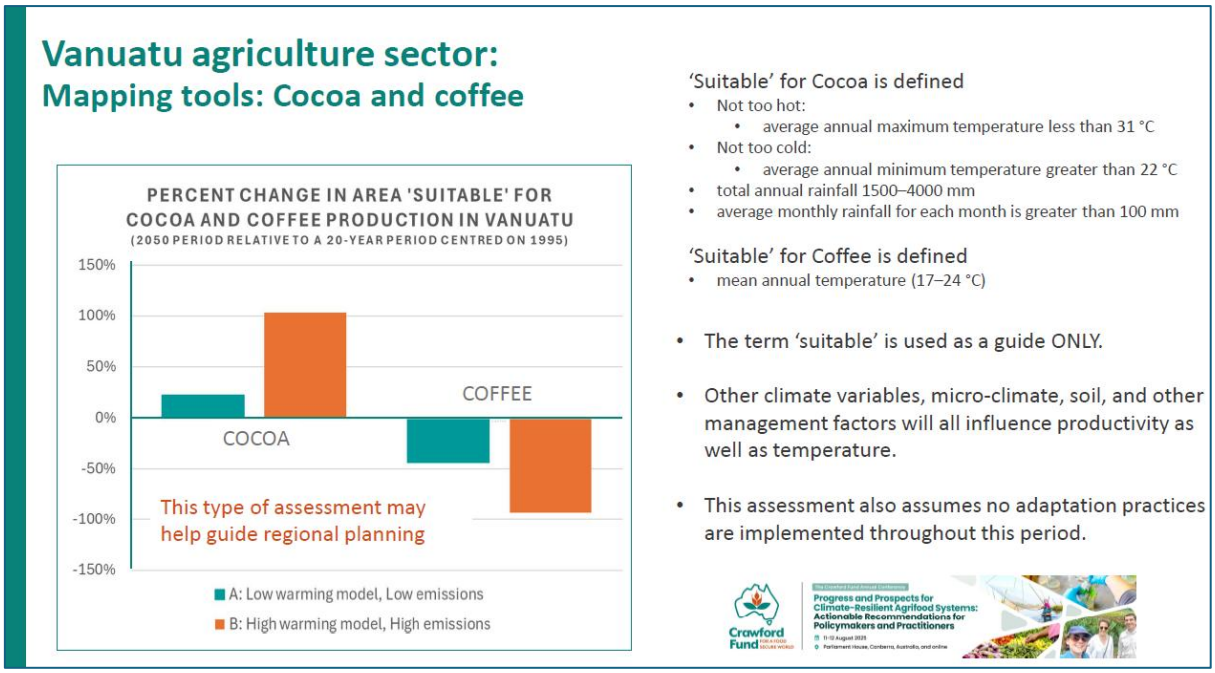
In Australia, My Climate View was designed to integrate climate science into farm management planning. Farmers can choose from a list of commodities currently being produced in their region of interest. The tool then provides a tailored snapshot of how climate risks for the commodity of interest will change for selected periods out to the 2070s under different greenhouse gas emission scenarios.

For example, an apple grower in Victoria can see projections for climate risks such as chill accumulation, frost risk, and sunburn damage, with comparisons between current conditions and future projections (2030, 2050, 2070). Users can explore projected changes in the climate risks

into the future, switching between medium and high-emission scenarios.

The tool was deliberately designed to be practical and user-friendly, allowing farmers and advisors to make evidence-based decisions. Training sessions, field days, and industry events have supported its uptake across Australia.

Van-KIRAP: Climate Resilience in Vanuatu



The Van-KIRAP project applied similar climate science principles in Vanuatu, an island archipelago located between Fiji and New Caledonia in the Western Tropical Pacific Ocean (SPREP VMGD and CSIRO, 2025).

In this project we worked with sector decision-makers to integrate climate information into planning across five sectors, with agriculture being a central focus. We developed case studies — short, accessible four-page reports — on key crops such as cocoa and coffee.

We also built a mapping tool to show how suitable land for crops like cocoa might change under different climate scenarios (Webb and Leo, 2023a). For example, under a high-emissions scenario by 2050, the land suitable for cocoa production could increase considerably. But there are winners and losers: while cocoa suitability increases, coffee suitability declines (Webb and Leo, 2023b).

Importantly, these tools are guides rather than prescriptions. Suitability depends not only on climate but also on soil, microclimate, and management practices. Nonetheless, they provide valuable evidence to support regional planning.

Lessons Learned Across Both Projects

Working across both Australia and Vanuatu, we've learned some important lessons:

- **Regional decision-making must be based on the latest science.** Tools like My Climate View and the Van-KIRAP Climate Futures Portal help integrate climate data into everyday planning.
- **Co-development is essential.** The best projects are built with users, not for them. We made sure to involve farmers, advisors, and local experts from the start, and kept iterating as needs evolved.
- **Capacity exchange matters.** I don't call it capacity development — it's an exchange. We learn from our partners, and they learn from us. That reciprocity makes tools more relevant and more likely to be used.
- **There is no one-size-fits-all.** Each location, crop, and community has different needs. The key to answering the question 'What's going to happen under a changing climate for me?' is to ask: for where, for what, for whom, and why are you asking this?

Conclusion

Agricultural resilience depends on equipping farmers and decision-makers with tools that combine scientific rigour with local relevance. Both the My Climate View and the Van-KIRUP projects show how climate information can be transformed into actionable insights, tailored to farmers in Australia or smallholders in the Pacific.

The future of farming under climate change will be challenging, but with science, co-development, and capacity exchange, we can give communities the confidence to adapt and thrive.

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Dr Leanne Webb is currently working as the science lead for the CSIRO Asia-Pacific Climate intelligence team. In this position Leanne draws on more than two decades of experience gained from studying climate change impacts and related adaptation strategies across many sectors, including agriculture, electricity, finance and health. Agriculture has been Leanne's foundational research domain, with her doctoral research published in 2007 exploring the potential impacts of climate change on the Australian wine industry.
Over the past seven years, Leanne's role has shifted to focus on the Pacific

region. Here, Leanne has been involved with extracting, evaluating, and processing climate model output for use in Pacific-focused case studies, again across multiple sectors, with the purpose of better informing future planning decisions. Currently, Leanne represents CSIRO's involvement across multiple Pacific-focused climate-related committees and panels.

SESSION 2: CASE STUDY 4

Carbon and financial performance and opportunities for silvopastoral systems

Dr Tyron Venn
Senior Research Fellow, School of Agriculture and Food Sustainability,
University of Queensland

Abstract

Mitigating climate risk requires substantial changes to socio-economic systems, including livestock production, which accounts for approximately 14% of global anthropogenic carbon emissions. Growing pasture, trees and livestock on the same land management unit in silvopastoral systems provides opportunities to increase farm financial performance while substantially reducing the carbon-intensity of livestock production. In timber-producing silvopastoral systems, a timber income stream can be generated after carbon credit payments diminish. Case studies are presented for Australia and Fiji. Increased adoption of silvopastoral systems by landholders requires long-term rights to benefit from sustainable vegetation management, as well as the development of carbon credit methods that permit natural vegetation management and account for international and domestic leakage.

Introduction

Good morning. My name is Tyron Venn from the School of Agriculture and Food Sustainability at the University of Queensland. I want to share my research on the carbon and financial performance of silvopastoral systems — integrated systems that combine trees, pastures, and livestock.

In 2024, the world recorded its highest level of anthropogenic greenhouse gas (GHG) emissions. At this pace, we risk exceeding the 1.5°C carbon budget by 2030. Agriculture is a big part of this picture: it accounts for around 22% of global GHG emissions, with livestock alone contributing 14–18%. In Australia, the livestock sector is responsible for about 10% of annual emissions.

That reality means we must find ways to lower emissions from livestock systems. Silvopastoral systems, which integrate trees with grazing landscapes, are one of the most promising pathways.

What are silvopastoral systems?

In simple terms, silvopastoral systems integrate timber production, pastures, and livestock on the same land. Trees can be established either through planting or through better management of natural regrowth.

- **Planted trees**: expensive to establish, but they are recognised under carbon credit schemes.
- **Managed native regrowth:** far less expensive to establish, but many carbon markets — including Australia's — don't currently provide credits for active management. Instead, they often require strict conservation, which prevents thinning to maintain pasture production and the commercial harvest of timber as the trees mature.

This creates a dilemma for landholders. Should they clear regrowth for open pasture to maintain livestock income and land value? Should they lock up land in a carbon project, knowing that farm productivity and income will fall in the medium and long-term with potential negative implications for land value? Or should they try to manage regrowth into productive silvopastoral systems, combining livestock, timber, carbon and biodiversity benefits?

I believe the third option holds the greatest potential benefits for landholders and the planet.

Opportunities in Australia and Beyond

In southern Queensland and northern New South Wales, there are about 1.5 million hectares of post-1990 regrowth forests with commercially valuable timber species. These landscapes could be transformed into productive silvopastoral systems, given the right policy frameworks and incentives.

The benefits go beyond income:

- **Diversified revenue streams** (livestock, timber, carbon).
- **Biodiversity gains** at both domestic and global levels.
- **Reduced reliance on imported timber**, much of which comes from regions where illegal or unsustainable harvesting is common.
- **Improved climate resilience** for farming systems.

I have also had the privilege of working on silvopastoral projects in Fiji. On degraded sloping lands, we found that these systems can boost landholder returns by around 50% in the long run, while also acting as a carbon sink.

Evidence from Research

Our modelling and field studies show silvopastoral systems have the potential for strong carbon sequestration and financial performance. Using Queensland spotted gum regrowth as a case study, silvopastoral systems can store around 133 tonnes of CO_2 per hectare more than conventional periodic re-clearing for open pasture, over a 100-year lifecycle.

If only half of the native forest regrowth in southern Queensland and northern New South Wales were converted into silvopastoral systems, the sequestration potential would reach about 100 million tonnes of CO_2.

Financially, these systems can also outperform open pastures. A well-managed silvopastoral system can deliver higher long-run returns, though landholders must typically wait 15–30 years before timber income begins. This is why carbon markets, if properly structured, are crucial: they can provide the early revenue streams that improve the short- to medium-term financial viability

of silvopastoral systems.

Barriers and Challenges

If silvopastoral systems are so promising, why aren't they more widely adopted? In my experience, the main challenges are:

- **Insecure land tenure or property rights**: In Queensland alone, there were 40 amendments to vegetation management laws between 2000 and 2020. This level of uncertainty breeds mistrust and discourages investment.
- **Reduced short- and medium-term income:** Trees compete with pasture, lowering livestock yields as trees mature.
- **Policy and carbon market design**: Current frameworks often fail to reward managed regrowth, instead pushing landholders toward either clearing or strict conservation.
- **Long wait for timber returns**: Without interim financial incentives, many landholders simply cannot afford to wait for trees to mature.

What Needs to Change

To unlock the full potential of silvopastoral systems, three key reforms are needed:

1. **Secure long-term rights for landholders**
   Farmers must have confidence that investments in trees won't be undermined by sudden regulatory shifts. Stability in vegetation management law is essential.
2. **Carbon credit methods that allow managed regrowth**
   Approaches like Forestry Australia's proposed Enhancing Native Forest Resilience method would recognise the carbon sequestration in managed native regrowth silvopastoral systems, permit timber harvesting and facilitate ongoing agricultural production.
3. **Lifecycle-based carbon markets**
   Current markets often ignore leakage. For example, locking up grazing land in carbon projects can simply shift beef production — and deforestation — offshore. Proper lifecycle analysis would ensure integrity and avoid undermining global climate goals.

