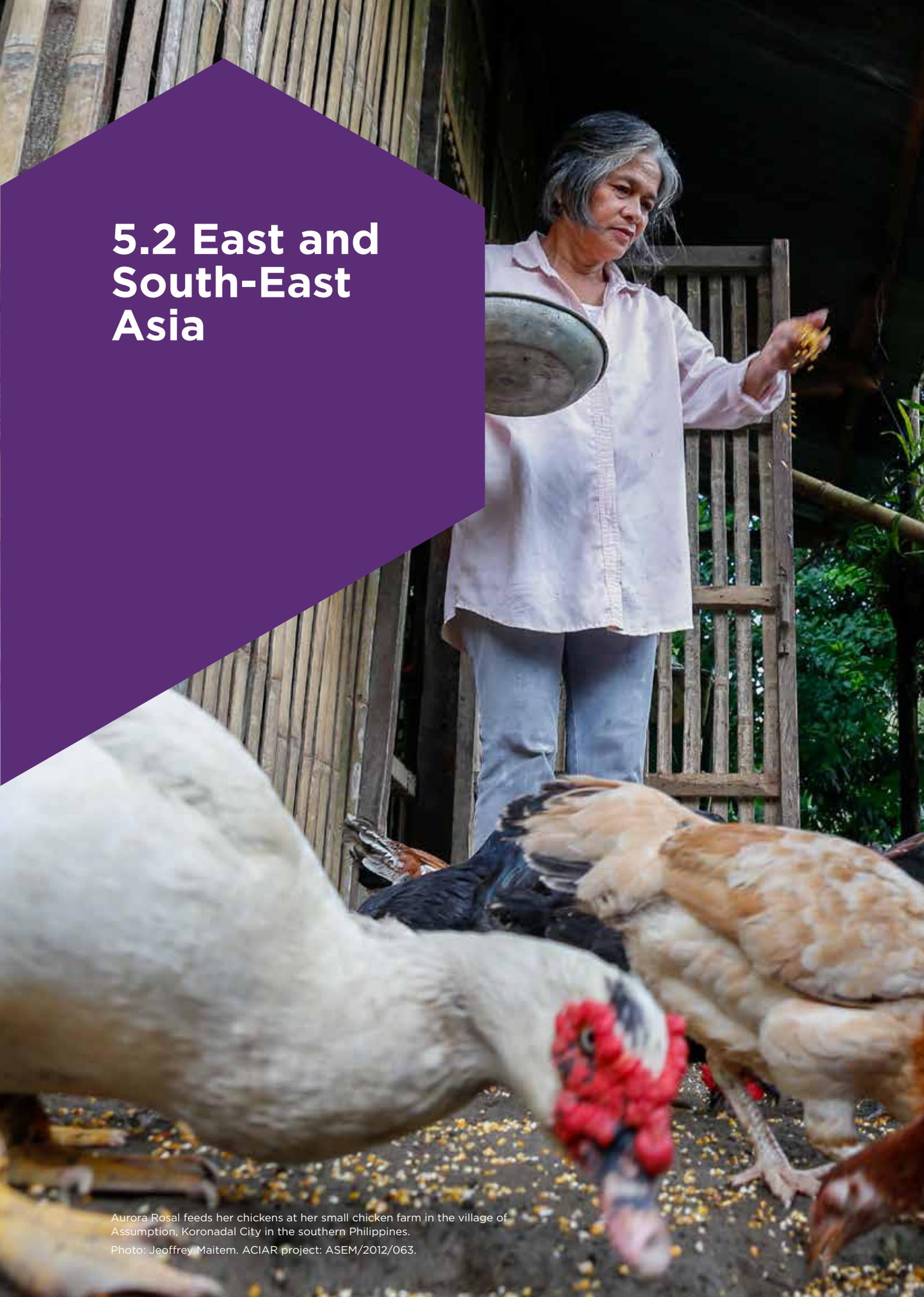


5.2 East and South-East Asia



Aurora Rosal feeds her chickens at her small chicken farm in the village of Assumption, Koronadal City in the southern Philippines.

Photo: Jeffrey Maitem. ACIAR project: ASEM/2012/063.

East and South-East Asia

Regional summary

The culturally and ethnically diverse region of East and South-East Asia is the most populous in the world and an economic powerhouse. Ten of the 11 states of South-East Asia are members of the Association of Southeast Asian Nations (ASEAN) and engage closely in terms of trade and investment with East Asian countries such as China and South Korea.

For the past decade, the region has shown a sustained decline in the incidence of poverty and income inequality, along with improvements in the Human Development Index for countries in the region. The ASEAN economy has consistently outperformed the global economy. Growth of the region's GDP has remained close to 5.0% since 2011, while global GDP stayed below 4.0% over the same period.

ASEAN remains the fifth largest economy in the world, with a combined GDP of A\$4.8 trillion in 2018. However, during 2019-20 the region experienced negative impacts from United States-China trade tensions. Based on the most recent Asian Development Bank data, ASEAN nations demonstrated less growth than anticipated (4.8%) leading in to 2020. Despite growing uncertainties in the global economy, ASEAN's total trade was A\$4.5 trillion in 2018 and the region attracted A\$250 billion of investment. Economic integration continues to contribute towards the region's emerging position as a global growth driver. In 2018, intra-ASEAN trade made up the largest share of ASEAN's total trade at 23.0%, and foreign direct investment inflows accounted for 15.9%.

Although agriculture only contributes around 10% of total ASEAN GDP, it is the main sector for employment in most member states, accounting for approximately one-third of total ASEAN employment. The development of the food, agriculture and forestry sector is vital to ensuring equitable and inclusive growth in the region.

Food security, food safety and better nutrition remain priority concerns for ASEAN and are included among the association's goals of agricultural cooperation. More recently, there is increasing support for women's economic empowerment, which has become a prominent approach to addressing gender gaps in economic spheres, including agriculture.

Investment in the agriculture sector is increasing in the region, growing from US\$0.4 billion in 2010 to US\$5.5 billion in 2018. South-East Asia is now the largest single focus of China's Belt and Road Initiative. Agriculture is also an important trade sector within some member states. For instance, Myanmar has the largest share of agricultural products in the country's total exports at 28.0% in 2018, followed by Indonesia (19.3%) and Laos (18.4%). The share of agricultural products in total imports in 2018 were highest in Myanmar (13.3%), followed by Laos (12.5%), Brunei Darussalam (12.3%) and the Philippines (11.6%).

Countries in the ACIAR East and South-East Asia region

- » Cambodia
- » China
- » Indonesia
- » Laos
- » Mongolia
- » Myanmar
- » Philippines
- » Thailand
- » Vietnam



Drivers of regional collaboration

ASEAN has more than 50 years of experience on regional collaboration to address shared challenges and engage with trade and development partners, including Australia and China. More recently, regional collaboration has been marked by critical factors such as geopolitics and transboundary concerns.

Even though trade and investment are the major drivers of economic growth, development assistance is still a critical factor for development and regional cooperation for ASEAN nations. Recently, official development assistance (ODA) to ASEAN countries has increased, with the most prominent of these being China's Belt and Road Initiative. This initiative aims to integrate ASEAN and other Asian economies with China by financing extensive interconnecting infrastructure in the region. The ASEAN countries are now the single largest regional focus of the Belt and Road initiative.

Cross-border challenges such as plant and animal biosecurity remain prominent and also drive regional integration. In the Mekong Region alone, plant diseases have recently spread across borders, destroying crops of cassava (cassava mosaic disease and cassava witches' broom) and banana (*Fusarium* wilt).

In the midst of these plant diseases, the ASEAN region has experienced African swine fever, which has destroyed large populations of pigs, caused serious production losses and taken a tremendous economic toll on countries like Vietnam, the Philippines, Laos and Cambodia. During 2020–21, biosecurity will be an increased priority for ASEAN nations.

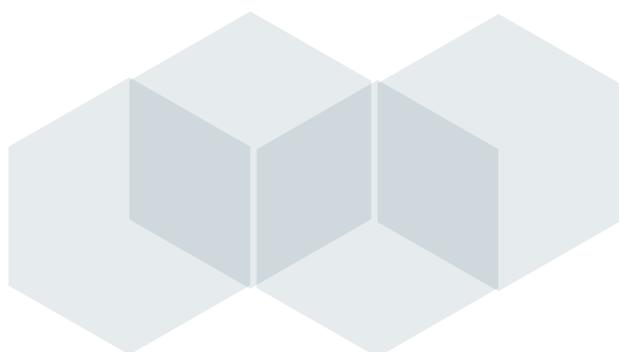
Shared concerns about imminent and increasing threats posed by climate change has resulted in ASEAN creating a 'framework of ASEAN community building, with strategies and actions to enhance regional and international cooperation in supporting adaptation'. In the field of agricultural research and development, regional cooperation plays a significant role, particularly in regard to increasing resilience and adaptation to climate change, natural disasters and other shocks.

The South-East Asia region is one of the most natural disaster-prone in the world, threatening food security and rural livelihoods. Natural disasters can cause economic consequences for the whole region, so disaster mitigation is a common interest among neighbouring countries. ASEAN leaders signed the ASEAN Declaration on One ASEAN One Response, which aims to increase the speed, scale and solidarity of disaster response in the region.

The rapid spread of COVID-19 in the region in 2020 has further driven the imperative for regional cooperation in health and trade. Australia's *Partnerships for Recovery: Australia's COVID-19 Development Response* notes:

South-East Asian countries face crises on multiple fronts. Mega-cities in the region are particularly vulnerable to the spread of the disease. The International Monetary Fund predicts growth in Asia will stall in 2020, resulting in a recession far worse than the 1997–98 Asian Financial Crisis. A region characterised by rapid growth before the pandemic, and where Australia has been building economic and strategic partnerships, is facing a significant setback. Unemployment is rising. Government revenues are falling precipitously just as demands for expenditure on health and social protection programs are rising steeply. The already fragile social contract could be tested in a number of countries, with risks of political upheaval that could threaten regional stability.

In response to the COVID-19 pandemic, ACIAR is supporting an [assessment of food system security, resilience and emerging risks in the Indo-Pacific in the context of COVID-19](#). This assessment is monitoring, documenting and analysing food systems vulnerabilities resulting from the COVID-19 crisis and their impacts on smallholder farmers. It will identify possible actions that could be taken by governments and other food systems stakeholders to increase food systems resilience in the face of future shocks. While the assessment includes the whole region, there is a particular focus on Indonesia and Philippines as case studies. This assessment may influence future ACIAR investments in the region.



ACIAR program in the region

The ACIAR program in East and South-East Asia remains the largest of the four regions in which ACIAR operates. It is characterised by strong bilateral collaboration based on robust national research systems, longstanding diplomatic connections and sustained development collaboration with Australia.

While the nature of ACIAR engagement within the region is strongly bilateral, there is a growing trend towards regional collaboration between countries facing shared challenges (as described in the previous section). This is consistent with the research partnerships under ASEAN, which acknowledge that collaboration among member states is a sensible path towards addressing common challenges in the region.

The ASEAN drive towards regional economic integration and connectivity will increase demand from individual countries and regional bodies for research support that harmonises approaches in some agricultural issues across countries, including biosecurity, food safety and climate resilience. ACIAR contributes to this by funding regional research collaboration and through its support and chairmanship of APAARI.