Conclusion

Silvopastoral systems are not a silver bullet, but they represent one of the most effective ways to align agriculture, carbon mitigation, and financial sustainability. They can reduce emissions, improve biodiversity, diversify farm income, and strengthen climate resilience.

But success depends on supportive laws, secure rights, and credible carbon markets. If we get the policy and legal settings right, silvopastoral systems could make a major contribution to Australia's — and the world's — journey to net-zero, while keeping farmers profitable and landscapes productive.

Dr Venn is a natural resource economist with a research focus on the design and evaluation of resource and environmental policy and practice to facilitate global action to conserve biodiversity, mitigate climate risk and address United Nations Sustainable Development Goals. This requires quantification of the complex and sometimes perverse domestic and international carbon,

biodiversity and socio-economic trade-offs (including leakages) that can be associated with well-intentioned policy. His research is highly interdisciplinary and collaborative with research institutions, government and industry, including ecologists, agricultural scientists, engineers and social scientists. Methods employed include stratified and replicated field experiments, cost-benefit analysis, lifecycle analysis of carbon, mathematical programming, simulation and applied environmental economics including non-market valuation. Specific research contexts include forest and wood product value chains, Australian Indigenous agribusiness, silvopastoral systems, wildfire risk mitigation and invasive species management.

SESSION 3 ACHIEVING A PATHWAY TO CLIMATE RESILIENCE

Lessons from Asia and Africa

Dr. Aditi Mukherji, Principal Scientist,

Climate Action in the Livestock, Climate and Environment Program, International Livestock Research Institute

Abstract

Agri-food systems across Asia and Africa, where over 2.5 billion people depend on agriculture for livelihoods and food security, are at risk due to current and projected climate change. For example, in Africa, maize and wheat yields have already declined by 5.8% and 2.3%, respectively, due to increased drought frequency and warming trends (IPCC, 2022a).

Across both continents and more so in Africa than Asia, rain-fed agriculture accounts for over 90% of staple crop production, making it acutely vulnerable to erratic rainfall and temperature extremes (IPCC, 2022a; IPCC, 2022b). In Asia, monsoon variability, glacier retreat affecting all perennial rivers, sea-level rise, and extreme heat threaten food production in densely populated river basins and deltas, such as the Ganges, Mekong, and Indus (IPCC, 2022b). Fisheries and aquaculture, which provide more than 20% of animal protein in many Asian countries, are also increasingly disrupted by warming and ocean acidification (IPCC, 2022c).

Without adequate adaptation, cereal yields could decline by 10–30% by 2050 across both regions, and suitable areas for rain-fed crops, such as maize, could shrink by up to 40% in parts of Sub-Saharan Africa under 1.5°C warming (IPCC, 2022a). While relatively under-researched, yields of non-cereal crops, as well as the nutritional content of all major food groups also decline at higher levels of global warming. These disruptions deepen food insecurity, affecting a disproportionate share of the 783 million people globally who are already undernourished, and exacerbating inequality for smallholders, women, and youth.

A range of solutions exists, encompassing adaptation and mitigation and their various co-benefits with nutrition and related SDGs and CGIAR and partners are working to scale these solutions. Climate-smart agriculture, including drought- and heat-tolerant crops, efficient irrigation, and agroecological practices, offers immediate adaptation benefits while leveraging digital tools such as AI-powered climate services, decision-support platforms, and mobile-based advisory systems, which helps small holder producers be better prepared for climate-induced hazards like floods and droughts.

Technological breakthroughs highlighted in recent CGIAR reports include methane inhibitors,

improved forages, green ammonia, and site-specific nutrient management are interventions that simultaneously boost productivity and reduce emissions. Scaling these solutions requires targeted adaptation finance, inclusive governance, and enabling policy frameworks and calls for a just transition in agri-food systems in Asia and Africa.

Introduction

Today I will share insights from the IPCC AR6, where I served as a Coordinating Lead Author, and from my work with CGIAR and the International Livestock Research Institute.

I want to begin with three key takeaways:

1. The intensity and severity of the climate crisis, particularly for agriculture, is still not fully appreciated. Incremental adjustments will not suffice.
2. Solutions exist, but chronic underinvestment in agricultural R&D has prevented low-emission technologies from maturing, leaving us unprepared.
3. Climate change is deeply entangled with global inequality — those least responsible are most affected. Tackling inequality is central to tackling climate change.

Climate Change and the Water–Food Nexus

Our findings from IPCC AR6 show that every component of the water cycle—precipitation, glaciers, groundwater, and soil moisture—has been altered by climate change. These shifts intensify extreme events, which cascade into risks for food and nutrition security. Impacts include reduced yields, increased pests and diseases, and declining nutritional content of crops. Governments worldwide endorsed these findings, lending them strong legitimacy. Heatwaves, heavy precipitation, and agricultural drought are already widespread, particularly in Africa and Asia. Attribution science confirms these trends are directly linked to greenhouse gas emissions, not natural variability.

Impacts on Agriculture and Food Systems

Climate change is already reducing yields of major crops across most regions. Projected warming will further diminish yields in a non-linear fashion: the higher the warming, the sharper the declines. Livestock systems are also highly vulnerable, with mid- to high-level warming scenarios projecting widespread heat stress and productivity losses.

Beyond crops and animals, human labour in agriculture is at risk. In South Asia, rising heat and humidity are already reducing farm labour capacity and, in some cases, causing mortality. These physical limits to adaptation underscore the urgency of mitigation.

Agriculture as a Driver of Climate Change

While agriculture is a victim of climate change, it is also a contributor. Food systems account for roughly one-third of global greenhouse gas emissions. However, fossil fuels remain the dominant driver, and the burden of mitigation cannot fall solely on agriculture.

Still, agriculture must transition to lower-emission pathways. This transition is constrained by a lack of cost-effective technologies, inadequate safety nets for farmers, and decades of underinvestment in R&D.

Adaptation and Mitigation Pathways

CGIAR and partners are working on a broad spectrum of adaptation strategies:

- Risk sharing and safety nets such as insurance.
- Climate services to deliver actionable weather and risk information.
- Disaster risk management and migration planning.
- Sustainable cropland and livestock management.

Promising technologies include:

- Low-methane forages to reduce enteric emissions in livestock.
- Site-specific fertilizer management to cut emissions while maintaining yields.

These are most likely to be adopted when they also provide adaptation co-benefits—such as resilience to drought or improved soil health.

Yet adaptation has limits. Once global warming crosses 1.5–2°C, many adaptation options (such as drought- or heat-tolerant crop varieties) will no longer be effective. This makes emission reduction urgent alongside adaptation.

Five Pathways Towards Resilience

From the Agricultural Breakthrough Report, five key pathways emerge:

1. Reduce unsustainable consumption (e.g., cutting food waste, reducing excess meat consumption, lowering fertiliser overuse).
2. Increase sustainable food production without expanding agricultural land.
3. Protect natural resources such as soil, water, and biodiversity.
4. Reduce emissions through cost-effective technologies.
5. Prioritise smallholder producers and food security, ensuring just transitions that protect the most vulnerable.

Beyond Incremental Change: Research and Justice

We must move beyond incremental adaptation to transformational change. Key emerging questions include:

- How do we account for losses and damages in agriculture, including through legal mechanisms such as the recent International Court of Justice advisory opinion?
- How do we prepare for overshoot scenarios, where global temperature temporarily exceeds 1.5°C?
- How do we ensure a just transition for food systems, comparable to the energy sector's debates, so that low-emission agriculture does not compromise food security?

Conclusion

The climate crisis is too severe for marginal adjustments. Without bold investment in research, equitable policy, and systemic transformation, adaptation options will diminish as warming intensifies. Agriculture must reduce emissions, but this transition must be just, farmer-centred, and globally supported.

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Dr Aditi Mukherji is Principal Scientist – Climate Action in the Livestock, Climate and Environment Program of the International Livestock Research Institute (ILRI) , effective 1 July 2025. Before joining ILRI, Aditi was the Director, Climate Change Adaptation and Mitigation Impact Action Platform of the CGIAR and was hosted by ILRI in Nairobi. She has also been a Principal Researcher at the International Water Management Institute based in India and Sri Lanka, and before that she led the Waterover and Air Theme at the International Centre for Integrated Mountain Development (ICIMOD) and was based in Nepal.

Aditi was a Coordinating Lead Author (CLA) of the Water Chapter in the Working Group II of the Intergovernmental Panel on Climate Change (IPCC) published in February 2022, and was a member, Core Writing Team of the IPCC's AR6 Synthesis Report which was published in March 2023. She is a currently a member of the Earth Commission where she is working with global experts on quantifying safe and just planetary boundaries. Her areas of specialization are climate change adaptation, agricultural resilience for small holder producers, climate governance, water-energy nexus and community governance of natural resources. She has worked in South Asia including the Hindu Kush Himalayan region, Nile basin and in Central Asia. She has published over 80 peer reviewed research papers, including four edited books. In 2012, she was awarded the Inaugural Norman Borlaug Field Award, endowed by the Rockefeller Foundation and given by the World Food Prize Foundation, USA.

Aditi is a human geographer by training and has a PhD from Cambridge University, United Kingdom where she was a Gates Cambridge Scholar. She has been widely quoted by the media, including New York Times, BBC, DW International, CNN, Al Jazeera and various news outlets in South Asia.

SESSION 3 ACHIEVING A PATHWAY TO CLIMATE RESILIENCE

Lessons from the Pacific

Professor Graham Sem

Environmental Science & Geography Discipline Lead, University of Papua New Guinea

Abstract

This paper examines the evolving landscape of climate resilience within the agrifood systems of Pacific Island countries, where agriculture, fisheries, transportation, and food distribution networks are deeply interconnected and highly vulnerable to climate change. Pacific Island agrifood systems – spanning smallholder crop and livestock production, subsistence and semi-commercial fishing, food processing, and marketing – are facing escalating threats from more frequent extreme weather, sea level rise, and resource scarcity. Through regional case studies drawn from Papua New Guinea, Fiji, Samoa, Solomon Islands, and Vanuatu, the analysis highlights how climate-smart agriculture, local innovations, and strengthened institutional collaboration are not only helping to safeguard production but also ensuring that food supply chains, market access, and rural livelihoods remain viable under changing climatic conditions.

The paper underscores the importance of evidence-based interventions, such as crop diversification, extension services, and improved value chain connectivity, for fostering a more adaptive and inclusive agrifood sector. Despite positive developments, significant challenges persist, such as underdeveloped infrastructure, limited agrifood financing, and challenges in knowledge-sharing across the region.

The study provides actionable recommendations aimed at strengthening the agrifood system's adaptive capacity – emphasising the need for integrated policies, investment in resilient infrastructure, and multistakeholder engagement – so Pacific Island countries can achieve sustainable food security and resilient rural economies in the midst of ongoing climate pressures.

Introduction

Good afternoon, ladies and gentlemen. I wish I could be there in person, but I am grateful that technology allows me to join you virtually. My thanks to Crawford Farm for inviting me to contribute to this important discussion on climate resilience and agrifood systems in the Pacific. Today, I want to share some lessons we are learning across the region. I will begin with why climate resilience in agriculture is so important for Pacific Island countries, then outline the climate impacts we are witnessing, the specific challenges facing our agrifood systems, and some emerging solutions. I will also reflect on regional support and policy alignment, and conclude with actionable recommendations.