Among newer regional collaborations are efforts to identify efficient biosecurity risk-management systems in the region to respond to prominent outbreaks affecting plant and animal health. For example, Indonesia, the Philippines and Laos are all involved in regional research focusing on an integrated system to manage *Fusarium* wilt (Panama disease) in banana crops, with components of biosecurity and disease management. The uncontrolled transboundary exchanges of banana planting material (in vitro plants) led to a rapid spread of *Fusarium* Tropical Race 4, the strain affecting Cavendish bananas. The disease has made thousands of hectares of land unsuitable for Cavendish banana cultivation and negatively impacted rural livelihoods.

Another research collaboration focusing on plant biosecurity engages the whole of the Mekong Region (Cambodia, Laos, Myanmar, Thailand and Vietnam), and includes China. Cassava production in the Mekong Region is a commercial activity. The crop is cultivated to meet the rapidly growing regional and global demand for animal feed, starch-based products, ethanol and biofuel, and there is significant cross-border trade in planting and raw materials. Two serious diseases are spreading in the region through the movement of infected stems, with secondary infection via invertebrate vectors. The ACIAR project consists of a multipronged strategy involving breeding, surveillance, agronomy and seed systems interventions, coupled with engagement with government institutions and agribusiness.



Biosecurity is a significant cross-border challenge and drives regional collaboration. In the Mekong region, plant diseases such as cassava mosaic disease and cassava witches' broom have spread across borders, causing regional economical impact. An ACIAR-supported project in Cambodia, Laos, Myanmar and Vietnam works to establish sustainable solutions to cassava diseases. Photo: Majken Sogaard. ACIAR project: AGB/2018/172.

The incursion of African swine fever to the region in 2019 has also provided a strong context for regional collaboration in One Health. An ACIAR regional research collaboration that involves Cambodia, Vietnam and Laos seeks to understand how veterinary service markets might be better managed and governed by agents of government interested in human health, in cooperation with agents interested in agriculture and animal health. In Indonesia, a new project focuses on sustainable agricultural development by addressing the direct association between agricultural activities and zoonotic malaria transmission. This work also aligns with the ACIAR strategic objectives of enhancing human nutrition and reducing risks to human health.

Trilateral collaboration and new partnership models are emerging for ACIAR in the East and South-East Asia region. Driving these new partnership models are greater capacities that can be achieved when resources are pooled. This is translating into substantial co-investment from partners such as China, Vietnam and the Philippines. While bilateral relationships remain the predominant model for development cooperation in the region, trilateral collaboration has increased with each partner country bringing in funds, expertise and other resources into joint initiatives.

Opportunities for trilateral research collaboration with Australia in the region include varietal development to manage devastating new diseases in banana, cassava and citrus; machinery innovation for conservation agriculture among smallholder farmers; and research to develop perennial rice varieties. A serious biosecurity issue in the citrus industry (citrus greening disease) is being addressed through trilateral collaboration involving China, Indonesia and Australia. This collaboration is identifying management strategies to better protect the citrus industries in China and Indonesia, and helping the Australian citrus industry to be prepared in the event of an incursion.

During 2020–21, 100 ACIAR-supported projects will be active in the East and South-East Asia region (Table 5.2).

Research for One Health Systems Strengthening

One Health is an approach that recognises that the health of people, animals and the environment are interconnected. Approximately 75% of newly emerging infectious diseases are zoonoses (diseases that can transmit from animals to humans) that arise as a result of one or several factors that are anthropogenic, genetic, ecologic, socioeconomic and climatic in origin. Across the Indo-Pacific region, animal production systems are changing rapidly; however, local and regional capacity to diagnose, treat and control diseases is generally weak and under-resourced.

Projects in the Pacific region

- » A One Health approach to establish surveillance strategies for Japanese encephalitis and zoonotic arboviruses in Papua New Guinea (LS/2018/213)
- » Drug sensitive and resistant tuberculosis and zoonotic infections as causes of lymphadenitis in two provinces in Papua New Guinea (LS/2018/217)
- » Enhancing the management of antimicrobial resistance in Fiji (LS/2019/119)

Projects in South-East Asia

- » Zoonotic malaria in Indonesia (LS/2018/214)
- » Evaluating zoonotic malaria transmission and agricultural land use in Indonesia (LS/2019/116)
- » Collaboration on One Health economic research for systems in Cambodia (LS/2019/118)

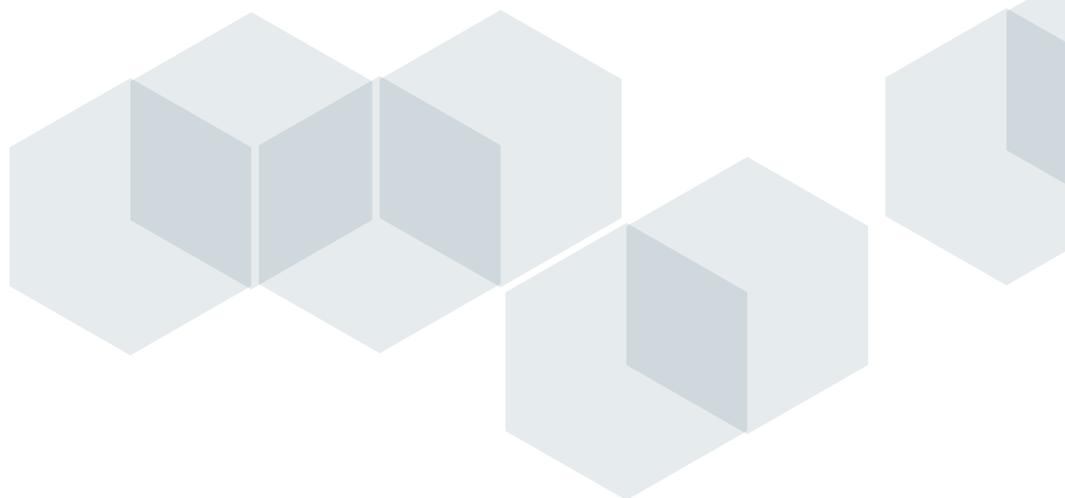


Table 5.2 Current and proposed projects in the East and South-East Asia region, 2020-21

Project title	Project code	Country
Agribusiness		
Policy and institutional reforms to improve horticultural markets in Pakistan	ADP/2014/043	China, Pakistan
Agricultural policy research to support natural resource management in Indonesia's upland landscapes	ADP/2015/043	Indonesia
Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan	ADP/2017/024	Bangladesh, China, Indonesia, Pakistan
Evaluating smallholder livelihoods and sustainability in Indonesian coffee and cocoa value chains	AGB/2010/099	Indonesia
Improving smallholder farmer incomes through strategic market development in mango supply chains in southern Vietnam	AGB/2012/061	Vietnam
Developing value-chain linkages to enhance the adoption of profitable and sustainable cassava production systems in Vietnam and Indonesia	AGB/2012/078	Indonesia, Vietnam
Improving milk supply, competitiveness and livelihoods in smallholder dairy chains in Indonesia	AGB/2012/099	Indonesia
Improving livelihoods in Myanmar and Vietnam through vegetable value chains	AGB/2014/035	Myanmar, Vietnam
Inclusive agriculture value chain financing	AGB/2016/163	Indonesia, Myanmar, Vietnam
Enhancing smallholder linkages to markets by optimising transport and logistics infrastructure	AGB/2017/036	Indonesia, Vietnam
Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines	AGB/2017/039	Philippines
Strengthening leadership, coordination and economic development of the temperate fruit industry in northern Vietnam	AGB/2018/171	Vietnam
Establishing sustainable solutions to cassava diseases in mainland South-East Asia	AGB/2018/172	Cambodia, Laos, Myanmar, Vietnam
Increasing the sustainability, productivity and economic value of coffee and black pepper farming systems and value chains in the Central Highlands region of Vietnam.	AGB/2018/175	Vietnam
Inclusive agribusiness-led development for high-value fruit and vegetable in the southern Philippines	AGB/2018/196	Philippines
Off-farm: strategic review and planning for enhancing the livelihoods of coffee and pepper smallholders in the Central Highlands of Vietnam through improving stakeholders' participation in agribusiness led value chains	AGB/2018/208	Vietnam
A theory of change for inclusive value chains in the Philippines	AGB/2019/100	Philippines
Planning and establishing a sustainable smallholder rice chain in the Mekong Delta	AGB/2019/153	Vietnam
Market and opportunity analysis to guide market-led development of the Myanmar pulse sector	AGB/2019/154	Myanmar
Research to support agricultural policy and strategic planning: research to assist the Vietnam Government with the formulation of the 2021-2030 Agricultural Development Strategy for Vietnam	AGB/2019/185	Vietnam
Philippines smallholder dairy: landscape analysis and research priorities	AGB/2020/120	Philippines
Agriculture for tourism – advancing a synergistic development pathway for both local agribusiness value chains and tourism in Bali, Indonesia	AGB/2020/121	Indonesia

Project title	Project code	Country
Crops		
Establishing the International Mungbean Improvement Network	CIM/2014/079	Bangladesh, India, Myanmar
Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan	CIM/2016/174	Bangladesh, Myanmar, Pakistan
Plant health—a major challenge to achieving sustainable “green” agriculture in Myanmar	CROP/2019/103	Myanmar
International Mungbean Improvement Network – phase 2	CROP/2019/144	Bangladesh, India, Indonesia, Kenya, Myanmar
Weed management techniques for mechanised and broadcast lowland crop production systems in Cambodia and Laos	CROP/2019/145	Cambodia, Laos
Characterisation of <i>Spodoptera frugiperda</i> (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC)	CROP/2020/144	Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia
Sustainable intensification and diversification in the lowland rice system in Northwest Cambodia	CSE/2015/044	Cambodia
Fisheries		
Quantifying biophysical and community impacts of improved fish passage in Laos and Myanmar	FIS/2014/041	Laos, Myanmar
Restoring damaged coral reefs using mass coral larval reseedling	FIS/2014/063	Philippines
Improving seaweed production and processing opportunities in Indonesia	FIS/2015/038	Indonesia
Improving fishery management in support of better governance of Myanmar’s inland and delta fisheries	FIS/2015/046	Myanmar
Harvest strategies for Indonesian tropical tuna fisheries to increase sustainable benefits	FIS/2016/116	Indonesia
Increasing technical skills supporting community-based sea cucumber production in Vietnam and the Philippines	FIS/2016/122	Philippines, Vietnam
Half-pearl industry development in Tonga and Vietnam	FIS/2016/126	Tonga, Vietnam
Accelerating the development of finfish mariculture in Cambodia through south-south research cooperation with Indonesia	FIS/2016/130	Cambodia, Indonesia
Development of rice–fish systems in the Ayeyarwady Delta, Myanmar	FIS/2016/135	Myanmar
Assessing upstream fish migration measures at Xayaburi Dam in Laos	FIS/2017/017	Laos
A nutrition-sensitive approach to coastal fisheries management and development in Timor-Leste and Nusa Tenggara Timur Province, Indonesia	FIS/2017/032	Indonesia, Timor-Leste
Evaluating processes and outcomes in south-south research collaboration—finfish mariculture development in Cambodia through cooperation with Indonesia	FIS/2018/115	Cambodia, Indonesia
Baseline monitoring and evaluation of long-term impacts on fish stocks from coral restoration	FIS/2018/128	Philippines
Translating fish passage research outcomes into policy and legislation across South-East Asia	FIS/2018/153	Cambodia, Indonesia, Laos, Myanmar
Regional networks for large-scale coral and fish habitat restoration in the Philippines	FIS/2019/123	Philippines
Forestry		
Enhancing community-based commercial forestry in Indonesia	FST/2015/040	Indonesia
Developing and promoting market-based agroforestry options and integrated landscape management for smallholder forestry in Indonesia (Kanoppi2)	FST/2016/141	Indonesia
Improving community fire management and peatland restoration in Indonesia	FST/2016/144	Indonesia
Advancing enhanced wood manufacturing industries in Laos and Australia	FST/2016/151	Laos