Why Climate Resilience Matters in the Pacific

The Pacific Islands are heavily reliant on agriculture and fisheries, both of which are increasingly threatened by climate change. Droughts, floods, and rising sea levels jeopardise local food production, and disruptions in agriculture push communities towards imported processed foods. These dietary shifts worsen health outcomes, contributing to obesity and non-communicable diseases, which—as recent headlines in Papua New Guinea remind us—are now the leading cause of death.

Population growth places further pressure on food systems, while agriculture and fisheries remain the backbone of livelihoods and economic development. For this reason, climate-resilient agrifood systems are not just about farming—they are about sustaining incomes, protecting jobs, and ensuring long-term food security, health, and sustainable development.

Climate change impacts in the Pacific

The Pacific is currently experiencing the harsh realities of climate change:

- **Rising sea levels** are causing land erosion, contaminating freshwater sources, and threatening the livelihoods of coastal communities.
- **Erratic rainfall** leads to both droughts and floods, disrupting planting cycles and compromising water availability.
- **Saltwater intrusion** diminishes water quality and adversely affects crop yields.
- **More intense tropical cyclones** are wreaking havoc on infrastructure, ecosystems, and agricultural systems.

These impacts and challenges render agriculture — an essential source of sustenance for Pacific communities - particularly susceptible to climate fluctuations. Changes in temperature and rainfall patterns are reducing crop yields, while extreme events can wipe out entire farms within a matter of days.

Challenges for Agrifood Systems

Pacific agrifood systems are primarily composed of smallholder farmers who encounter numerous obstacles:

- Limited access to data and technology: Many farmers struggle with inadequate access to critical data and technology for effective weather forecasting and early warning systems, hindering their ability to prepare for climate-related events.
- Slow adoption of climate-resilient crop varieties: Financial constraints and the lack of knowledge prevent many farmers from adopting climate-resilient crop varieties, which are essential for adapting to changing conditions.
- Insufficient infrastructure- the absence of adequate infrastructure for irrigation, water storage, transport, and market access makes it challenging for farmers to optimise production and reach consumers efficiently.
- Minimal insurance option – There are few insurance products available to help farmers protect themselves against the financial repercussions of climate shocks, leaving them vulnerable to losses. Supply chain disruptions - natural disasters can severely disrupt supply chains, isolating communities and impeding their capacity to recover and continue agricultural activities.

These constraints make building resilience urgent and also deeply challenging.

Emerging Solutions

In the face of numerous challenges, innovative solutions are emerging and taking root across the Pacific:

- **Climate-resilient crops**- Initiatives are underway to cultivate climate-resilient crops such as salt-tolerant taro in Fiji and drought-tolerant varieties in Samoa, enabling farmers to adapt to changing environmental conditions.
- **Agroforestry systems** – The integration of crops with trees in agroforestry systems is proving beneficial. This approach not only reduces flood damage but also diversifies income sources for farmers, enhancing their resilience.
- **Early warning systems** and mobile technology – Advanced early warning systems and mobile technology are now providing real-time climate information directly to farmers, helping them make informed decisions and better prepare for adverse weather conditions.
- **Community seed banks** – The establishment of community seed banks is crucial for safeguarding local varieties and supporting recovery efforts following natural disasters. These banks ensure that farmers have access to culturally significant and climate-resilient seeds.
- **Collaborative Initiatives -** Partnerships such as the Australia–PNG coffee and cocoa initiative focus on strengthening climate risk management, providing training, and improving market access for farmers in the region.

While, these solutions are promising, successfully scaling them up will require substantial investment, collaborative partnerships, and robust institutional support.

Regional Support and Partnerships

Regional cooperation is essential for addressing the challenges faced by agrifood systems in the Pacific. Key organisations and partners play a vital role in providing the necessary support: Secretariat of the Pacific Community (SPC)- SPC is actively involved in promoting sustainable development across the region, offering technical and capacity-building assistance to enhance resilience among Pacific Island communities.

Bilateral partners – Countries such as Australia contribute significantly to regional efforts, providing both financial support and technical expertise aimed at climate adaptation and sustainable agricultural practices.

Multilateral donors – Institutions like the World Bank provide technical, financial, and capacity-building support to bolster agrifood systems, ensuring that resources are allocated effectively to tackle climate-related challenges.

Programs such as the Pacific Adaptation to Climate Change project focused on implementing strategies to mitigate the impacts of climate change, while the Pacific Island Farmers Organisation Network fosters collaboration among farmers to share knowledge and best practices. Additionally, integrated agroforestry initiatives aim to enhance biodiversity and improve sustainability within agricultural systems across countries.

By leveraging these partnerships and programmes, the Pacific region can enhance its capacity to

adapt to climate change, ultimately strengthening food security and community resilience.

Recommendations

To strengthen the climate resilience of agrifood systems across the Pacific agrifood systems, I recommend implementing the following four key actions:

- **Promote Climate-Smart Agriculture –** invest in extensive training for farmers, enhance access to innovative technologies, and provide robust incentives to encourage the adoption of sustainable practices.
- **Expand financial resources and insurance** – broaden access to financing options and insurance products by leveraging microfinance, offering crop insurance, and exploring innovative financing mechanisms, such as climate green bonds.
- **Improve disaster risk management** – enhance early warning systems, develop community-based recovery plans, and conduct comprehensive risk assessments to improve preparedness and response to climate-related disasters.
- **Encourage regional cooperation – Facilitate cooperation** through shared platforms, farmer networks, promote collaborative research efforts, and align policies across Pacific island countries to address climate change challenges collectively.

Conclusion

Pacific agrifood systems are adapting to significant changes in response to new challenges. but these systems still face many hurdles. To effectively tackle these issues, collaboration is essential. Governments, local communities, researchers, and development partners must work together. Such unified efforts can strengthen food security, improve health outcomes, and foster sustainable livelihoods for Pacific Island communities in the face of a changing climate.

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Professor Graham Sem is a leading figure in climate change adaptation, environmental conservation, and sustainable development. His extensive experience in academia and consultancy roles underscores his commitment to enhancing community resilience and informing policy and practice in the face of climate challenges. His work significantly contributes to the global discourse on environmental sustainability and climate action, particularly in the Pacific region.

Professor Graham Sem boasts over 20 years of experience addressing climate change and disaster risk reduction issues in collaboration with communities, governments, and international organisations. His work primarily focuses on strengthening capacities and capabilities to combat the adverse impacts of climate change and disaster risks at national, regional, and international levels. He plays a crucial role in assisting countries in mobilising financial, technical, and human resources necessary for the implementation and management of climate change activities, projects, and programs. A significant aspect of his recent efforts includes the preparation of Nationally Determined Contributions for Kiribati and the Solomon Islands.

In addition, Professor Sem has been actively managing the Managalas Project on Forest Protection, Climate Change Adaptation and Mitigation, and Biodiversity Conservation in Oro Province, Papua New Guinea. He possesses extensive experience in conducting stakeholder consultations with local communities, national governments, and international organisations, developing a deep understanding of their unique challenges and needs. Professor Sem excels in preparing technical and policy documents related to climate change, and he has successfully assisted Pacific Island countries in crafting project proposals for various funding opportunities.

His contributions include involvement in initiatives such as the Pacific Islands Climate Change Assistance Programme, national communications, national adaptation programme of action, vulnerability and adaptation assessments, and regional disaster risk reduction projects. Moreover, he has been instrumental in the development of key policies and frameworks, including NAPA, the International Climate Change Adaptation Initiative, the Pilot Programme on Climate Resilience, and the Pacific Adaptation Strategies Assistance Programme. His understanding of the Pacific small island developing states government systems is profound, having lived and worked in the region for over three decades. Additionally, he engages in mentoring experts across these countries, facilitating capacity building and training on various aspects of climate change adaptation and disaster risk reduction.

SESSION 3 GUIDED DISCUSSION

Chair: Mr Shaun Coffey

CEO Crawford Fund for Food Security

Chair:

Thank you, Graham, if you can stay online, we've got a couple of questions we'd like you to address.

Firstly, one of the things that struck me from your presentations and the discussions during the morning, we seem to be talking about the need to change the terms climate resilience and climate adaptation.

Dr Aditi Mukherji :

It can be used in an interchangeable way: do we pursue resilience or do we pursue adaptation? So, thank you for that question. My understanding is that resilience, as a term combines both mitigation and adaptation. So, while adaptation is simply: how do you adapt to a changing climate, mitigation is how do you adapt while also decreasing the emission of greenhouse gas? Because it's become increasingly clear that there is no way we can adapt our way out of this climate crisis as long as the greenhouse gas emissions into the atmosphere keep increasing, adaptation will have its limits, both physical limits, but also financial, ecological, and other limits. So I feel that resilience is a more holistic term that somehow includes both mitigation and adaptation, and underlines the fact that both have to go hand in hand. One without the other would be like a one-legged stool

Chair:

Thank you. Graham, do you have anything to add to that?

Professor Graham Sem:

Climate resilience, I think we have used it here interchangeably. And I agree that here it covers both adaptation and mitigation. In the Pacific, people have proposed the co-benefits between adaptation and mitigation to increase resilience. So, yes in this case, it is the same thing when we talk about adaptation.

Chair:

Thank you. One of the juxtapositions I see in the two presentations, Aditi, you've talked about the fact that we're approaching threshold modes, and we may be running out of time.

You've both identified technologies that can be scaled. What do we need to do to create more ambitious deadlines to make this change happen?

Dr Aditi Mukherji

Well, that's a very hard question. It's very clear what causes climate change and the impacts of climate change

The more we delay, the more we try to put a fine spin on that science or to interpret it in the way we wish, the more delays we are causing. So, I think let's be honest and understand the severity of the situation. Which brings us to the political will, because some of these decisions will be hard decisions.

And in parliamentary democracies where governments change every five years, there are obvious difficulties. And therefore comes a need for awareness among the public.

So there's nothing better than asking your elected representative for climate action. I would think we understand the science. There is just so much climate misinformation out there. So to have the ability to distil what the scientific consensus is versus what the Facebook post is saying is super important, and then use that evidence to lobby for a change, for a positive change, because I feel that's the fundamental thing here. Everything else is just a delaying tactic. I think that's an important point about internalising the science and having an effects-based approach, particularly to policy development.

Chair:

We've talked a lot about partnerships in the conference and how do we actually involve local communities more in developing real partnerships? As opposed to merely bilateral collaborations? How do we involve local communities more in developing partnerships for climate resilience?

Professor Graham Sem:

That's a very good question. Agriculture is an activity that most local communities are involved in. And so there must be a pathway for them to be engaged. Most of the partnerships that we have at the moment are at the higher level, at the government-to-government level or bilateral partnerships.

I think we need to get down to the community level. But the communities have a hierarchy that is in place. They can't just have a partnership with an organisation or a program in Australia, for instance. Australia. The way to do this better is probably using non-government organisations because they actually work better, delivering partnerships with the local communities.

But it's an area that needs to work. And I think, experience has already shown that the non-government organisations are doing this better. And the governments in this case. So maybe that's a way of getting down to the local communities better through non-government actors.

Chair:

We've talked a lot about opportunities here, setting targets and what end points might be, and what are the essential tasks of leadership to identify the path and take the first few steps. Given your experience and observations over a very large part of the world, what would you see as the most profitable first steps that we could be taking following a meeting like this?

Dr Aditi Mukherji

Okay, that's a hard one. Maybe I can start with a very narrow, specific kind of observation that I also made during my presentation. And the fact is that we know that there are solutions, but we, at the same time, know that those solutions are not cost-effective. So making solutions cost-effective requires a whole lot of R&D investments.

So I would actually think that this is a very good opportunity for the agriculture sector to go

out there and argue for more, not less, in agriculture. But these investments will not be the business-as-usual investments, where the only focus is increasing yield, because that's how we have done in the agriculture sector for the last 58 years.

Our focus has been increasingly on just yields, but now the focus has to be on yields with co-benefits of reduced emissions. So I feel we should be arguing for greater R&D investment. This morning, our keynote speaker showed us how the budgets of some of the leading organisations, including the CGIAR, have stagnated over the years. So, I think that targeted interventions around the links between climate change and food security, and the links with R&D are needed.

There is a greater tendency for climate misinformation to move towards more authoritative forms of government or more right-wing. And I think as citizens, and me as a scientist, we need to be vigilant to identify when climate misinformation is happening, calling those out.

So I think those of us who are still lucky to live in democratic societies have a very short, narrow window of opportunity to agitate for that change. So just don't do research, be an activist and agitate for that change that needs to happen. But I think it requires much more thought. Thank you

Chair:

That's a good place to finish. Can I ask you to join me in thanking Aditi and Graham? Thank you.

SESSION 4: RESILIENCE THROUGH EQUITY, INCLUSION AND COMMUNITY PARTICIPATION

Gender Equality and Food System Resilience

Dr Purnima Menon
Senior Director for Food and Nutrition Policy and Acting Senior Director,
Transformation Strategies,
International Food Policy Research Institute

Abstract

Gender dynamics within food systems illustrate deep-seated structural inequalities that impede progress toward economic, social, nutritional, and environmental objectives. This presentation explores the progression from key concepts to measurement and solutions, underscoring the influence of gender across the food system and the strategies required to reshape these dynamics.

A range of methodologies now exist that can be used to examine and highlight how gender dynamics in society affects food system transformation. Evidence-based solutions addressing structural inequality—such as cash transfers, community-based initiatives, and gender-sensitive financial inclusion in agriculture—are emerging in rural contexts and provide promising models of change.

Transformative laws, national programs, and policy frameworks play a critical role in reinforcing and scaling such community-driven efforts. Altogether, this presentation builds a conceptual, empirical, and rights-based argument for sustained investment in social transformation—through measurement, targeted solutions, and policy innovation—to advance global food system goals.

Introduction

Thank you, Nigel, for your kind introduction, and thank you, Cathy, for inviting me to be with you all today. On behalf of the CGIAR team, we are delighted to be partners on this journey of building evidence to support inclusive development for all and to create sustainable, resilient, and healthy food systems.

Today, I will focus primarily on insights from our research on gender equality and food systems resilience, spanning a wide range of topics. I want to acknowledge our many funders for supporting our research on gender inequity, including the Australian government. I also want to recognise my colleagues—gender leaders at IFPRI: Agnes Quisumbing, Hazel Malapit, Elizabeth Bryan, and Emily Schmidt - for their contributions to this presentation.

Let me deeply acknowledge the partnerships and collaborations that generate evidence and contribute to the impact of our research around the world - None of this work happens without our implementation, research and policy partners.

Gender (In)Equality as an Outcome in Food Systems
Gender inequality in food systems is a critical issue.

Women's greater vulnerabilities stem from structural barriers rooted in patriarchal norms, reflected in legal systems, including those governing land rights. Women are often marginalised in food systems, and for all of these structural reasons — not for any inherent reasons — they have lower adaptive and coping capabilities. We live in a world of poly crises, and with every crisis, women are more vulnerable — even as they hold the tools to respond.

For instance, research shows that heat stress and other climate extremes have greater impacts on women's labour in food systems compared to men. For example, labour force data from 30 African countries shows that heatwaves and drought reduce labour intensity, and women's labour contributions can increase relative to demands. Women in fragile contexts are particularly vulnerable to shocks and stressors, and these impacts also affect the children they bear.

Research also shows the effects of rising food prices and increased conflict on malnutrition, disproportionately affecting women and children.

So, how do we address these challenges? First, we must take a full food systems view, not just focus on agriculture. There are excellent frameworks to guide us, such as the High Level Panel of Experts (HLPE) food systems framework, which has proven durable and adaptable.

The Gender and Food Systems Framework
With colleagues like Jemima Njuki, we have applied a gender lens to the food systems framework. For every level in the framework, we must consider how women are affected and how they can contribute, then act accordingly. I highly recommend using such conceptual frameworks to anchor our work and thinking.

In addition to using robust conceptual frameworks, at IFPRI, we also approach research-to-policy in four connected dimensions that cut across the policy cycle and enable us to gather insights that help to set agendas, identify solutions, create enabling environments and support capacity sharing:

1. **Clarifying the situation and outlook:** Are we doing enough to help people grasp the problem and its outlook and help set the development agenda? We cannot offer solutions to tackle major challenges without engaging people around why the problem itself matters.
2. **Testing, adapting and scaling solutions:** We constantly test, adopt, and scale solutions, identifying entry points for delivery. In this work, it is key that we keep our eyes on scalability, feasibility and cost effectiveness in addition to assessing the impact of solutions.
3. **Shaping enabling environments:** Since solutions cannot scale without an enabling policy environment, we examine political economy, governance, and financing issues that underpin the extent to which effective solutions can be deployed.
4. **Strengthening Research Methods and Capacity:** We invest in efforts to strengthen research methods and capacity across all dimensions.

Let me give you a brief tour of how these approaches that are part of IFPRI's strategic research-to-impact pathways play out in our work on gender equity and resilience, drawing from work with grassroots communities and governments around the world.

Clarifying the situation and outlook

Investments in research on understanding the state of play of gender inequalities in food systems is key to setting the agenda for gender transformation. Our work on metrics, measurement and capturing gender and other inequalities in large-scale datasets has helped us to understand the state of play.

Our work on the Women's Empowerment in Agriculture Index, or in analyses of large-scale analyses depicting the overlay of gender-agriculture and climate hotspots are key examples of this work.

Another example is some new work looking at how women's roles play out across the food system. It's one thing to have a food systems framework, and another to recognise that gender is important in the context of that. Now, we are increasingly at a point where we can begin to put data around this.

In South Asia, for example, using a simple five-minute task allocation tool, we showed that women are heavily involved in agriculture and food systems and yet still carry the largest burdens of domestic work. If we want full-scale food systems transformation, we must consider women's roles across the entire system and identify entry points for rebalancing gender dynamics.
In addition to imbalanced gender dynamics across the food system, we also hypothesise that there are likely implications for healthy diets in this. If women are time-stressed and are the primary household members who also carry domestic work burdens, we are likely to see an increasing reliance on unhealthy, convenient foods, which, in turn, presents a major challenge for healthy diets**.**

Testing, adapting, and scaling solutions

Now pivoting to some of our work on testing, adapting, and scaling solutions. Over the past decade and a half, much work has focused on engaging women in agriculture, measuring women's empowerment, and delivering more gender-friendly outcomes. We know from some of our experimental studies that empowered women are more likely to adopt climate-smart practices. New evidence from multidimensional interventions at the nexus of agriculture, gender, and nutrition—such as the ANGEL trial in Bangladesh—shows sustained impacts on food security, diets, nutrition, and gender dynamics, even four years post-program.

Our challenge is now to make these tested interventions more cost-effective and scalable.

Another crucial area is social protection and its intersection with gender. Adaptive social safety nets, especially when bundled with key activities and targeted to women in rural communities, can have a significant impact in supporting women during climate shocks. Increasingly, we are seeing that social protection, especially adaptive social safety nets, can be a core strategy for addressing climate shocks. This is a major research area for research ahead, and we need to

understand it better from both policy, financing and implementation perspectives.

Shaping enabling environments

Examining policy and legal barriers to women's empowerment in agriculture and food policy is vital. For example, policies and laws to strengthen women's land and resource rights are a well-documented area for continued effort, as is work with civil society and community efforts to realise those rights. Other policy areas that need attention are increasing women's access to information and financial services. Without access to technology, markets, extension services, climate information, and insurance products designed with a gender lens, women will be held back in food systems and society. Deliberate, intentional policy design is necessary to build evidence and achieve desired outcomes.

Much work on women, gender, policy, and law has focused on land and resource rights. Increasingly, we must also look at women's leadership and participation in system-level governance, not just land ownership. In this instance, the Women's Empowerment in Agriculture tool is now being adapted to bring a governance lens to different contexts.

We also bring a gender lens to long-term government collaborations, such as to our policy support program in Papua New Guinea, helping design updated national food security policies that ensure gender is central to reformulation.

Strengthening research methods and capacity

Capacity building to use measurement tools that gender has been a cornerstone of our work on gender and food systems. As noted above, explicit efforts to measure women's empowerment have helped to highlight problems and drive action, and a key part of this has been to build capabilities amongst a large partner network to deploy, analyse and use these metrics effectively. New efforts are underway to strengthen and scale measurement, including the new women's empowerment metric for national statistical systems.

Priorities for future research and policy action

In closing, as we look to the future, we must continue generating timely evidence on the state of women in the context of food systems transformation, and to sharply examine the implications for women's lives. We need to continue to build the evidence, not just on the benefits, but also on the cost-effectiveness of the diverse suite of interventions that are delivering success. Going beyond evidence of effectiveness, we also need to think about how to finance and scale effective interventions. Recognising the vital role of enabling environments, we also need to look at governance all the way across the food system, and also all the way from community and local levels, to policy and leadership in national systems, because women are not at the table.

The issue of how women are affected is often not asked in different rooms where policy decisions are taken. Ensuring that the data and evidence used to shape policy are gender-disaggregated and that advocates for gender are always included in decision-making spaces is indeed vital to progress.

In closing, we must continue to strengthen capacity and co-create tools that help us understand problems, identify solutions, and build enabling environments for a better world for women,

which in turn contributes to a better world for all.

Thank you very much, and I end with much gratitude to my colleagues at IFPRI, our partners, and our funders.

Dr Purnima Menon is Senior Director for Food and Nutrition Policy. She also serves as Acting Director for Transformation Strategies (as of January 2025). In this dual role, Dr Menon works closely with IFPRI's Director General and IFPRI's research unit directors to manage IFPRI's global research strategy.

Dr Menon has extensive research experience in evaluating large-scale programs in nutrition, health systems, agriculture, gender, technology, and food systems for better nutrition. She has published extensively in high-impact journals across disciplines and has co-authored and/or advised major global reports on nutrition and health. Her contributions to the field are reflected in over 200 peer-reviewed publications. Notably, she has played a pivotal role in agenda-setting academic collaborations, including the Lancet Series on Nutrition, Countdown to 2030, the Global Nutrition Report, and more.

Dr Menon collaborates widely across disciplines and invests deeply in research translation with policy communities. She has conceptualised and co-facilitated policy courses focused on nutrition, engaging a diverse audience of policymakers holding significant decision-making roles globally and within South Asia. She is a founding member of the Next Gen(d)eration Leadership Collective, an initiative to nurture effective leadership practices for a better-nourished world. In 2020, Dr Menon received the prestigious Nevin Scrimshaw Mid-Career Award in Global Nutrition from the American Society for Nutrition, in recognition of her contributions to the field.