Project title	Project code	Country
Developing and promoting market-based agroforestry and forest rehabilitation options for Northwest Vietnam	FST/2016/152	Vietnam
Managing risk in South-East Asian forest biosecurity	FST/2018/179	Indonesia, Vietnam
Policy analysis for forest plantations in Laos and Vietnam	FST/2019/121	Laos, Vietnam
Scoping for a forest biosecurity network in South-East Asia	FST/2020/102	Cambodia, Laos, Vietnam
Supporting agroforestry through tree improvement and gene conservation in Laos	FST/2020/119	Laos
Building effective forest health and biosecurity networks in South-East Asia	FST/2020/123	Cambodia, Laos, Vietnam
Horticulture		
Supporting an international initiative to maintain the coconut genetic resources network (COGENT)	GP/2018/193	Regional
Development of area-wide management approaches for fruit flies in mango for Indonesia, Philippines, Australia and the Asia-Pacific region	HORT/2015/042	Indonesia, Philippines
Developing vegetable value chains to meet evolving market expectations in the Philippines	HORT/2016/188	Philippines
Integrated crop management for mango in Cambodia and the Philippines to meet market quality standards	HORT/2016/190	Cambodia, Philippines
An integrated management response to the spread of fusarium wilt of banana in South-East Asia	HORT/2018/192	Laos, Philippines
Preparedness and management of huánglóngbing (citrus greening disease) to safeguard the future of citrus industry in Australia, China and Indonesia	HORT/2019/164	Indonesia, China
Livestock Systems		
Strengthening incentives for improved grassland management in China and Mongolia	ADP/2012/107	China, Mongolia
Profitable feeding strategies for smallholder cattle in Indonesia	LPS/2013/021	Indonesia
Intensification of beef cattle production in upland cropping systems in Northwest Vietnam	LPS/2015/037	Vietnam
Investigating and developing interventions to mitigate food borne parasitic disease in production animals in Laos	LS/2014/055	Laos, Vietnam
Improving farmer livelihoods by developing market-oriented small ruminant production systems in Myanmar	LS/2014/056	Myanmar
Improving cattle production in the Myanmar Central Dry Zone through improved animal nutrition, health and management	LS/2016/132	Myanmar
Safe pork: market-based approaches to improving the safety of pork in Vietnam	LS/2016/143	Vietnam
Goat production systems and marketing in Laos and Vietnam	LS/2017/034	Laos, Vietnam
Smallholder livestock futures in South-East Asia	LS/2018/107	Indonesia
Forages—taking stock and identifying research needs	LS/2018/186	Cambodia, Laos, Vietnam
Zoonotic malaria in Indonesia (One Health)	LS/2018/214	Indonesia
Evaluating zoonotic malaria transmission and agricultural and forestry land use in Indonesia (One Health)	LS/2019/116	Indonesia
Collaboration on One Health economic research for systems (One Health)	LS/2019/118	Cambodia
Asian chicken genetic gains: a platform for testing, delivering, and improving chickens for enhanced livelihood outcomes in South-East Asia	LS/2019/142	Cambodia, Myanmar, Vietnam
Value-adding to existing livestock programs to understand and quantify the implications of greenhouse gas emissions, provide options for emissions reduction and inform in-country policy development	LS/2019/159	Cambodia, Indonesia, Kenya, Laos, Myanmar, Pakistan, South Africa, Tanzania, Timor-Leste, Vanuatu, Vietnam, Zambia

Project title	Project code	Country
Soil and Land Management		
Land management of diverse rubber-based systems in the southern Philippines	SLAM/2017/040	Philippines
Mainstreaming research in Myanmar's agricultural and veterinary universities	SLAM/2017/041	Myanmar
Synthesis of learnings on sustainable intensification of agriculture in Cambodia from ACIAR research investments to inform the future and support impact	SLAM/2018/127	Cambodia
Farmer options for crops under saline conditions in the Mekong River Delta, Vietnam	SLAM/2018/144	Vietnam
Crop health and nutrient management of shallot-chilli-rice cropping systems in coastal Indonesia	SLAM/2018/145	Indonesia
Soil-based challenges for cropping in Shan State (nutrient acquisition)	SLAM/2018/190	Myanmar
Assessing and monitoring peatland restoration in Indonesia	SLAM/2020/118	Indonesia
State of land and water assessment framework	SLAM/2020/138	Philippines
Management practices for profitable crop-livestock systems for Cambodia and Laos	SMCN/2012/075	Cambodia, Laos
Improving maize-based farming systems on sloping lands in Vietnam and Laos	SMCN/2014/049	Laos, Vietnam
Land suitability assessment and site-specific soil management for Cambodian uplands	SMCN/2016/237	Cambodia
Social Sciences		
Improving the methods and impacts of agricultural extension in conflict areas of Mindanao, Philippines	ASEM/2012/063	Philippines
Improving food security in the northern uplands of Laos: identifying drivers and overcoming barriers	ASEM/2012/073	Laos
Uptake of agricultural technologies amongst farmers in Battambang and Pailin provinces, Cambodia	ASEM/2013/003	Cambodia
Action ready climate knowledge to improve disaster risk management for smallholder farmers in the Philippines	ASEM/2014/051	Philippines
Developing cassava production and marketing systems to enhance smallholder livelihoods in Cambodia and Laos	ASEM/2014/053	Cambodia, Laos
Enhancing livelihoods through forest and landscape restoration	ASEM/2016/103	Philippines
Building institutions for the sustainable management of artesian groundwater in Myanmar	SSS/2018/135	Myanmar
Analysing gender transformative approaches to agricultural development with ethnic minority communities in Vietnam	SSS/2018/139	Vietnam
Next generation agricultural extension: social networks for practice change	SSS/2019/138	Cambodia
A framework for assessing agricultural extension approaches and an analysis of transferrable public health approaches	SSS/2019/186	Cambodia, Laos, Myanmar, Thailand, Vietnam
Policy impact in Laos: from research to practice	SSS/2020/142	Laos
Water		
Expanding opportunities to use groundwater for poverty alleviation and climate change adaptation in Laos	WAC/2018/167	Laos
Climate Change		
Emissions avoidance of soil carbon from lands undergoing practice change	WAC/2019/149	Indonesia
Supporting greenhouse gas mitigation for sustainable farming systems in the Asia-Pacific and East Africa	WAC/2019/150	Fiji, Indonesia, Kenya, Vietnam

Notes: More details (including project leader, commissioned organisation and partner organisations) are provided in the appendixes. The project list was compiled during July 2020. Additional projects, not listed in this table, may be commissioned during 2020-21.

Cambodia

 **A\$3.1** million
Budgeted funding

 **16**
Bilateral and regional
research projects

 **5**
Small projects and
activities

Cambodia has one of the fastest growing economies in the world, but unequal distribution of economic gains means many Cambodians still struggle to access quality, affordable essential services. While poverty continues to fall, the rate of decline has slowed significantly.

The United Nations estimates that 13.5% of Cambodians live below the national poverty line, down from 53% in 2004. However, many Cambodian households, especially in rural areas, remain highly vulnerable. About 4.5 million people (approximately 28% of the population) remain near the poverty line and are vulnerable to falling back into poverty if exposed to economic and other shocks. Australian aid will continue to deliver development programs to improve infrastructure, increase farmers' incomes and deliver better-quality health and education outcomes.

An overview of Australia's aid program in Cambodia is available on the DFAT website.

The Kingdom of Cambodia has more than 16 million people and accounts for 2% of the total population of the ASEAN region, placing it seventh (out of 10) among ASEAN member states. In 2018, Cambodia experienced accelerated growth of 7.5% but the economy is expected to register a return to its long-term potential of about 7% for 2019.

According to the World Bank, Cambodia was the fastest growing country in East Asia and was among the few countries that performed better than forecast in 2018. Exports are the mainstay of Cambodia's economy, buoyed by stronger external demand. Foreign direct investment inflows grew by 24.8%, reaching a record high of more than A\$4.8 billion, or 13.4% of GDP, in 2018.

Around 80% of Cambodia's population lives in rural areas and agriculture remains the main source of employment. Poor rural households, which include most of the country's female-headed households, generally have little land and livestock, and food insecurity is a day-to-day reality. Weather conditions were again unfavourable in 2019-20, and agricultural production was affected by midseason drought and floods in some parts of the country.

Rice production, which accounts for about half of agricultural GDP, increased by 3.5%, which is lower than the 5.7% growth rate in 2017. Government statistics indicate that Cambodia's paddy rice surplus reached 5.8 million tonnes (or 3.7 million tonnes milled rice equivalent). Cambodia exports its rice surplus mostly in the form of paddy rice, while milled rice exports accounted for 0.6 million tonnes (or 16.7% of total surplus). In 2019, China increased its import quota for Cambodia's rice to 400,000 tonnes, up from 300,000 tonnes in 2018.

Given its location in the neighbourhood of agricultural commodity giants (Thailand and Vietnam), Cambodia has been strategically working towards quality differentiation (rice, pepper) while advancing agroprocessing capability (cashews, starch). At the same time, Cambodia is establishing its credentials for sustainability (green) and improved food safety (clean).

Women in Cambodia still dominate the secondary farm labour sector. Programs targeting women primarily focus on increasing their access to resources such as natural assets, technology, skills training and credit-based loans but to date have had little impact in promoting women's influence in changing land use and adoption of new technologies.

In 2019, the Ministry of Agriculture, Forestry and Fisheries launched its new five-year strategic plan (2019–2023) to develop farming and encourage the agriculture sector to modernise, become more competitive and more resilient to climate change, and to improve labour-intensive traditional practices. The strategic plan urges the creation of agricultural cooperatives and encourages farmers to cooperate with the private sector under an agricultural public-private partnership involving contract farming to ensure sufficient supplies, available markets and stable prices.

According to its new plan, the ministry will be supporting and encouraging the private sector, small- and medium-sized enterprises and development partners to invest in the processing sector to ensure sustainable, local productivity, stable markets and value-added products while promoting quality, sanitation and safety standards that comply with the demands of domestic and international markets. Around 95% of small- and medium-sized enterprises in Cambodia work directly with agriculture-related products.

Country priorities

In November 2019, ACIAR and the Royal Government of Cambodia (represented by the Ministry of Agriculture, Forestry and Fisheries) signed a new 10-year agreement on the strategic priorities of its research collaboration. From 2019 to 2029, ACIAR and its Cambodian partners will focus research collaborations on three domains to support the development of Cambodian agriculture:

- » sustainable intensification and diversification of agriculture, focusing on non-rice crops in traditional crop-rice system and alternative cropping systems
- » sustainable intensification of market-oriented smallholder livestock production systems
- » sustainable intensification of freshwater aquaculture production systems for nutrition-rich species.

Research priorities over this time will also take into consideration cross-cutting themes that address challenges across the agriculture sector. These are:

- » gender equity, women's empowerment and nutrition—these are particularly important in the context of increasing labour migration that impacts women and children in rural Cambodia, and high rates of stunting and poor nutrition among women and children
- » climate variability mitigation and adaptation to climate change—taking into consideration climate variability and enabling climate-resilient farming systems
- » food safety and standards.