Dr Menon previously served as a Senior Research Fellow in IFPRI's former Poverty, Health, and Nutrition Division and a Research Associate at Cornell University. She holds a PhD in International Nutrition from Cornell University and an MS in Nutrition from the University of Delhi. Her research and engagement efforts have extended across diverse regions, reflecting her commitment to shaping a sustainable and nutritious future. She speaks many languages and has lived both in India and the United States. She is currently based in India with her husband, Jitendra Balakrishnan, and their daughter.

SESSION 4: CASE STUDY 1

Cultivating Resilience: Feminisation as a Pathway to Climate Adaptation in Cambodia's Agriculture

Dr Sonia Akter
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Crawford School of Public Policy,
Australian National University

Abstract

Climate change is intensifying the frequency and severity of climatic hazards, disrupting agricultural systems and reshaping rural livelihoods worldwide. In climate-vulnerable countries like Cambodia, these disruptions are also transforming gender roles within agriculture. While the feminisation of agriculture—where women assume greater agricultural responsibilities as men transition to non-farm work—has been widely observed, less is known about whether this trend also extends to women's involvement in farm-level decision-making. This case study examines the relationship between climate change adaptation, climatic hazards, and the multidimensional feminisation of agriculture in Cambodia.

Using nationally representative, sex-disaggregated data from the Cambodia Agriculture Survey (2019–2021), covering over 40,000 households, we analyse shifts in women's roles as unpaid family labourers, hired workers, and decision-makers in agricultural production. Our findings show a significant increase in women's participation in all aspects of agriculture during the study period. Feminisation was more pronounced in female-headed households, those heavily dependent on agriculture for income, and those exposed to climatic shocks—especially droughts and floods. We find that crop and livelihood diversification, key household adaptation strategies, are strongly associated with increased female labour and decision-making roles.
By contrast, we find little evidence that male outmigration or non-climatic hazards (e.g., pests & diseases) are major drivers of feminisation in this context. These results highlight the need for gender-responsive agricultural and climate adaptation policies. In particular, agricultural extension programs should actively support women's access to climate-smart technologies, training, and resources—especially in areas most affected by climate change—so that women's growing role in agriculture translates into greater resilience rather than deepening the burdens of climate stress.

Introduction

Thank you for giving me the opportunity to share our work in Cambodia. Today, I want to speak about our case study on agricultural feminisation and climatic hazards, a project carried out with

the support of the ACIAR and with valuable contributions from my colleague, Ms Lynn Bui.

Cambodia is a lower-middle-income country that relies heavily on agriculture. About a quarter of GDP comes from agriculture, and over a third of the workforce is employed in the sector. Importantly, two-thirds of employed women in Cambodia work in agriculture. Farming is predominantly subsistence-based, with rice as the major crop, and the sector is highly vulnerable to climate change.

Cambodia ranks 12th on the Global Climate Risk Index, with floods, landslides, and droughts as the most pressing climatic hazards. This vulnerability, combined with shifting labour patterns, makes it a crucial case to examine.

Why Focus on Feminisation?

Across South and Southeast Asia, agriculture is becoming increasingly feminised. Men are often migrating for work, leaving women to assume more responsibilities in the fields. But key questions remain unanswered:

- Does feminisation mean women are gaining greater decision-making power in agriculture, or are they simply working more as unpaid or low-paid labour?
- How is climate change adaptation influencing women's roles in agriculture? Are women taking on more responsibilities or authority as part of household adaptation strategies?
- How do climatic hazards drive agricultural feminisation? Are women stepping into key agricultural roles due to extreme weather events?

These are the questions we set out to explore.

Methodology

To investigate, we used the Cambodia Agricultural Surveys of 2019, 2020, and 2021, collected by the Cambodian National Statistics Agency. These nationally representative datasets, covering about 40,000 households, are unique because they include sex-disaggregated data and specifically ask about decision-making roles in agriculture — a rarity in most national datasets.

This allowed us to examine both the extent of feminisation and its relationship with climate adaptation and climatic hazards.

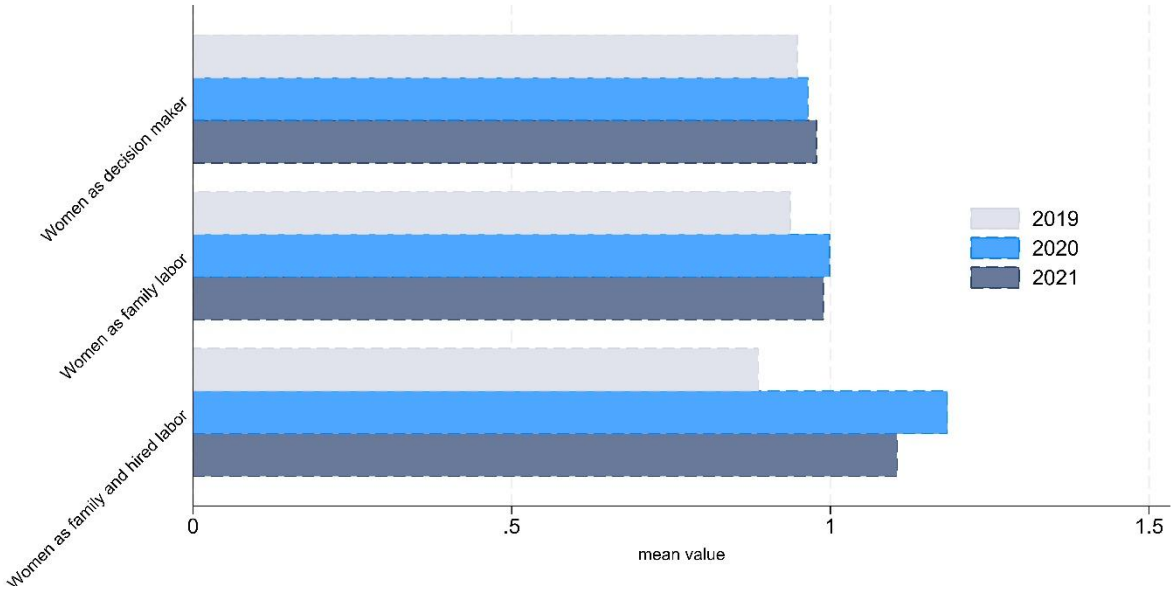
Findings: Trends in Feminisation

We measured feminisation in three ways:

1. Women's participation in decision-making relative to men.
2. Women's participation as unpaid family labour relative to men.
3. Women's participation as paid and unpaid agricultural workers.

Across all three measures, we found a clear increasing trend of feminisation over the three years (Figure 1). Decision-making power is inching closer to parity between men and women, unpaid family labour is rising, and the most rapid growth is in women's roles as both paid and unpaid agricultural workers.

Figure 1 Agricultural feminisation in Cambodia 2019–2021.



Notes: The figure presents mean values of agricultural feminization scores.
Source: Authors' calculation using Cambodia Inter-Censal Agriculture Survey 2019 and Cambodia Agriculture Survey 2020, 2021

Female-headed households showed significantly higher levels of feminisation, though the upward trends were similar across household types. Feminisation was also more pronounced in subsistence households compared to commercially oriented ones.

Drivers of Feminisation: Adaptation and Diversification

We then explored the relationship between feminisation and climate adaptation strategies. Diversification emerged as a central theme. Households growing more crops, producing a wider variety of food groups, or pursuing multiple livelihood strategies showed higher levels of feminisation.

One possible explanation for this is that diversification demands significant labour and flexibility. Women may be disproportionately involved in these roles because they often integrate agricultural tasks with household duties. Their frequent engagement in homestead-based activities—such as vegetable gardening, small livestock rearing, and food processing—could suggest a comparative advantage in this type of diversified work.

Climatic Hazards and Gender Roles

We also examined how climatic hazards such as droughts and floods influence feminisation. We found that households affected by climatic shocks experienced:

- Reduced reliance on agricultural income.
- Lower commercialisation of produce.
- Declining savings and increased borrowing.

At the same time, these households showed higher levels of feminisation in both labour and decision-making. Interestingly, households with greater feminisation were more food secure in the face of shocks, often because women drove diversification strategies.
From my experience in other contexts such as Bangladesh and Pakistan, I have seen how crises

reshape gender norms. After floods, women entered the labour market while men took on more domestic responsibilities — solidarity and role flexibility emerged as strategies to survive. A similar dynamic may be unfolding in Cambodia.

Key Insights

To summarise, our study shows:

- Cambodian agriculture is becoming increasingly feminised, with women taking larger roles in labour and decision-making.
- Diversification as a climate adaptation strategy is strongly associated with feminisation.
- Climatic hazards, while damaging to household welfare, are also accelerating women's roles in farming and decision-making.

Policy Recommendations

These findings highlight the urgent need for gender-responsive agricultural policies, especially in climate-vulnerable regions. Specifically, Cambodia should:

1. Ensure agricultural and climate policies explicitly recognise and support women's contributions.
2. Provide climate-smart extension services that reach and empower women.
3. Promote women's leadership in crop diversification and climate adaptation initiatives.

As climate change reshapes gender roles in agriculture, our policies must evolve too.

Conclusion

The shifting gender roles in Cambodian agriculture must be actively accounted for within national policies. To harness this transition effectively, targeted investment is needed to build the capacity of women—who are increasingly central to the sector—enabling them to adopt climate-resilient practices, access new technologies, and participate in profitable value chains. Integrating these gender-responsive strategies is not merely an issue of equity; it is a fundamental component of building a sustainable and climate-resilient agricultural future for all.

Thank you.

Dr Sonia Akter joined the Crawford School of Public Policy as Senior Lecturer in January 2023. Her research is situated on the nexus of agriculture, environment and development in the Asia-Pacific region. She has worked extensively on agriculture and food policy, natural disasters and women's empowerment in South and Southeast Asia.

Sonia has published single and co-authored articles in top journals in the field of environment and development studies and is a Senior Editor for the journal Food Security and Associate Editor for the Australian Journal of Agricultural and Resource Economics (AJARE).

Sonia graduated with a PhD in Environmental Management and Development from the Australian National University in 2010 and holds a MS degree in Economics from York University, Toronto, Canada. Prior to joining the Crawford School of Public Policy in 2023, she was Assistant Professor at the Lee Kuan Yew School of Public Policy at the National University of Singapore (2015-2022). She was Scientist at the International

Rice Research Institute (IRRI) (2014-2015) and Senior Researcher at Helmholtz Centre for Environmental Research-UFZ, Leipzig, Germany (2011-2013). She has served in numerous advisory roles and expert panels including the Australian Center for International Agricultural Research (ACIAR), the Asian Development Bank, the World Bank and the Ministry of Environment and Water Resources, Singapore where she contributed broad-ranging methodological and strategic insights around valuation of water resource, strengthening women's participation in agricultural programs and designing instruments for capturing the gender differentiated impact of natural disasters.

SESSION 4: CASE STUDY 2

Women's voices in fisheries governance for climate-resilient food systems in Timor-Leste

Mr Acacio Sarmento da Silva,
Senior Research Analyst,
WorldFish

Abstract

Timor-Leste is highly vulnerable to climate-related disasters, with a food system heavily reliant on imports, contributing to widespread malnutrition, particularly among women and children. Fisheries, managed appropriately, can provide a climate-resilient source of nutrients and income to the vulnerable households, as fish can still be harvested from the sea during natural disasters or food system disruptions and during COVID – 19 pandemics, ensuring food availability and stability in local contexts. However, the sector remains male-dominated, and women's critical roles, such as gleaning aquatic foods, processing and trading, are often overlooked in policy and governance.

We present a project aimed at fostering women's participation in fisheries governance by establishing co-management committees in coastal communities. These committees ensure women's representation and members are trained in climate-smart practices for coastal resource management. Through the committees, communities participate in trainings in fish processing and business literacy, strengthening resilient livelihoods with gender-sensitive technologies while promoting the nutritional value of aquatic foods, particularly for pregnant and lactating women and young children.

The project estimated the contribution of gleaning and fisheries to local diets by analysing the nutrient content of 32 aquatic species caught by both women and men fishers and quantifying their consumption. This research demonstrates that these resources are vital for year-round nutrition security and highlights the importance of gleaning in local food systems. Incorporating women's knowledge and practices into coastal management is essential to enhancing food security and the sustainability of marine resources.

By fostering the participation of women in co-management committees and valorising gleaning, we make a compelling case for including women's voices in fisheries governance to support climate resilience and enhance food systems' sustainability.

Introduction

I am a researcher working on the ground in Timor-Leste, focusing on women's voices in fishery governance and their role in building climate-resilient food systems. Today, I will share insights from our project research and the realities we observe in Timor-Leste, a country facing climate vulnerabilities similar to those experienced in the Pacific Islands.

Climate Vulnerabilities in Timor-Leste

Timor-Leste is frequently affected by climate-related natural disasters such as floods, droughts, and cyclones. The country's heavy reliance on food imports exacerbates its vulnerability, contributing significantly to food insecurity. For example, in 2021, a severe cyclone led to the loss of 27 lives, with many more reported missing, alongside widespread destruction of property and livelihoods. Malnutrition rates remain alarmingly high, especially among women and children.

Role of Women in Fisheries Governance

While fisheries activities are often dominated by men, women play a vital yet frequently overlooked role in small-scale fishing activities. Despite their significant contribution to nutrition security and community livelihoods throughout the year, women's involvement rarely receives recognition in leadership or policymaking forums. Fisheries represent a critical resource for climate resilience, but governance structures tend to exclude women's voices.

Challenges Faced by Women in Fisheries

Several challenges persist in fishery governance in Timor-Leste. One key issue is the lack of acknowledgment of women's contributions within formal fisheries management. Our research and publications, including a poster brief on the War Fish website, highlight the importance of small-scale fishery activities led by women in building food security and resilience to climate change.

Importance of Gender-Sensitive Strategies

To address these challenges, our project, Recognize Hiding Harvest in Climate Adaptation, emphasizes the value of formally recognizing women's roles in fisheries. Policymakers need to integrate gender-sensitive and inclusive strategies into fishery and climate resilience governance. Such an approach will strengthen food systems and improve community livelihoods by incorporating local knowledge and women's vital contributions.

In conclusion, women's active participation in fishery governance is crucial for enhancing climate resilience and achieving sustainable food security in Timor-Leste. Integrating local, gender-sensitive approaches into governance structures is essential to foster resilient communities that can effectively adapt to evolving climate challenges.

Additional information

- Link to the publication ongleaning in case people want to further explore findings about women's roles in gleaning in Timor -Leste through WorldFish project. https://www.worldfishcenter.org/publication/gleaning-fisheries-timor-leste
- Finding 32 aquatic nutritious fish types in Timor – Leste Fhttps://hdl.handle.net/20.500.12348/6199

Acacio Sarmento is a health professional, research analyst, nutrition sensitive agricultural trainer, agriculture and nutrition curriculum developer, senior researcher, program manager, advisor at National Alliance for tobacco control, health promotor, agriculture group and community facilitator and DMERL specialist.
Acacio Sarmento is a highly accomplished senior researcher and development practitioner in Timor-Leste, specializing in agriculture, nutrition, and rural economic development. With deep expertise in agriculture-sensitive nutrition and gender-inclusive programming, he brings extensive experience in research design, methodologies, data analysis, project implementation, and MEL (Monitoring, Evaluation, and Learning). Acacio has a strong background in capacity building, serving as an advisor to project teams and junior researchers, and as a trainer and facilitator for government staff. His work is grounded in community-level engagement, with a proven track record of advancing food security and nutrition outcomes through collaborative, evidence-based approaches.

SESSION 4: CASE STUDY 3

Aka'tika Uira (Realign the Wheel): An analysis of the climate adaptation methods adopted by farmers in Rarotonga, Cook Islands

Ms Selane Tairea
Research Officer
Te Puna Vai Marama – Cook Islands Centre for Research,
University of the South Pacific

Abstract

Climate change is already a critical issue for Pacific nations and threatens the ability of local farmers to produce crops. Despite this issue, farmers have been historically left out when it comes to research. Understanding Pacific farmers' experiences of climate change, the way they adapt in response, and the challenges they face in sustaining their production is essential.

This study analyses the adaptation methods used by farmers in Rarotonga, Cook Islands, using data from a survey conducted by PHOAFS Regional Research Agenda partners across multiple Pacific countries. A sample of 174 farmers were surveyed across August-September 2024. Descriptive and bivariate analyses were employed. Farmers reported experiencing inconsistent rainfall (49%), rising temperatures (50%) and increasing frequency and/or severity of droughts (49%). Overall, most farmers (87.9%) had made at least one adaptation method in response to changing weather patterns and were more likely to adapt in response to increasing drought conditions.

The major adaptation methods implemented by Rarotonga farmers were crop and soil management methods (52% of all adaptations), such as crop rotation, mulching, and composting. Contrary to other bits of research, there were no demographic factors influencing farmers' likelihood of adapting. The findings from this research illustrate that farming is holistic. And point to a practical focus on increasing support from the government through improving opportunities for education and access to resources.

Introduction

Kia Orana. My name is Selane Tairea, and I work as a research officer with the Te Puna Vai Marama Research Centre in Rarotonga, Cook Islands. I am humbled to share a glimpse into the resilience and innovation of our growers as they adapt to shifting climates and uncertain seasons.

In 2024, the Pacific Heads of Agriculture and Forestry Services identified two research priorities: first, to understand farmers' real experiences of adapting to changing climatic conditions, and second, to ensure that farmers' voices are centred in the research process. With colleagues across Tonga, Papua New Guinea, Fiji, Nauru, the Marshall Islands, and here in the Cook Islands, we developed the Farmers and Climate Change Survey to bring those voices forward.

Farmers' Experiences of Climate Change

Working with our Ministry of Agriculture, we surveyed 174 growers on the island of Rarotonga. We asked: *What changes in weather have you experienced over the past ten years?*
The clearest message was drought:

- 51% reported more frequent droughts compared to 10 years ago.
- 34% reported increasingly unpredictable drought patterns compared to 10 years ago.

Farmers told us their traditional indicators no longer match the seasons. It is harder to know what to grow and when.

Adaptation Strategies on the Ground

Despite these challenges, our farmers are adapting:

- **Soil and crop management**: mulching, composting, cover cropping, mixed cropping, and crop rotation.
- **Water management**: irrigation systems and new water tanks (which are far more common today than just a few years ago).
- **Pest and disease management**: combating problems like powdery mildew, slugs, and snails — though farmers noted frustration at the lack of timely information to identify and respond to new threats.
- **Organic farming**: many growers are shifting toward organic methods, though definitions vary. For some, organic means eliminating chemicals entirely; for others, it means focusing on soil health practices like composting and mulching.

Interestingly, only a minority of farmers (about 24%) changed their crop selection, preferring instead to adapt *how* they grow rather than *what* they grow.

Barriers to Adaptation

The biggest barriers our growers reported were:

1. Lack of government support.
2. Lack of resources and technical information.
3. Lack of funding — always the hardest "F-word" for farmers.

Without stronger institutional support, many adaptation efforts remain limited in scale and impact.

Building Solutions Together

After the survey, we shared the findings back to farmers and held a community workshop with growers, government, NGOs, and private sector actors. Together, we identified practical solutions:

- Installing mini weather stations.
- Increasing government plantation visits at times that suit growers.
- More workshops and training opportunities.
- Providing financial subsidies.

Already, we are seeing progress. The Ministry of Agriculture is adjusting planting schedules and running village workshops, while the Meteorology Office is seeking funding for weather stations that farmers themselves can use to collect and interpret data. This creates a win–win: farmers gain locally relevant data, and national services receive more accurate forecasts.

Why It Matters

Farmers are at the heart of food security. In the Pacific, where countries like the Cook Islands rely heavily on imports, their role is magnified tenfold. We need to grow more of our own food despite climate challenges. Farming is not just an economic activity — it is central to our daily lives, our resilience, and our identity as a people.

Conclusion

This work would not have been possible without the commitment of our local growers. They are already making real efforts to adapt to climate change, despite scarce resources and support.

Now it is up to us — researchers, policymakers, academics, and decision-makers — to stand alongside them. Climate change affects us all, and as we say: *Meitaki maata, ka taokotai tatou ka tae tatou*— if we all work together, we can overcome anything.

Selane Tairea is a Research Officer at Te Puna Vai Marama Cook Islands Centre for Research. She holds a background in psychology and statistics and specializes in community-based data collection, analysis, and reporting. Selane has a passion for blending research with purposeful community engagement. Her work includes national surveys, professional development, program design, and policy dialogue. Selane has worked closely with local farmers to document the on the ground impacts of climate change and is working in collaboration with agencies to develop solutions that reflect local realities. Her contributions to the Pacific regional research agenda is the focus on making research more grounded, inclusive, and useful for decision-making. Serving amongst a number of NGOs in the Cook Islands, she pushes for people to understand that "If you want to do research in the Cook Islands but you do not work with the community, you are not going to get far."

SESSION 4: CASE STUDY 4

Empowered or just a metric index? Women in Indonesia's dairy households

Ms Vyta Hanifah

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School of Economics and Public Policy, University of Adelaide, and
Researcher, National Research and Innovation Agency, Indonesia

Abstract

Approximately 99% of Indonesian dairy farmers reside on Java Island, where small-scale farms (typically managing fewer than four cows and selling through local cooperatives) dominate dairy production. Despite their size, these farms play a vital role in sustaining rural economies and social structures. Women in dairy households contribute significantly to the dairy labour force, including feeding, watering, milking, managing manure, maintaining animal health, processing, and selling dairy products for income.

Drawing on experiences from the Women's Discussion Group initiatives under the IndoDairy (ACIAR-funded) and 1000 Srikandi (ADB-funded) projects, this case study illustrates how gender-sensitive technologies (i.e. mastitis testing using detergent or 'surf' test) and gender-inclusive extension services (i.e. hands-on training for women) enhance household resilience and foster food system sustainability. Analysis using a modified version of IFPRI's Abbreviated Women's Empowerment in Agriculture Index (A-WEAI) reveals that women in these households are, on average, as empowered as men. The key drivers of this parity include shared responsibilities in farm management and asset ownership, control over income, and active participation in informal groups, though interestingly, not in dairy-related groups (e.g. cooperatives).

A deeper examination of the A-WEAI domains, however, reveals persistent challenges in access to credit. Additionally, women's participation in dairy cooperatives remains limited due to structural and cultural barriers, restricting involvement in decision-making and hindering access to key services and information. While high-level metrics (like A-WEAI) provide a useful tool to measure progress over time, this case study illustrates the need for nuance in the local context as we strive for climate-resilient and inclusive food systems.