2020–21 research program

ACIAR supports 21 projects in Cambodia, six of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Cambodia. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

Cassava witches' broom disease and Sri Lanka cassava mosaic virus are spreading rapidly. A project led by Dr Jonathan Newby of the International Center for Tropical Agriculture is developing technically viable and economically and socially sustainable ways to improve the resilience of cassava production systems and value chains in Cambodia, Laos, Myanmar and Vietnam. During 2020–21, the project will test and evaluate methods to slow the diseases, such as virus-free planting material and resistant varieties, and strengthen capacity and regional networks to reduce new pest and disease incursions.¹

Crops

Sustainable intensification and diversification of rainfed lowland rice production systems in north-western Cambodia has the potential to increase farm income and business resilience. Associate Professor Daniel Tan of the University of Sydney leads a project that has evaluated innovative crop management practices and high-value crops. Machine planting of direct-seeded rice using high-quality seed at lower seed rates that potentially leads to better crop establishment and production. It will give growers confidence to purchase more expensive but high quality seed. During 2020–21, the project will investigate scale-up and scale-out models for adoption at village and community level. Capacity-building activities with farming communities and tertiary agricultural education institutions will ensure implementation of new technologies beyond the life of the project.²

New crop establishment practices for rice, such as broadcasting and direct seeding (manually or mechanically), offer significant labour savings for growers. However, changed field conditions compared with traditional crop establishment methods, such as transplanting, increase the risk of weed infestations. A project in Cambodia and Laos, led by Dr Jaquie Mitchell of the University of Queensland, aims to develop weed management packages to address labour constraints and reduce the reliance on chemical control. New weed control options will enable rice farmers to adopt and benefit from mechanisation and sustainable intensification and conservation agriculture practices. Appropriate weed management will also improve grain quality and enable growers to participate in high-value markets.³

A new species of armyworm, the fall armyworm (*Spodoptera frugiperda*), has caused serious damage to rice, sugarcane, sorghum, beet, tomato, potato and cotton crops throughout the Indo-Pacific region, and individuals have been recorded in northern Australia. The species poses a serious challenge to smallholder farmers in terms of sustainable management practices. A small research activity, led by Dr Wee Tek Tay of CSIRO and co-funded with the Australian Grains Research and Development Corporation, will investigate current successful management options for the pest and determine genetic differences between populations of the pest in South-East Asia and Australia—particularly to understand existing levels of insecticide resistance. The knowledge generated will be useful for future integrated pest-management approaches and the development of a draft resistance management plan.⁴

Fisheries

In Cambodia, about 80% of animal protein consumed originates from freshwater fisheries, which provides full-time and part-time work for about two million people. The development of finfish mariculture in Cambodia has been accelerated through a south-south cooperative research partnership with Indonesia in a project led by Professor Nicholas Paul and Dr Mike Rimmer of the University of the Sunshine Coast, and in partnership with Cambodian and Indonesian fisheries research organisations. Experienced researchers from Indonesia are training Cambodian researchers to gain skills in fish nutrition, hatchery production and fish health to support marine finfish aquaculture development in Cambodia.⁵

The south-south cooperative approach to capacity building in the previous project will be assessed for its potential application to other ACIAR projects. Professor Janelle Allison of the University of Tasmania is advising, facilitating and evaluating teaching approaches for achieving innovative and effective south-south collaboration, which could be applied to future agricultural research and development in the Indo-Pacific region and elsewhere.⁶

Across South-East Asia, as floodplains are developed for irrigation and river flows are regulated, river communities are at risk of losing fishing income and an important source of protein and essential nutrients. Previous ACIAR projects showed that fishways, which facilitate passage of migratory fish up and down regulated rivers, can have lasting economic and social benefits for river communities. Professor Lee Baumgartner of Charles Sturt University is leading a project to develop a platform for sound decision-making on fish passage construction programs across South-East Asia, a targeted capacity-building program to address institutional needs for the integration of fish passages into irrigation infrastructure and guidelines for the development of fish passage policy and legislation in Cambodia, Laos, Myanmar and Indonesia.⁷



Poultry enterprises are a way to improve the nutrition of poor households, while economically empowering women, who are the key custodians of poultry. Photo: Majken Søgaard. ACIAR project: LS/2019/142.

Forestry

A small research activity, headed by Dr Madaline Healey of the University of the Sunshine Coast, has gathered data from the ASEAN countries around priorities, capacities and perceived risk pathways in forest biosecurity. Biosecurity investment and biosecurity regulations within the region are being reviewed. These analyses will underpin initiation of a regional biosecurity network that will link the agriculture and forestry agencies of the national partners.⁸

Regional collaboration in South-East Asia is urgently needed to create a unified network capable of a coordinated response to forest pest and disease incursions. This new project, led by Professor Simon Lawson of the University of the Sunshine Coast, aims to foster such a network. The project will reduce the risk of forest pest and disease incursion and the impacts of established pests and diseases by developing enhanced techniques and capacities in pest risk analysis, surveillance and diagnostics and deploying these through the regional network. Research results will support evidence-based forest biosecurity policy for the region.⁹

Horticulture

Mango production in the Asia-Pacific region accounts for about two-thirds of global production. Much of the crop is produced by smallholders, who achieve relatively modest yields and participate in traditional value-chain arrangements that offer producers little incentive to innovate or pursue higher quality. Some producers seek better returns by supplying higher-value export markets (such as Korea), but they have struggled to deliver fruit that meets market or regulatory standards. A project in Cambodia and the Philippines, led by Dr Cameron McConchie of the Northern Territory Department of Primary Industry and Fisheries, aims to improve the ability of selected mango supply chains to deliver fruit that better meets consumer expectations of high quality and value, and provide smallholder growers with a better return on investment.¹⁰

Livestock Systems

A stocktake of the potential of forage production by smallholders in Cambodia, Laos and Vietnam is the focus of a small research activity that concludes in 2020. Dr Lava Yadav of the University of Queensland has analysed factors that contribute to, and constrain, forage production and development of related enterprises. The work will report on the constraints and opportunities for more effective uptake and use of forages and identify potential business models for more demand-driven development.¹¹

Several issues threaten regional, and potentially global, health security in the Mekong region: economic growth rates among the fastest in the world, marked climate and other environmental disruptions, and shifting human and animal geographies. Recent zoonotic disease outbreaks such as severe acute respiratory syndrome (SARS) and highly pathogenic avian influenza can be attributed to these converging issues. A major constraint to the development of the One Health agenda in the region is the capacity of veterinary systems. Professor Barbara McPake of the Nossal Institute for Global Health leads a project to understand the opportunities to improve collaboration between human and animal health sectors and use incentive-based regulation to intervene in veterinary markets in Cambodia to improve health security outcomes.¹²

Poultry enterprises are increasingly recognised as a way to improve the nutrition of poor households, while economically empowering women, who are the key custodians of smallholder poultry. However, low-producing chicken genotypes typically dominate smallholder or family production systems. Dr Tadelles Dessie of the International Livestock Research Institute will lead a new project that aims to test and make available high-producing, farmer-preferred genotypes of chickens to increase smallholder productivity as a pathway out of poverty in Cambodia, Myanmar and Vietnam. The project will also strengthen the capacity of young scientists in the project countries to conduct high-quality research on village poultry systems to benefit smallholder farmers in their countries.¹³

There is an urgent need to consolidate existing evidence and identify gaps in global research to demonstrate the scale of reductions in greenhouse gas emissions that occur with more efficient livestock production systems. Using the expertise and capabilities of Australian and New Zealand climate science, Dr Paul (Long) Chen of the University of Melbourne will lead a new project developing methods and models that apply to livestock development projects to quantify real and potential reductions in emissions and determine the opportunities and trade-offs between productivity gain and economic returns. The results will help determine if greenhouse gas offsets can be captured and linked with nationally determined contributions of partner countries, and if there is potential for voluntary carbon-credit trading to diversify smallholders' income.¹⁴

Social Sciences

A farmer's decision to adopt an agricultural technology or practice involves technical, local, financial, contextual and personal factors. Efforts to encourage adoption must therefore prioritise analysis of problems and solutions. A project led by Dr Brian Cook of the University of Melbourne has determined problem-solution pathways, which emphasise the everyday influences that ultimately determine adoption. The project is investigating the adoption of technologies and best practice for sustainable cassava production in north-western Cambodia, where the crop area is rapidly expanding and market returns are high. During 2020–21, the project will measure the adoption of agricultural technologies to explain why some groups adopt, and identify barriers specific to poor, marginalised and female-headed households.¹⁵

A project starting in 2021, also led by Dr Brian Cook of the University of Melbourne, will build on the findings from the previous project that extension does not overcome powerful social relations, especially credit and debt. This project will analyse the social relations that farmers actively avoid, wish to avoid, or prefer and wish to strengthen as part of self-determined efforts to improve their livelihoods. Ultimately, the project seeks to define pathways that support farmers to benefit from agricultural development.¹⁶

With the rapid growth of the cassava sector across South-East Asia, various arrangements emerged between industry and smallholder farmers, varying from large estates to smallholder-oriented models. There are considerable opportunities to increase the productivity, profitability and sustainability of the cassava industry. Dr Dominic Smith of the University of Queensland will complete a project in 2020 that has identified the socioeconomic conditions under which improved technology and market booms in commercial crops, such as cassava, can be harnessed to increase the profitability and sustainability of smallholder farming systems.¹⁷

Previous ACIAR work reported that turning research into practical innovation is increasingly challenging in an era of accelerating global resource demand and climate change, creating an imperative for transformational change across farms, landscapes, markets, institutions and populations. A small research activity will generate practical insights and actionable recommendations for ACIAR programs to better integrate agricultural practice change and community engagement. Dr Mary Johnson of RMIT University will lead a literature study from the Mekong region, comparing and contrasting public health promotion approaches and agricultural extension to find practical lessons and areas for cross-disciplinary learning and innovation. A diagnostic framework and supporting resources will be produced for use by ACIAR to assess project proposals to ensure that agricultural practice change and community engagement are at, or redefining, the cutting edge of agricultural extension.¹⁸

Soil and Land Management

Practices to increase the overall productivity of crop-livestock systems in rice-growing areas of Cambodia and Laos were investigated in a project led by Dr Matthew Denton of the University of Adelaide. The project will report on soil and water management practices to improve sustainability, productivity and profitability, and on social and economic impacts of adoption of forages. Farmers will be provided with practical information and technologies from the research, and local scientists and extension officers are being trained to conduct ongoing research and promote outcomes.¹⁹

Continued expansion of cultivation into unused or degraded land has been recognised as environmentally unsustainable by the Royal Government of Cambodia. Sustainable intensification, improved yields and diversification of cropping is a priority in areas where upland farming is being developed. A project led by Dr Wendy Vance of Murdoch University focuses on understanding indigenous soil knowledge and suitable land use to determine site-specific soil management. The project concludes in 2021 with the delivery of simple tools to help farmers identify soil types and constraints, and soil data to be added to the Cambodian Agronomic Soils Classification system and FAO World Reference Base for Soil Resources.²⁰

A small research activity will consolidate findings from ACIAR investments in sustainable intensification of agriculture in Cambodia at the program and cross-program level. Dr Davina Boyd of Murdoch University leads the project that will produce a synthesis of the major insights from ACIAR investment in sustainable intensification in Cambodia, and facilitate multidisciplinary cross-project research and capacity-building activities that build on, develop or combine project insights, tools and approaches relating to sustainable intensification of agriculture.²¹

Regional Manager, East and South-East Asia

Ms Dulce Carandang Simmanivong

Research Program Managers

Agribusiness: Mr Howard Hall

Crops: Dr Eric Huttner

Fisheries: Dr Ann Fleming

Forestry: Dr Nora Devoe

Horticulture: Ms Irene Kernot

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Soil and Land Management: Dr James Quilty

See page 209 for contact details



ACIAR supports research to enable farmers to grow profitable crops with less water. Cambodian rice farmer, Phoun Phall, discusses his experience of growing forages instead of rice on his land, with Lim Vandy from CARDI. Photo: Majken Søgaard. ACIAR project: SMCN/2012/075.

Current and proposed projects

1. Establishing sustainable solutions to cassava diseases in mainland South-East Asia [Cambodia, Laos, Myanmar, Vietnam] (AGB/2018/172)
2. Sustainable intensification and diversification in the lowland rice system in Northwest Cambodia (CSE/2015/044)
3. Weed management techniques for mechanised and broadcast lowland crop production systems in Cambodia and Laos (CROP/2019/145)
4. Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC) [Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia] (CROP/2020/144)
5. Accelerating the development of finfish mariculture in Cambodia through south-south research cooperation with Indonesia (FIS/2016/130)
6. Evaluating processes and outcomes in south-south research collaboration—finfish mariculture development in Cambodia through cooperation with Indonesia (FIS/2018/115)
7. Translating fish passage research outcomes into policy and legislation across South-East Asia [Cambodia, Indonesia, Laos, Myanmar] (FIS/2018/153)
8. Scoping for a forest biosecurity network in South-East Asia [Cambodia, Laos, Vietnam] (FST/2020/102)
9. Building effective forest health and biosecurity networks in South-East Asia [Cambodia, Laos, Vietnam] (FST/2020/123)
10. Integrated crop management for mango in Cambodia and the Philippines to meet market quality standards (HORT/2016/190)
11. Forages—taking stock and identifying research needs [Cambodia, Laos, Vietnam] (LS/2018/186)
12. Collaboration on One Health economic research for systems (One Health) [Cambodia] (LS/2019/118)
13. Asian chicken genetic gains: a platform for testing, delivering, and improving chickens for enhanced livelihood outcomes in South-East Asia [Cambodia, Myanmar, Vietnam] (LS/2019/142)
14. Value-adding to existing livestock programs to understand and quantify the implications of greenhouse gas emissions, provide options for emissions reduction and inform in-country policy development [Cambodia, Ethiopia, Indonesia, Laos, Myanmar, Pakistan, Tanzania, Timor-Leste, Vanuatu, Vietnam, Zambia] (LS/2019/159)
15. Uptake of agricultural technologies amongst farmers in Battambang and Pailin provinces, Cambodia (ASEM/2013/003)
16. Next generation agricultural extension: social networks for practice change [Cambodia] (SSS/2019/138)
17. Developing cassava production and marketing systems to enhance smallholder livelihoods in Cambodia and Laos (ASEM/2014/053)
18. A framework for assessing agricultural extension approaches and an analysis of transferrable public health approaches [Australia, Cambodia, Laos, Myanmar, Thailand, Vietnam] (SSS/2019/186)
19. Management practices for profitable crop-livestock systems for Cambodia and Laos (SMCN/2012/075)
20. Land suitability assessment and site-specific soil management for Cambodian uplands (SMCN/2016/237)
21. Synthesis of learnings on sustainable intensification of agriculture in Cambodia from ACIAR research investments to inform the future and support impact (SLAM/2018/127)



China

 **A\$0.2** million
Budgeted funding

 **4**
Bilateral and regional
research projects

The Australia–China bilateral relationship is based on strong economic and trade complementarities, a comprehensive program of high-level visits and wide-ranging cooperation. In 2014, the Australian Prime Minister and Chinese President agreed to describe the relationship as a ‘comprehensive strategic partnership’. Australia has largely phased out bilateral aid to China. In recognition of China’s growing role as an aid donor, Australia and China signed a memorandum of understanding on development cooperation in 2013, which was renewed in 2017. The memorandum of understanding facilitates cooperation in shared development objectives on issues of regional or global importance, such as the first project, which targeted the management of malaria in Papua New Guinea.

An overview of Australia’s relationship with China is available on the DFAT website.

In early 2020, China reaffirmed that the development of agriculture, rural areas and farmers’ issues remained at the very top of China’s domestic priorities for the seventeenth consecutive year.

This first policy statement for the year emphasised a focus on the dual tasks of fighting poverty and strengthening areas of weakness in relation to agriculture, rural areas and farmers. In particular, China will focus on improving infrastructure and public services in rural areas, ensuring supplies of key agricultural products, promoting an increase in farmers’ income and strengthening grassroots governance in rural areas. Even though the COVID-19 pandemic has impacted all sectors of the economy, the Chinese Government has reaffirmed its goal of eradicating absolute poverty by the end of 2020.

Soil degradation, excessive use of groundwater and soil contamination are among the major issues in the main grain-production regions, especially in north-eastern China. To address these problems, the Ministry of Agriculture and Rural Affairs and the Ministry of Finance jointly released the Black Soil Conservation Tillage Action Plan in north-eastern China 2020–2025 in March 2020. The plan announced that the total area adopting conservation tillage in north-eastern China will reach 140 million mu (93 million hectares) in north-eastern China by the end of 2025. According to the plan, the government will support the development of high-performance conservation agriculture machinery, while expert groups at the ministry and provincial levels will be established to provide technical guidance. ACIAR invested in two conservation tillage projects between 1992 and 2003, and with government support the technology now has been widely adopted in China.

In light of substantial achievements by China in the development of its society and economy, changes are in place to foster a relationship between ACIAR and China that is substantially or totally focused on trilateral collaboration.

Country priorities

In August 2019, ACIAR signed a memorandum of understanding with the Chinese Academy of Tropical Agricultural Sciences (CATAS). CATAS is China’s national institution for tropical agricultural research, which employs nearly 4,000 scientists across a range of fields and disciplines. The memorandum of understanding will see greater collaboration between ACIAR and CATAS in contributing to the United Nations’ Sustainable Development Goals through brokering trilateral partnerships across South-East Asia and the Pacific region.



A detailed study of horticultural markets in China is part of a broader project to design practical horticulture marketing policy reforms in Pakistan. Photo: ACIAR. ACIAR project: ADP/2014/043.

Fusarium wilt (Panama disease) has affected banana crops in many countries in the world and is a potential theme for trilateral collaboration between Australia, China and another partner country. CATAS, together with Guangdong Academy of Agricultural Sciences and the International Tropical Fruits Network, is planning to host an international workshop on *Fusarium* wilt in late 2020 or early 2021. At this time, ACIAR will take the opportunity to discuss potential cooperation on *Fusarium* wilt with CATAS and Guangdong Academy of Agricultural Sciences.

During 2020–21, ACIAR will continue developing opportunities for trilateral collaboration with other Chinese research organisations, including the Chinese Academy of Agricultural Sciences (CAAS). This includes joint work with Indonesia and the CAAS Citrus Research Institute on citrus greening disease, which will bring China’s expertise in the management of the disease to the Indonesian context. We are also developing opportunities for trilateral collaboration with Pakistan on citrus and forages.

ACIAR is also exploring opportunities to work with the CAAS Center of International Agricultural Research, which in 2019 hosted a number of events including an international workshop on women’s empowerment that attracted many participants from Asia. These events aligned well with the ACIAR gender equity policy and strategy, and we believe great impacts will be delivered if we can work together in this field. In 2020, ACIAR will seek to develop a collaborative arrangement with the CAAS Center of International Agricultural Research.

2020–21 research program

ACIAR supports four projects in China, all of which are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in China. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

The China–Pakistan Economic Corridor will provide Pakistan with preferential access to the world’s fastest growing horticulture market. Understanding this market and China’s experience in market reform is valuable for increasing growth, employment and productivity in Pakistan’s horticultural markets. A project led by Professor Jeffrey LaFrance of Monash University has undertaken a detailed study of horticultural markets in China as part of a broader project to design practical horticulture marketing policy reforms in Pakistan. This will help improve producer and consumer welfare, with attention to gender and poverty dimensions. The study finishes in 2020, and its outputs will support the development of commodity market models and provide an analysis of domestic and export market potential.¹

Success in rural transformation is not only measured by income growth of the rural population, but also by the degree of inclusiveness in society. A project in China, Bangladesh, Indonesia and Pakistan, led by Dr Chunlai Chen of the Australian National University, endeavours to understand the nature and drivers of rural transformation in order to provide better policy advice to underpin the success of transformation. In 2020–21, the project will select study regions and collect data to understand the components of success.²

Horticulture

Huánglóngbīng, or citrus greening disease, is a destructive bacterial disease of citrus. It is spread mainly by the Asian citrus psyllid and infected propagation material. All commercially cultivated citrus varieties are susceptible to the disease and currently there is no cure. Effective management is considered the largest challenge ever faced by citrus industries worldwide. A new project led by Dr Jianhua Mo of the NSW Department of Primary Industries will leverage international expertise to tackle the deficiencies in current huánglóngbīng management practices. A trilateral project with partners from Australia, Indonesia and China will be conducted to enhance the sustainable management of huánglóngbīng and the Asian citrus psyllid in Indonesia and China, and increase the preparedness of the Australian citrus industry for an incursion of both the disease and the vector.³

Livestock Systems

China and Mongolia have more than 520 million hectares of inter-connected grasslands that support the livelihoods of more than five million low-income pastoral households. The grasslands also support various ecosystem services, from improving air and water quality to providing a carbon sink. A project, led by Dr Colin Brown of the University of Queensland, seeks to address concerns over the condition of these grasslands and the livelihoods of herders in China and Mongolia. The project will conclude at the end of 2020. Having identified the incentives that will drive improved management of grassland grazing systems in previous years, the project will deliver a suite of incentive-based policies that are designed to improve grassland management practices and pastoral livestock systems, for the consideration of stakeholders.⁴

Country Manager, China

Mr Wang Guanglin

Research Program Managers

Agribusiness: Mr Howard Hall

Horticulture: Ms Irene Kernot

Livestock Systems: Dr Anna Okello

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Current and proposed projects

1. Policy and institutional reforms to improve horticultural markets in Pakistan [China, Pakistan] (ADP/2014/043)
2. Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan (ADP/2017/024)
3. Preparedness and management of huánglóngbīng (citrus greening disease) to safeguard the future of citrus industry in Australia, China and Indonesia (HORT/2019/164)
4. Strengthening incentives for improved grassland management in China and Mongolia (ADP/2015/107)



Indonesia

 **A\$6.5** million
Budgeted funding

 **24**
Bilateral and regional
research projects

 **7**
Small projects and
activities

While Indonesia has experienced steady economic growth in recent years and achieved substantial development progress, development across the country is uneven—poverty rates are seven times higher in Papua than in Java—and inequality remains a pressing challenge for the government. More than 72 million people in Indonesia continue to live under the World Bank poverty line of \$3.20 (PPP) per day. This context makes our work in Indonesia all the more important because sustainable and inclusive economic growth in Indonesia benefits Australia and contributes to regional growth and stability. Australia works in an economic partnership with Indonesia, supporting Indonesia's efforts to tackle inequality and maintain social stability, promote tolerance and pluralism, and counter violent extremism.

An overview of Australia's aid program in Indonesia is available on the DFAT website.

With a population of 270 million people, Indonesia is the world's fourth most populous nation, the world's tenth largest economy and a member of the G20. Indonesia has significantly reduced its level of poverty to 9.4% in 2019. By maintaining political stability, the country is now a middle-income country. Indonesia is on track to become the world's sixth largest economy by 2030.