Introduction

Good afternoon. My name is Vyta, and I am honoured to share my experience working with smallholders and women dairy farmers in Indonesia through ACIAR and ADB-funded projects, as well as findings from my thesis research on women's empowerment in agriculture.

The Indonesian dairy sector has enormous potential, but it faces challenges in productivity, self-sufficiency, and gender equity. Through my work, I have seen both the promise of innovation and the persistent barriers women farmers face.

The Indonesian Dairy Sector

Indonesia is one of the largest dairy producers in Southeast Asia, alongside Thailand and Vietnam (Priyanti & Soedjana, 2016). Four provinces, particularly East Java, dominate production (Figure 1). Yet almost all dairy farms are smallholder operations, typically with fewer than four cows per household (Akzar et al., 2023, 2024).

Farmers usually sell fresh milk to cooperatives (Resti et al., 2017; Wijers, 2019), but domestic production only meets about 20% of demand. The remaining 80% must be imported, showing just how much room there is to grow the sector (DLAH, 2024).

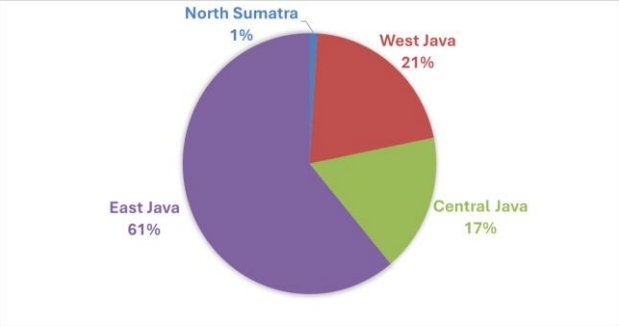

Figure 1. Four leading dairy producers in Indonesia (Statistics Indonesia, 2024)

Lessons from the Indo Dairy Projects

I was involved in two key projects: Indo Dairy Phase 1 (ACIAR funded) and 1000 Srikandi (ADB funded), which together worked with hundreds of farmers, including women farmers in West Java Province. These projects used participatory approaches to test new extension methods:

- **Discussion groups**: monthly farmer meetings, some mixed and one exclusively for women, regular visits and monitoring from the Project's field officer
- **Focus farms (adopted the same approach by Dairy Australia)**: demand-driven training and technology demonstration at the farmers' farm. More information about Focus Farms IndoDairy, please read Hanifah et al. (2025).
- **Gender-sensitive technologies**: such as simple tests for mastitis, record keeping for farm businesses, and milking hygiene practices.

Although the projects were not designed specifically for women, female participation was surprisingly high at around **30%** (Hetherington et al., 2023). The women's groups proved particularly effective in building confidence, skills, and peer networks.

We also partnered with a private dairy company and local dairy cooperatives to deliver hands-on training for more than 1,000 women farmers across six districts. Training covered best practices in nutrition, animal health, reproduction, milk quality, and financial literacy.

From these experiences, I learned that inclusive extension services deliver three key outcomes:

1. Greater access for women to resources and knowledge.
2. More equitable decision-making within households.
3. Stronger resilience and productivity at farm level.

Measuring Women's Empowerment

Beyond project implementation, I wanted to understand how women's empowerment could be measured more systematically. For my thesis, I applied the Abbreviated Women's Empowerment

in Agriculture Index (A-WEAI) to IndoDairy project data.
This index looks across five domains: production, resources, income, leadership, and time (Malapit et al., 2017). We surveyed 435 men and 435 women separately to ensure authentic responses. Surprisingly, the results suggested that women scored as empowered as men overall, with higher scores in income control, particularly income from milk marketing (Table 1).
Table 1. Empowerment score by domain using A-WEAI for women and men in dairy households, West Java, Indonesia, 2021

Note: A score above 0.80 means empowered, and below 0.80 means disempowered (Alkire et al., 2013)

However, deeper analysis showed that this was misleading. Women remained less empowered in production decisions (where husbands dominated) and in leadership (where women lacked cooperative membership and access to resources, services, and milk market). The index masked these nuances, reminding me that empowerment cannot be reduced to a single number (Bageant et al., 2024).

Reflections and Recommendations
From my research and fieldwork, I have three recommendations:

1. **Support care and community roles**: Provide childcare during training, flexible extension schedules, and stipends for women facilitators.
2. **Expand empowerment metrics**: Complement quantitative indices with qualitative insights that capture local realities.
3. **Measure time use effectively**: Develop simple, digital tools to document both paid and unpaid work, recognising women's full contribution to farming households.

Conclusion
Indonesia's dairy sector is full of potential, but its future depends not just on increasing milk yields, but on empowering the farmers — especially women — who produce it.
Through inclusive extension, gender-sensitive technologies, and better measurement of empowerment, we can build a more resilient and equitable dairy industry. My hope is that by recognising women's contributions and addressing the barriers they face, we will see dairy farming households that are more productive, more resilient, and more just.

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Vyta is a researcher at the National Research and Innovation Agency of Indonesia (BRIN Indonesia) with interests in agricultural economics, rural development, and livestock sector research. Currently, she is pursuing a PhD at the University of Adelaide, focusing on women's empowerment and agricultural extension in dairy farming. She holds an MSc in International Development (Economics & Rural Development) from the University of Manchester, UK, and a BSc in Animal Production Science from IPB University, Indonesia. Her experience includes working in the Project Management Unit (PMU) of the World Bank-funded SMARTD project (2016–2019), conducting research under the ACIAR-funded projects: Straw Cow project (2009-2012) & IndoDairy project (2017–2022), and supervising a team for the ADB-funded Dairy Women's Empowerment project (2021–2022). Vyta is passionate about improving smallholder livelihoods, gender inclusion, and sustainable agricultural development through research and policy innovation.

SESSION 4 Q&A

Chair: Mr Nigel Hart,
Director GRDC

Chair: I would like to invite our speakers up onto the stage, and invite questions from the floor.

Audience -Salma Indonesia:
I'm Salma from East Java, Indonesia, representing rural farmers and women farmers. My question is: How can we measure women's empowerment in line with climate-smart agriculture? In East Java, especially among sugar palm and soybean farmers, access to resources, research, and technology is limited. We really need stronger government intervention.

Ms Selane Tairea:
In the Cook Islands, women are commonly involved in agriculture, often working alongside men in plantations. However, the imbalance appears after harvest: women typically handle selling, accounting, and household responsibilities. To make things more equitable, unpaid domestic and administrative work must be redistributed, with men taking on more of these roles as well.

Audience - Grace, Indonesia/Melbourne:
We often hear about the feminisation of agriculture, where women are portrayed as vulnerable or as victims. *How can we design interventions that avoid this narrative?*

Dr Sonia Akter:
We don't see women as victims, but as agents of change. In our research, households experiencing climatic hazards and greater feminisation were actually more food secure. This strength can be better leveraged if women have access to resources, knowledge, and technology.

Ms Selane Tairea:
It depends on context. In our case studies, women's local knowledge has been critical. By creating spaces where women can lead, express priorities, and apply their expertise, we've seen resilience strengthened.

Ms Vyta Hanifah:
Before designing interventions, we consult leaders of women's farmer groups, then directly engage with women themselves. By facilitating discussions and understanding their needs, we can design interventions that truly empower rather than impose.

Audience member Wendy:
Across many contexts, men and women often have different perceptions of women's roles in agriculture. *What differences have you observed, and how can we raise awareness of women's contributions?*

Ms Vyta Hanifah:
Empowerment surveys often capture perceptions. But ethnographic and generational research is also needed. Women's roles must be seen in the context of their *whole lives*, including care work. Time-use surveys reveal important differences between genders, which can spark conversations about balance.

Dr Sonia Akter:

In my early work, many women undervalued their contributions, calling themselves “helpers” rather than farmers. There was even resentment from men when women were given more visibility. This is changing, but the mindset persists in some areas.

Ms Selane Tairea:

On paper, men are listed as household heads. But in practice, women often handle finances, run households, and even complete census forms. Awareness could be raised through better communication strategies, including media and user-focused design, to inspire rather than confront.

Dr Sonia Akter:

In Southeast Asia, women take on productive, reproductive, and social roles. Yet many women still see themselves as merely “helping” their husbands, not as farmers themselves. Changing this perception is vital.

Mr Acacio Sarmento da Silva:

Cultural barriers remain strong. For example, feeding children is seen solely as women’s work, with men discouraged from participating. Through participatory projects, we’ve learned to view men as part of the solution, not the problem, while also addressing hidden influences like elders reinforcing traditions.

Chair:

Thank you for those thoughtful contributions. This wraps up our Q&A session. A big thank you to our inspiring panel for sharing their insights on such an important topic.

SESSION 5: CONVERSATION ON RECOMMENDATIONS FOR POLICYMAKERS AND PRACTITIONERS

Chair: Professor Wendy Umberger
Chief Executive Officer ACIAR

Panel

Professor Glenn Denning, Professor of Professional Practice, Columbia University
Ms Caitlin McConnel, Australian Farmer & Lawyer
Dr Purnima Menon, Senior Director, Food and Nutrition Policy and Acting Senior Director, Transformation Strategies, IFPRI
Dr Aditi Mukherji, Principal Scientist – Climate Action in the Livestock, Climate and Environment Program of ILRI
Adjunct Associate Professor Seeseei Molimau-Samasoni, Bioeconomy Science Institute New Zealand

Chair:

Welcome back, everyone. We'll now move into our late afternoon Q&A and panel discussion. Thank you to our panellists for joining. Let's start with some reflections from today.

What were the big ideas or common themes you heard today?

Associate Professor Seeseei Molimau-Samasoni:

I wasn't originally on the program—I was asked to step in for our Pacific colleague. I've just transitioned from 17 years at the Scientific Research Organisation of Samoa to the International Development Unit at New Zealand's new Bioeconomy Science Institute. The Crawford Fund for Food Security keeps inviting me back, even though I tend to stir the

pot. My main lesson is this: disruption can be positive. Listening is critical—listening to farmers, to men and women, across the value chain. That message has come through strongly today.

Dr Aditi Mukherji:

Glenn's opening struck me: *universal food security is possible if we get our house in order.* Caitlin's remarks on the rule of law and legal instruments for climate action were also a major takeaway.

Associate Professor Seeseei Molimau-Samasoni:

Many climate challenges cut across regions, yet some are localised. In the Pacific, countries with the lowest emissions face the harshest impacts. This raises serious questions about fairness and adaptation versus mitigation.

Dr Purnima Menon:

I sensed urgency, but also concern. Climate change, food security, and gender equity often fall off political agendas. The challenge ahead is keeping these issues visible for policymakers—because if they're not on the agenda, solutions won't be financed.

Ms Caitlin McConnel:

From my perspective as both a farmer and legal advisor, we already have abundant research and adaptation strategies. What's missing is recognition of *why* we're here: the bigger picture of food security, law, and responsibility.

Professor Glenn Denning:

I'd highlight three themes:

1. Food security and complacency – still not fully understood domestically or internationally.
2. Partnerships – we all say they matter, but we need skills and mechanisms to make them real.
3. Career opportunities – the next generation sees how exciting and important this sector is.

Chair:

How do we balance food security with emissions reduction and sustainability?