Indonesia is in the final stage of a 20-year economic development plan (2005–25). The plan is segmented into five-year medium-term plans, called the Rencana Pembangunan Jangka Menengah Nasional, with different development priorities in each phase. The current plan—the last phase of the long-term plan—focuses on infrastructure development, human resource development, ease of investment, bureaucratic reform and better-targeted spending of the national budget toward health care and education.

Of particular focus for ACIAR is the strong encouragement from Indonesia to support deep functional capacity building for both individuals and institutions. The agriculture sector contributed approximately 13% to GDP in 2019 but it employs around one-third of the workforce and remains a vital source of income for rural households. Despite considerable challenges, Indonesia's large areas of arable land and extensive marine resources, combined with a thriving tech innovation ecosystem, offer significant potential for long-term, value-added expansion.

Indonesia's large and distributed agricultural research system, including the provincial Institutes for Assessment of Agricultural Technologies, is vital for the development of the agriculture sector and its contribution to the country's economy. The research system is complex. A new agency, Badan Riset dan Inovasi Nasional (National Research and Innovation Agency), has been established. It falls under the authority of the Ministry of Research and Technology and aims to amalgamate basic research activities previously conducted by several ministries. Consequently, the landscape of Indonesia's national agricultural research system will change substantially and the model for ACIAR partnerships in Indonesia will require significant calibration or wholesale adjustment in the near future, when the changes in the Indonesian national research system are fully established and the consequences for collaboration become clear.

Country priorities

Feeding a nation, especially in the context of the COVID-19 pandemic, has been reasserted as a critical priority for the Government of Indonesia. Under the second term of President Joko Widodo's administration (2019–24), agriculture has attained a higher strategic position, with line agencies tasked to achieve an advanced, modern and independent agricultural system. This has strong implications for ACIAR, as it is the first major reorientation of agricultural research priorities for a decade. Short- and medium-term priorities of the government include:

- » establishing the Kostra Tani (strategic command of agriculture development) through human resources development (vocational education and training) and the development of an Agriculture War Room—a single and integrated data system at district level
- » strengthening agricultural financing facilities, infrastructure and mechanisation
- » improving corporate-based food crop production
- » strengthening the competitiveness of horticultural zones
- » improving production, value-add and competitiveness of estate crops (especially export-oriented commodities such as cocoa, coffee, rubber, palm oil and tea)
- » improving population, productivity and genetic quality of livestock (including poultry)
- » improving seed systems innovation and technology
- » alleviating poverty through family farming, reducing stunting and food diversification
- » enhancing food distribution and price stability on staple crops (rice, maize, soybeans, as well as sugar and beef)
- » strengthening biosecurity and quarantine.

In addition to strengthening human resources across all sectors, the Government of Indonesia also has a vision to improve marine and fisheries infrastructure, including fishing ports. This involves strengthening fisheries aquaculture; developing integrated fisheries centres, cold chains and processing facilities; modernising fish markets; and rehabilitating coastal zones.

Cross-cutting priorities between agriculture and forestry sectors include:

- » reforming agrarian and community forestry
- » improving water quantity, quality and accessibility in relation to forest management, conservation and its ecosystems (including peatland restoration and waste management).

During 2020–21, there will be continued focus and participation on regional and trilateral collaboration. Regional research partnerships with the Philippines, Laos, Cambodia, Timor-Leste and Pakistan and trilateral collaboration with Australia and China provide opportunities to tackle shared challenges. These include developing policy and legislation for fish passages, rural regional transformation, an integrated management response to *Fusarium* wilt in bananas, and the control and prevention of citrus greening disease. There also is an emerging opportunity for trilateral collaboration with Pacific island countries in the aquaculture sector, as part of south-south cooperation.

Aligning with Australian and Indonesian priorities, ACIAR has facilitated a new research collaboration focusing on human health in Indonesia during 2020. It is a new partnership with leading research institutions, such as the Eijkman Institute of Molecular Biology, the University of Sumatera Utara and the University of Gajahmada, focusing on zoonotic malaria in Indonesia.

The COVID-19 pandemic is having a major impact on the food systems and economy of Indonesia. ACIAR is supporting [an assessment of food system security, resilience and emerging risks in the Indo-Pacific in the context of COVID-19](#), which will help identify areas of focus for our research collaboration with Indonesia to increase food systems resilience in the face of future shocks.

Securing the future of coconut

Grown in more than 90 tropical countries, on more than 12 million hectares, coconut is important to millions of smallholder households. The future of coconut production and livelihoods is threatened by senile plantings, which face further decline from pest and disease, climate change and poor conservation and management of genetic resources. Access to coconut genetic diversity is vital to sustaining the livelihoods of millions of smallholders and their communities around the world, particularly in the Asia-Pacific region.

During 2020–21, ACIAR, DFAT and the International Coconut Community will continue their collaboration to reinvigorate and sustain the Coconut Genetic Resources Network (COGENT). The program will focus on better coconut science, through a global coconut strategy to address the challenges outlined above. The program will work with other organisations to ensure a viable COGENT secretariat to safeguard coconut genetic resources and better address disease threats.

The network is active throughout the Asia-Pacific region and led by Dr Jelfina Alouw, Executive Director of the International Coconut Community, who is based in Jakarta, Indonesia.

ACIAR project GP/2018/193

2020–21 research program

ACIAR supports 31 projects in Indonesia, 16 of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Indonesia. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

Success in rural transformation is not only measured by income growth of the rural population, but also by the degree of inclusiveness in society. A project in China, Bangladesh, Indonesia and Pakistan, led by Dr Chunlai Chen of the Australian National University, endeavours to understand the nature and drivers of rural transformation in order to provide better policy advice to underpin the success of transformation. In 2020–21, the project will select study regions and collect data to understand the components of success.¹

In Indonesia, some 48 million people live in and around forest boundaries, and most rely on upland landscapes for their livelihoods and economic development. Existing policies and land allocation procedures accelerate agricultural expansion into forested catchments, which is reducing agricultural productivity and ecosystem services and leading to increased poverty and food insecurity. Based on analysis of existing policies and procedures, Professor Randy Stringer of the University of Adelaide is leading a project that will provide information and data for land use planning by local and national government, which enhances socioeconomic wellbeing and environmental outcomes.²

Coffee and cocoa are Indonesia's third and fourth most important sources of agricultural export earnings. Smallholder farmers are the main producers of these crops, with around two million households involved. While many value-chain approaches to development have been applied to the industry, there has been little research on the effectiveness of these approaches for improving rural livelihoods, achieving broader development goals and encouraging sustainability. A project led by Dr Jeff Neilson of the University of Sydney will report on the impacts of certification schemes, buyer linkages, geographical indicators and downstream processing on smallholder livelihoods and environmental sustainability.³

Cassava is an increasingly important crop throughout South-East Asia in terms of both rural livelihoods and regional economic development, and it remains an important food-security crop in specific subregions. The market outlook for cassava, and the prospects for smallholder producers, are strongly linked to supply and demand in global starch, grain and energy markets. A project in Indonesia and Vietnam, led by Dr Dominic Smith of the University of Queensland, aims to make smallholder cassava production more profitable and sustainable, by linking value-chain actors to increase the adoption of improved technologies. The project finishes in 2020 with the delivery of policy recommendations and the development of learning alliances.⁴

Domestic demand for milk in Indonesia significantly outstrips supply and growth of the domestic dairy sector. Until recently, most production occurred on Java; however, the Government of Indonesia has identified 12 additional provinces for dairy development. Dr Wendy Umberger of the University of Adelaide leads a four-year project that has conducted a comprehensive analysis of the dairy sector in west Java and north Sumatra. In its final year, the project will encourage development, policy dialogue and industry advocacy to improve the research capacity of lead agencies, and identify profitable management practices and extension models to enhance adoption of technologies and increase on-farm profitability.⁵



Smallholder farmers are the main producers of coffee and cocoa in Indonesia. An ACIAR-supported project is investigating the effectiveness of value-chain development to improve livelihoods. ACIAR project: AGB/2010/099.



ACIAR is supporting a project that is encouraging the development of the dairy sector in west Java and north Sumatra. Photo: University of Adelaide. ACIAR project: AGB/2012/099.

Smallholder farmers in South-East Asia often cannot access credit to invest in new crops or technologies, deal with risks and shocks, and safely carry wealth from harvest to planting. To help smallholders reach their production potential, a project led by Dr Alan de Brauw of the International Food Policy Research Institute will review and research financing models for agricultural value chains and evaluate specific interventions in Indonesia, Myanmar and Vietnam. Based on evaluation of agricultural value-chain financing models, the project will work with project partners to design and implement innovative and inclusive models.⁶

A small research activity, led by Dr Chris Chilcott of CSIRO Land and Water, evaluated opportunities to reduce logistics costs to small-scale farmers to contribute to more-informed policy on infrastructure that promotes development and access to markets in Indonesia and Vietnam. The project will further develop an adapted logistics model to better understand links, stakeholders and requirements to operate the model in the two countries.⁷

The rapid growth of tourism in Bali and consequent demand for large quantities of safe, high-quality food are not matched by capacity and capability of local agricultural production and agribusiness. This threatens the social and natural values of the island. Additionally, the unprecedented impact of COVID-19 on agriculture, tourism and the local economy demonstrates the urgent need for a measured and collaborative agribusiness growth plan. Mr Jeremy Badgery-Parker of Primary Principles will conduct a small research activity to prepare a strategic plan to guide engagement and investment in collaborative agribusiness value chains that support livelihoods and reliably and sustainably deliver safe, high-quality products to target markets.⁸

Crops

Mungbean is an ideal rotation crop for smallholder farmers. The International Mungbean Improvement Network, established through an ACIAR-supported project led by Dr Ramakrishnan Nair of the World Vegetable Center, helped realise the potential of mungbean to improve cropping system productivity and livelihoods by improving researchers' access to genetic material, and coordinating and providing technical support to variety development work in Bangladesh, India, Myanmar and Australia. Phase 2 of the network commences in July 2020, continuing variety development for another five years and extending the network to Kenya and Indonesia, providing access to new genetic material and improved cropping options for smallholder farmers in eastern Africa and South-East Asia.⁹

A new species of armyworm, the fall armyworm (*Spodoptera frugiperda*), has caused serious damage to rice, sugarcane, sorghum, beet, tomato, potato and cotton crops throughout the Indo-Pacific region, and individuals have been recorded in northern Australia. The species poses a serious challenge to smallholder farmers in terms of sustainable management practices. A small research activity, led by Dr Wee Tek Tay of CSIRO and co-funded with the Australian Grains Research and Development Corporation, will investigate current successful management options for the pest and determine genetic differences between populations of the pest in South-East Asia and Australia—particularly to understand existing levels of insecticide resistance. The knowledge generated will be useful for future integrated pest-management approaches and the development of a draft resistance management plan.¹⁰

Fisheries

Indonesia is the world's second largest producer of seaweed, and the industry is one of the few income-generating opportunities for coastal communities in eastern Indonesia. Employing a whole-of-value-chain approach, Associate Professor Nicholas Paul of the University of the Sunshine Coast leads a project that aims to provide a scientific basis to transform and modernise the seaweed industry. The project concludes in 2021 and will consolidate research to improve the quality of seaweeds produced at the farm level and identify opportunities to create innovative products from seaweeds and processing waste streams.¹¹

Indonesia is the world's largest producer of tuna. Its fishing fleet is large and diverse, spanning the eastern Indian Ocean and the western and central Pacific Ocean. A project led by Dr Campbell Davies of CSIRO Oceans and Atmosphere is working with Indonesian fisheries scientists, industry and managers to better understand tuna population biology and the effectiveness of monitoring and management systems. The project contributes to the longer-term goal of improving the economic and social benefits of Indonesian tuna fisheries, while reducing the conservation risks to regionally important fish stock.¹²

In Cambodia, about 80% of animal protein consumed originates from freshwater fisheries, which provides full-time and part-time work for about two million people. The development of finfish mariculture in Cambodia has been accelerated through a south-south cooperative research partnership with Indonesia in a project led by Professor Nicholas Paul and Dr Mike Rimmer of the University of the Sunshine Coast, and in partnership with Cambodian and Indonesian fisheries research organisations. Experienced researchers from Indonesia are training Cambodian researchers to gain skills in fish nutrition, hatchery production and fish health to support marine finfish aquaculture development in Cambodia.¹³

The south-south cooperative approach to capacity building in the previous project will be assessed for its potential application to other ACIAR projects. Professor Janelle Allison of the University of Tasmania is advising, facilitating and evaluating teaching approaches for achieving innovative and effective south-south collaboration, which could be applied to future agricultural research and development in the Indo-Pacific region and elsewhere.¹⁴

Globally, growing momentum for nutrition-sensitive agricultural policy and development assistance is yet to have any impact in the small-scale artisanal fishery sector. To address this, the role and contribution of fish to livelihoods and nutrition security must be supported by rigorous data and communicated at global, national and local scales. A project with a geographical focus of the eastern Lesser Sunda Islands, encompassing the independent nation of Timor-Leste and Nusa Tenggara Timur province of Indonesia, aims to identify the livelihood and nutrition benefits of fisheries and test nutrition-sensitive co-management systems for inshore fisheries. Led by Dr David Mills of the WorldFish Center, the project will evaluate the nutritional value of fisheries to households and identify the factors enabling or limiting the consumption of fish. It will highlight the potential of fish to reduce malnutrition, particularly during early childhood. Through a south-south collaboration, lessons learned for sustainable inshore management in Indonesia will be used to guide policy development in Timor-Leste that benefits poor households.¹⁵

Across South-East Asia, as floodplains are developed for irrigation and river flows are regulated, river communities are at risk of losing fishing income and an important source of protein and essential nutrients. Previous ACIAR projects showed that fishways, which facilitate passage of migratory fish up and down regulated rivers, can have lasting economic and social benefits for river communities. Professor Lee Baumgartner of Charles Sturt University is leading a project to develop a platform for sound decision-making on fish passage construction programs across South-East Asia, a targeted capacity-building program to address institutional needs for the integration of fish passages into irrigation infrastructure and guidelines for the development of fish passage policy and legislation in Cambodia, Laos, Myanmar and Indonesia.¹⁶

Forestry

Community-based plantation forestry enterprises have the potential to provide social, economic and environmental benefits for the people of Indonesia. Associate Professor Digby Race of the University of the Sunshine Coast leads a project in Gorontalo, Lampung, South Sulawesi, Yogyakarta and Central Java provinces that continues activities to increase the capacity of forest-farmer groups to make better investment decisions. The project is analysing the social and economic dimensions of two community-based commercial forestry systems to produce evidence to support implementation of these systems at national, provincial and local levels.¹⁷

Smallholder farmers in eastern Indonesia have long based their livelihoods on the production of timber and non-timber forest products. However, constraints ranging from silvicultural practices to lack of market access has limited productivity and profitability. Mr Aulia Perdana of the World Agroforestry Centre leads a project that aims to improve the production and marketing of timber and non-timber forest products and foster better extension and policy approaches. The project enters its final full year and will consolidate results and learnings to increase scientific understanding of smallholder agroforestry and identify policies and regulations that act as disincentives to smallholders. The project will also identify appropriate business models to develop and commercialise bamboo products.¹⁸

Smoke haze from indiscriminate burning of peatlands has become a major issue in South-East Asia in recent decades, negatively affecting public health and the economy of several countries in the region. A multidisciplinary program of research led by Dr Daniel Mendham of CSIRO Land and Water is underway to support Indonesia's commitment to achieve fire-wise villages and restore large areas of peatland. The project is conducting research to prevent fires in peatlands and improve peatland restoration practices, while enabling profitable and sustainable alternative livelihoods. It will also look at ways to improve access to, and use of, knowledge on fire prevention and peatland management.¹⁹

A new project in 2020-21, with activities in Indonesia and Vietnam, will underpin good plant biosecurity practices in forestry. With government and industry partners, the project led by Dr Caroline Mohammed of the University of Tasmania, will extend screening approaches from prior *Acacia/Ceratocystis* research to eucalypts that have replaced acacias in the wet tropics; develop remote-sensing software applications for cheap and rapid forest health surveillance; and, through geospatial modelling, deliver establishment (suitability and survival) risk maps under current and future climates at a regional level for the highest priority pests and pathogens.²⁰

Horticulture

About 40 species of tropical fruit flies damage horticultural crops and impede trade throughout South-East Asia. A project in Indonesia and the Philippines builds on the success of previous ACIAR projects, and links to fruit-fly work in other ACIAR partner countries and Australia. The project, led by Mr Stefano De Faveri of the Queensland Department of Agriculture and Fisheries, aims to reduce fruit-fly infestation of mango crops through area-wide management of the pest, and improve pre-harvest and post-harvest practices. The ultimate aim is to improve the yield and quality of crops in order to improve livelihoods and trade opportunities.²¹

Huánglóngbǐng, or citrus greening disease, is a destructive bacterial disease of citrus. It is spread mainly by the Asian citrus psyllid and infected propagation material. All commercially cultivated citrus varieties are susceptible to the disease and currently there is no cure. Effective management is considered the largest challenge ever faced by citrus industries worldwide. A new project led by Dr Jianhua Mo of the NSW Department of Primary Industries will leverage international expertise to tackle the deficiencies in current huánglóngbǐng management practices. A trilateral project with partners from Australia, Indonesia and China will be conducted to enhance the sustainable management of huánglóngbǐng and the Asian citrus psyllid in Indonesia and China, and increase the preparedness of the Australian citrus industry for an incursion of both the disease and the vector.²²



Livestock Systems

The Government of Indonesia has placed a high priority on self-sufficiency in beef production, but improvements in reproductive efficiency and growth rates of cattle are required to achieve this. Dr Karen Harper of the University of Queensland leads a project to develop simple, low-cost feed rations for cow-calf and cattle-fattening operations. This has the potential to increase the profitability of smallholder and small-scale feedlot systems in Indonesia. It is envisaged that supplementary feeds will complement local feed resources and be based on a small number of low-cost, locally available ingredients.²³

Dr Mario Herrero of CSIRO Agriculture and Food completes a small research activity in 2020 that reports on the likely competitiveness, resilience and adaptability of smallholder livestock production systems in the future. The study will identify development pathways and review findings, in consultation with key stakeholders, to understand how these production systems can remain an engine of agricultural and human development in the region.²⁴

Substantial gains have been made towards eliminating two major parasites (*Plasmodium* spp.) that cause malaria in humans in South-East Asia. At the same time, however, there are increasing cases of malaria in humans due to the transmission of a *Plasmodium* sp. parasite from macaques by certain species of mosquitoes. As part of the Research for One Health Systems Strengthening program (page 77), a small research activity, led by Professor Nicholas Anstey of the Menzies School of Health Research, will establish surveillance for zoonotic *Plasmodium* species of public health importance in Kalimantan and Sumatra, Indonesia.²⁵ This leads into a research project to evaluate zoonotic malaria transmission and agricultural land use in Indonesia.²⁶

There is an urgent need to consolidate existing evidence and identify gaps in global research to demonstrate the scale of reductions in greenhouse gas emissions that occur with more efficient livestock production systems. Using the expertise and capabilities of Australian and New Zealand climate science, Dr Paul (Long) Chen of the University of Melbourne will lead a new project developing methods and models that apply to livestock development projects to quantify real and potential reductions in emissions and determine the opportunities and trade-offs between productivity gain and economic returns. The results will help determine if greenhouse gas offsets can be captured and linked with nationally determined contributions of partner countries, and if there is potential for voluntary carbon-credit trading to diversify smallholders' income.²⁷

A trilateral project with partners from Australia, Indonesia and China will investigate sustainable management of huánglóngbǐng (citrus greening disease). Photo: ACIAR. ACIAR project: HORT/2019/164.

Soil and Land Management

Coastal and upland agricultural systems support the livelihoods of the majority of rural people in Indonesia. These systems vary in intensity, from predominantly low-value rice production to highly intensive mixed rotations that particularly include shallot and chilli. Shallot and chilli are Indonesia's most significant vegetable commodities and are integral components of Indonesia's unique cuisine. A new project, led by Dr Stephen Harper of the University of Queensland, addresses key issues and challenges associated with the safe and sustainable production and intensification of high-value vegetable cropping options (particularly shallot and chilli) in the sensitive coastal agroecosystems.²⁸

Peatland restoration efforts in Indonesia are progressing rapidly, but the success of these efforts is often low or undocumented. Two techniques trialled in previous ACIAR projects, eddy covariance flux towers and chameleon sensors, demonstrated strong potential as tools to empower government and communities to monitor the success of peatland restoration. These techniques monitor changes to peat moisture levels and carbon flux from the ecosystem and integrate this environmental data with local decision-making. This small research activity, led by Dr Samantha Grover of RMIT University, will collect a full 12-month cycle of data from each technique. Stakeholder engagement, which has already commenced, will be a major focus of this project.²⁹

Climate Change

ACIAR will add a new research program to its portfolio in September 2020 to focus and strengthen work towards our strategic objective that addresses climate variability and climate change.

Indonesia is home to 36% of the world's tropical peatlands, which can hold up to 20 times more carbon than most other types of mineral soil. However, from 2000 to 2015, around half a million hectares of forest were cleared each year for the cultivation of palm oil. A small research activity led by Professor Deli Chen of the University of Melbourne will analyse information from a range of sources to understand and document the factors affecting the loss of soil carbon from tropical peatlands and identify potential management options to prevent or reduce this loss. The project is a collaboration between Australia, New Zealand and Indonesia to develop recommendations for land managers.³⁰

Australia is a world leader in greenhouse gas mitigation research in agriculture. A new project provides the opportunity to transfer this knowledge to assist our partner countries to identify and quantify on-farm management options that reduce emissions from farming practices and help establish national greenhouse gas accounting systems to monitor, report and verify emissions reductions to the same high standard used by Australia. This project, led by Professor Peter Grace of Queensland University of Technology, and co-funded by New Zealand, will work with government and research institutions in Fiji, Vietnam, Indonesia and Kenya to develop expertise to enable those institutions to better support their national governments in meeting current and future nationally determined emissions reduction commitments (NDCs) under the Paris Agreement.³¹



Safe and sustainable production and intensification of high-value vegetable cropping options (particularly shallot and chilli) for sensitive coastal agroecosystems are being investigated. Photo: ACIAR. ACIAR project: SLAM/2018/145.