Dr Aditi Mukherji:

We must act on both simultaneously. If today's solutions undermine food security in five years, we've failed. Bhutan's *Gross National Happiness* model shows how policy can integrate broader well-being into decision-making.

Dr Purnima Menon:

We avoid "tinkering at the edges." We must address corporate accountability in food systems—major players driving plastic waste, unhealthy products, and supply chain issues. The conversation can't only be about consumers and smallholders.

Ms Caitlin McConnel:

Agriculture will always have emissions. My cattle will always emit methane. The issue is proportionality and fairness. Litigation and the rule of law can drive accountability across the supply chain, just as food safety lawsuits transformed systems in the 1990s.

Associate Professor Seeseei Molimau-Samasoni:

Sometimes the simplest perspective matters: growing our own food. In the Pacific, we once

sustained ourselves with minimal externalities. Courageous leaders must revisit values and make tough, transparent decisions.

Professor Glenn Denning:

Universal food security should be our guiding light. Trade-offs happen at every level—global to local—but leadership is essential to ensure decisions respect both present and future generations.

Audience – Eric Huttner ACIAR:

How can we harness traditional knowledge as an enabler of transformation, not a barrier?

Dr Aditi Mukherji:

Traditional practices like water harvesting or fire management hold lessons. The challenge is adapting them to modern contexts, but they remain valuable starting points.

Ms Caitlin McConnel:

We must engage landholders and traditional custodians where they are, not pull them into boardrooms. My father's experience with dual-axis solar trackers showed how on-the-ground wisdom often outpaces engineers and models. Listening is vital.

Audience -Maximus, University of Sydney:

Agriculture isn't always seen as attractive. How can we make it "sexy" again, especially for young people?

Ms Caitlin McConnel:

Agriculture *is* sexy. I returned to farming despite being discouraged. Youth are increasingly choosing agriculture for its societal value, not just financial gain.

Dr Purnima Menon:

Consumers are passionate about food, and food connects directly to sustainability. Engaging youth around food systems—where food comes from, how it's produced—creates natural interest.

Associate Professor Seeseei Molimau-Samasoni:

In the Pacific, many parents discourage farming as unsustainable. We're working to reframe agriculture as an opportunity for youth, both on-farm and in science.

Dr Aditi Mukherji:

The nexus of education, health, and agriculture policies is key. Agriculture must be integrated into school curricula and seen as a modern, innovative career path.

Chair:

Today's discussion reinforced themes of leadership, listening, partnerships, and urgency. Agriculture is at the heart of food security, climate action, and sustainable development. Thank you to our panelists and audience for such a rich and thoughtful dialogue.

SUMMING UP AND THE WAY AHEAD

Shaun Coffey
CEO, Crawford Fund for Food Security

I was reflecting that perhaps it might help our cause if we all got locked in here tonight. My job was originally to sum up the conference, but after the last discussion, I think there are a couple of high-level messages that are coming through.

Firstly, Australia has a pivotal role in food security in the future. We have a particularly useful model with the ACIAR model, which means we are a trusted partner and have the opportunity to take leadership. The conference has underscored that achieving food security in the changing climate we live in is viable, but we must get our ambition right.

Partnerships need to be inclusive. We need more sustainable and diverse investments, and there is a need to integrate across technical policy and local and indigenous knowledge areas. From the viewpoint of the Crawford Fund for Food Security, we recognise that there is an imperative at present, particularly in this country, to change some of the things we are doing.

Over the last six or seven months, we have started repositioning. Today's conference is a key part of that. We must continue the work we have been doing in capacity development, the wonderful work around the development of early and mid-career partnerships. However, we recognise that we need to do more in keeping the issues on the agenda and lifting our role in advocacy.

This is about ensuring that we have informed public voices and informed political voices. We need to start lifting the awareness and understanding that our politicians and decision-makers have so that they are informed, committed, and open to change. This is the challenge that we will be adopting within the Crawford family now. Reflecting on the last four decades that the fund has been operating, being able to tell our stories and get the stories across has been pivotal.

At this stage, I would like to invite Cathy Reade to the stage, John Anderson, and our patrons, Neil, Andrew, and Helen. To be able to tell your story is particularly important. The conferences we have had are very much down to the work and effort done by Cathy. She leaves us now to take an important role as chair of the ICRISAT board.

Our patrons will make a presentation, and I remind members of the board and their coordinators that at our family dinner tonight, we will have a more personal presentation to Cathy.

Thank you so much to everyone who has come to visit.

Thank you, and I hope you all have a safe journey home. I look forward to seeing you here again next year.

Conference Registrants

Name		Organisation
Lynette	Abbott	Crawford Fund for Food Security WA
Rajendra	Adhikari	The University of Queensland
Somia	Afzal	RAID Network
Gusti Ngurah	Agung	DFAT Australia Awardee Indonesia
Ammara	Ainee	University of Sargodha
Sonia	Akter	RAID Network
Sk Rabiul	Alam	Western Sydney University
Abdallah	Aldahadha	National Agricultural Research Centre
Baber	Ali	Western Sydney University
Geof	Allan	Crawford Fund for Food Security NSW
Adanma	Amaefula	National Root Crops Research Institute, Nigeria
Kym	Anderson	Crawford Fund for Food Security Board
John	Anderson	Crawford Fund for Food Security Board
Neil	Andrew AO	Crawford Fund for Food Security Patron
Sileshi	Andualem	Bahir Dar University
Diogenes	Antille	CSIRO
Jayashree	Arcot	University of New South Wales
Mostafa	Ashraf	Alexandria University
Chloe	Aspros	University Of Melbourne
Nick	Austin	ACIAR
Ammar Abdul	Aziz	University of Queensland
Zainul	Azmi	DFAT Australia Awardee Indonesia
Allah Ditta	Babar	Independent Consultant
John	Bafui	Fresh Produce Development Agency
Craig	Baillie	GRDC
Dinusha Nuwan	Bandara Ekanayake	University Of Kelaniya
Shahil	Baral	Agriculture and Forestry University
Rutwik	Barmukh	Crawford Fund for Food Security Scholar
Kaye	Basford	Crawford Fund for Food Security Board
Jane	Bastin-Sikimeti	DFAT
Aditya	Baxi	RAID Network
Keira	Beattie	DAFF
Emi	Benic	Crawford Fund for Food Security Scholar
Alison	Bentley	Crawford Fund for Food Security ACT
Monique	Berkhout	Crawford Fund for Food Security Scholar
Bosibori	Bett	ACIAR
Christine	Beveridge	University of Queensland
Jyothi	Bhandari	Crawford Fund for Food Security Scholar
Surya	Bhattarai	CQUniversity
Ben	Biddulph	CSIRO
Denis	Blight	Crawford Fund for Food Security

Martin	Blumenthal	Crawford Fund for Food Security NSW
Scott	Boden	University of Adelaide
Jessica	Bogard	CSIRO
Jen	Bond	Charles Sturt University
Stephanie	Boyce	Crawford Fund for Food Security Scholar
Lucy	Broad	Crawford Fund for Food Security
Phil	Brown	CQUniversity
Jody	Bruce	CSIRO
Linh	Bui	ANU
Russell David	Bush	University of Sydney
Andrew	Campbell	Triple Helix Consulting
Harry	Campbell-Ross	DAFF
Jean-Bernard	Carrasco	DFAT
Emma	Carroll	DAFF
Lungelo	Cele	Trade and Investment KwaZulu-Natal
Colin	Chartres	Crawford Fund for Food Security
Malavanh	Chittavong	National University of Laos
Afroza	Chowdhury	University of Queensland
Ava	Christie	Crawford Fund for Food Security Scholar
Cameron	Clark	Gulbali Institute
Bob	Clements	Crawford Fund for Food Security
Onoriode	Coast	University of New England
Shaun	Coffey	Crawford Fund for Food Security CEO
Sam	Coggins	ANU
Jeff	Connor	University of South Australia
Brandon	Conway-Rusk	Crawford Fund for Food Security Scholar
Lucinda	Corrigan	Rennylea Pastoral Company P.L.
Rebecca	Cotton	Crawford Fund for Food Security
Wendy	Craik	Crawford Fund for Food Security Board
Lin	Crase	Crawford Fund for Food Security SA
Mikayla	Crouch	University of Queensland
Chris	Dale	DAFF
John	Dalton	Crawford Fund for Food Security NSW
Federico	Davila	University of Technology Sydney
Georgia	Davis	ACIAR
Max	De Antoni	DETSI
Livia	De Jesus	TOSKA
Rosemary	Deininger	Crawford Fund for Food Security Board
Glenn	Denning	Columbia University
Stephanie	Dickson	Bureau of Meteorology
John	Dixon	Crawford Fund for Food Security
Pierre	Dobunaba	D5 Investments
Fran	Doerflinger	Plant and Food Research Australia
Nerida	Donovan	Crawford Fund for Food Security NSW

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Nam Ha	Duong	University of Tasmania
Rodd	Dyer	Focusgroupgo Asia Pacific
Marcia	e Silva	TOSKA
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Rich	Eckard	CRC For Net Zero Agriculture
Andrew	Edwards	University of New England
Bethany	Ellis	Crawford Fund for Food Security Scholar
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Lindsay	Falvey	ACIAR
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Leandra	Fernandes	ACIAR
Loate	Filoa	Dignity Pasifik
Tony	Fischer	Crawford Fund for Food Security ACT
Joel	Fitzgibbon	Crawford Fund for Food Security Board
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Abebayehu	Geffersa	CSIRO
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Marcal	Gusmao	Universidade Nasional Timor Lorosa'e
Beris	Gwynne	Global Rethinking Finance Collaborative
Anca	Hanea	University of Melbourne
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Jenny	Hanks	Central Queensland University
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Thi Kim Phuong	Nguyen	Can Tho University
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Yen	Nguyen	Edsource Africa
Loan	Nguyen	Vietnamese Academy of Forest Sciences
Thuy Duong	Nguyen	University of Tasmania
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My	Pham	Vietnam National University of Agriculture
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Indira Wido	Primadipta	DFAT Australia Awardee Indonesia
Anggun Dwi	Puspitoasih	ANU
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Samurdhi	Ranasinghe	Cultivate Communications Australia PTY LTD
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Nicola	Roysmith	Crawford Fund for Food Security Scholar
Jonathan	Rushton	University of Edinburgh
Kim	Russell	Stump Jump Foundation
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Kamran	Soomro	Pakistan Agricultural Research Council
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Sokchea	Srey	Gret Cambodia
Naomi	Stafford	Stafford Lawyers
Sharon	Starick	Grains Research and Development Corporation
Uta	Stockmann	CSIRO
Greg	Stoodley	Greg Stoodley Photography
Ahmad	Suriadi	National Research and Innovation Agency of Indonesia
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Jason	Valusaga	ACIAR
Ingrid	Van Putten	ACIAR
Priscilla	Vega	Shekinah Farms Incorporated
Tyron	Venn	University of Queensland
Leigh	Vial	ACIAR
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Caitlin	Waddell	Conference Solutions
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Michael	Walker	Soil Science Australia
Mali	Walker	ACIAR
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Megan	Williams	RAID Network
Peter	Windsor	University of Sydney
Qoni	Wisudawan	DFAT Australia Awardee Indonesia
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Olivia	Woodiwiss	Falkland Islands Government
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Penny	Wurm	Charles Darwin University
Jinyan	Yang	CSIRO
John	Yaxley	ACIAR
Bereket	Yemer	Amhar Regional Agricultural Research Institute
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