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Fisheries: Dr Ann Fleming

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Horticulture: Ms Irene Kernot

Livestock Systems: Dr Anna Okello

Soil and Land Management: Dr James Quilty

Climate Change: Dr Veronica Doerr

See page 209 for contact details

Current and proposed projects

1. Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan (ADP/2017/024)
2. Agricultural policy research to support natural resource management in Indonesia's upland landscapes (ADP/2015/043)
3. Evaluating smallholder livelihoods and sustainability in Indonesian coffee and cocoa value chains (AGB/2010/099)
4. Developing value-chain linkages to enhance the adoption of profitable and sustainable cassava production systems in Vietnam and Indonesia (AGB/2012/078)
5. Improving milk supply, competitiveness and livelihoods in smallholder dairy chains in Indonesia (AGB/2012/099)
6. Inclusive agriculture value chain financing [Indonesia, Myanmar, Vietnam] (AGB/2016/163)
7. Enhancing smallholder linkages to markets by optimising transport and logistics infrastructure [Indonesia, Vietnam] (AGB/2017/036)
8. Agriculture for tourism – advancing a synergistic development pathway for both local agribusiness value chains and tourism in Bali, Indonesia (AGB/2020/121)
9. International Mungbean Improvement Network – phase 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
10. Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC) [Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia] (CROP/2020/144)
11. Improving seaweed production and processing opportunities in Indonesia (FIS/2015/038)
12. Harvest strategies for Indonesian tropical tuna fisheries to increase sustainable benefits [Indonesia] (FIS/2016/116)
13. Accelerating the development of finfish mariculture in Cambodia through south-south research cooperation with Indonesia (FIS/2016/130)
14. Evaluating processes and outcomes in south-south research collaboration—finfish mariculture development in Cambodia through cooperation with Indonesia (FIS/2018/115)
15. A nutrition-sensitive approach to coastal fisheries management and development in Timor-Leste and Nusa Tenggara Timur Province, Indonesia (FIS/2017/032)
16. Translating fish passage research outcomes into policy and legislation across South-East Asia [Cambodia, Indonesia, Laos, Myanmar] (FIS/2018/153)
17. Enhancing community-based commercial forestry in Indonesia (FST/2015/040)
18. Developing and promoting market-based agroforestry options and integrated landscape management for smallholder forestry in Indonesia (Kanoppi2) (FST/2016/141)
19. Improving community fire management and peatland restoration in Indonesia (FST/2016/144)
20. Managing risk in South-East Asian forest biosecurity [Indonesia, Vietnam] (FST/2018/179)
21. Development of area-wide management approaches for fruit flies in mango for Indonesia, Philippines, Australia and the Asia-Pacific region (HORT/2015/042)
22. Preparedness and management of huánglóngbīng (citrus greening disease) to safeguard the future of citrus industry in Australia, China and Indonesia (HORT/2019/164)
23. Profitable feeding strategies for smallholder cattle in Indonesia (LPS/2013/021)
24. Smallholder livestock futures in South-East Asia [Indonesia] (LS/2018/107)
25. Zoonotic malaria in Indonesia (One Health) (LS/2018/214)
26. Evaluating zoonotic malaria transmission and agricultural and forestry land use in Indonesia (One Health) (LS/2019/116)
27. Value-adding to existing livestock programs to understand and quantify the implications of greenhouse gas emissions, provide options for emissions reduction and inform in-country policy development [Cambodia, Indonesia, Kenya, Laos, Myanmar, Pakistan, South Africa, Tanzania, Timor-Leste, Vanuatu, Vietnam, Zambia] (LS/2019/159)
28. Crop health and nutrient management of shallot-chilli-rice cropping systems in coastal Indonesia (SLAM/2018/145)
29. Assessing and monitoring peatland restoration in Indonesia (SLAM/2020/118)
30. Emissions avoidance of soil carbon from lands undergoing practice change [Indonesia] (WAC/2019/149)
31. Supporting greenhouse gas mitigation for sustainable farming systems in the Asia-Pacific and East Africa [Fiji, Indonesia, Kenya, Vietnam] (WAC/2019/150)

Laos

 **A\$3.4** million
Budgeted funding

 **16**
Bilateral and regional
research projects

 **7**
Small projects and
activities

Laos is a Least Developed Country, and one of the poorest countries in South-East Asia. Approximately 23% of its population lived under the national poverty line in 2012, and poverty is almost three times higher in rural areas than urban areas. Key development challenges include limited access to high-quality education services, skills shortages and constraints to the development of the private sector. Australia's official development assistance (ODA) to Laos aims to help the Government of Lao PDR lift its people out of poverty, and develop as a prosperous and stable neighbour that can contribute constructively to the region. This objective is consistent with the themes of the Australian Foreign Policy White Paper—contributing to global efforts to reduce poverty, alleviate suffering and promote sustainable development—and building our influence through education, including scholarships.

An overview of Australia's aid program in Laos is available on the DFAT website.

Laos is a small landlocked country, but it has had substantial economic growth of more than 6% each year since 2015. The growth is driven mainly by the construction sector (due to investments in large infrastructure projects) and a resilient services sector (wholesale and retail trade growth).

Other factors that contribute to the economic growth of Laos include increased power generation, growing opportunities in the non-resource sectors from closer regional integration, and reforms to improve the business environment.

While Laos has one of the fastest economic growth rates in ASEAN, its agriculture sector has grown at a rate of only 3% over the past two decades. This is despite the fact that Laos remains primarily an agricultural economy with around 70% of the population working in the agriculture sector. Subsistence farming is still the norm and traditional production methods do not produce enough to meet market demand. Many rural families struggle to meet their own household food requirements, making malnutrition a critical issue.

According to a report by the Japan International Cooperation Agency, inefficiencies in farm production mean the agriculture sector contributed only 17% to the country's GDP in 2018. While foreign direct investment to Laos increased from A\$538 million in 2010 to A\$2.7 billion in 2017, it mostly went to infrastructure (primarily electricity generation). Agriculture attracted A\$297 million of investment, around 10% of total foreign direct investment in 2017. Based on FAO and Asian Development Bank reports, climate change and the risk of natural disasters such as floods and drought has discouraged investors.

Apart from rice, which is half of the country's agricultural output, the main traded crops in Laos include livestock, rubber, maize, coffee, bananas and citrus fruits. Lao agriculture is characterised by a relatively narrow range of productive outputs that involve small, fragmented production volumes, extremely short and seasonal market chains, and a high cost of freight. The lack of downstream enterprises is also a major barrier to growth in the sector.

In 2019, the Ministry of Agriculture and Forestry outlined plans to ensure the country is on track to meet the goals of its agriculture development strategy. The five-year development plan aims to support growth in the agriculture and forestry sector of greater than 3%, which means it will contribute 19% to the national economy. Targets include a national yield of at least five million tonnes of paddy rice, production of meat and eggs to rise to greater than 400,000 tonnes, fish and aquatic animal production to rise to 300,000 tonnes a year, and export of meat products to rise to 15,000 tonnes as production and processing operations are modernised.

A major policy development in Laos came in the form of the newly amended Forestry Law. Laos has the highest percentage of forest to land area in South-East Asia (68%). The Lao Government is committed to protecting its forest cover while making the forestry sector able to support livelihoods of its people.

The National Green Growth Strategy 2030 is the basis for actions of the Ministry of Agriculture and Forestry to increase forest cover by up to 70%. It also frames policy priorities to focus on environmental friendliness, sustainability and socially inclusive growth. The plan stresses the need to use the natural resources of Laos more efficiently, while taking a development path that is more resilient to risks such as climate change and also protects people's health. To deliver on this policy commitment, the ministry is drafting the Strategic Framework for Green and Sustainable Agriculture in Lao PDR.

Also guiding the strategic priorities of the Ministry of Agriculture and Forestry is the Lao Government's National Nutrition Strategy (2015–2025), which aims at reducing chronic malnutrition (stunting) in children under five from the current rate of 33% to 25% by 2025.

Country priorities

In 2020–21, the ACIAR Country Program for Laos plans to develop new long-term strategic program priorities based on outcomes of dialogue with the Lao Government. In the meantime, current strategic priority outcomes that guide ACIAR investments in Laos are:

- » efficient and sustainable forestry industries, including non-timber products, with suitable climate-change resilience
- » innovative livestock systems that allow for intensification and land-use requirements, while raising animal health and biosecurity levels
- » increased fish habitat restoration and protection of fish migration routes
- » cost-effective and sustainable rice-based farming systems, through mechanisation, diversification and intensification, along with better crop quality, quarantine standards and value-adding for domestic and export markets
- » improved natural resource management that benefits livelihoods and food security by delivering land-use options to smallholders, with attention to both water and nutrient management within climate-change adaptation
- » improved institutional training and communication frameworks that enable smallholders to adopt and adapt new technologies, and increase the capacity development of researchers and educators.

2020–21 research program

ACIAR supports 23 projects in Laos, six of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Laos. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

Cassava witches' broom disease and Sri Lanka cassava mosaic virus are spreading rapidly in South-East Asia. A project led by Dr Jonathan Newby of the International Center for Tropical Agriculture is developing technically viable and economically and socially sustainable ways to improve the resilience of cassava production systems and value chains in Cambodia, Laos, Myanmar and Vietnam. During 2020–21, the project will test and evaluate methods to slow the spread of the diseases, such as virus-free planting material and resistant varieties, and strengthen capacity and regional networks to reduce new pest and disease incursions.¹





New weed control options will enable rice farmers to adopt and benefit from mechanisation, and sustainable intensification and conservation agriculture practices. Photo: Massimo Municchi. ACIAR project: CROP/2019/145.

Crops

New crop establishment practices for rice, such as broadcasting and direct seeding (manually or mechanically), offer significant labour savings for growers. However, changed field conditions compared with traditional crop establishment methods, such as transplanting, increase the risk of weed infestations. A project in Cambodia and Laos, led by Dr Jaquie Mitchell of the University of Queensland, aims to develop weed management packages to address labour constraints and reduce the reliance on chemical control. New weed control options will enable rice farmers to adopt and benefit from mechanisation, and sustainable intensification and conservation agriculture practices. Appropriate weed management will also improve grain quality and enable growers to participate in high-value markets.²

A new species of armyworm, the fall armyworm (*Spodoptera frugiperda*), has caused serious damage to rice, sugarcane, sorghum, beet, tomato, potato and cotton crops throughout the Indo-Pacific region, and individuals have been recorded in northern Australia. The species poses a serious challenge to smallholder farmers in terms of sustainable management practices. A small research activity, led by Dr Wee Tek Tay of CSIRO and co-funded with the Australian Grains Research and Development Corporation, will investigate current successful management options for the pest and determine genetic differences between populations of the pest in South-East Asia and Australia—particularly to understand existing levels of insecticide resistance. The knowledge generated will be useful for future integrated pest-management approaches and the development of a draft resistance management plan.³

Fisheries

Rice and fish are two essential components of nutritious diets in the Lower Mekong Basin, with fish from the Mekong River system providing the main source of animal protein. Thousands of low-level irrigation barriers have been installed in the Lower Mekong Basin to regulate water flow for rice cultivation and control flooding. These structures create barriers to fish attempting to migrate to and from floodplains, which are vital breeding and nursery habitats. Fish ladders for upstream fish passage, based on designs used in the Murray–Darling Basin in Australia, have been applied successfully in the Mekong system. To complement this work, Professor Lee Baumgartner of Charles Sturt University and teams are developing fish-friendly downstream regulators. These new designs improve fish survival as they allow fish to pass without injury.⁴

The Xayaburi Power Company, responsible for the design and construction of the Xayaburi hydroelectric dam across the Mekong River in Laos, built a complex fishway system designed to enable the upstream passage of migratory fish. It is anticipated that the design will allow over 100 species of fish to pass. The fish vary in size from a few centimetres to more than one metre. A project team led by Professor Lee Baumgartner of Charles Sturt University is working with the company to develop robust techniques to assess the performance and effectiveness of the Xayaburi Dam fish passage facilities, and provide a standard for other hydroelectric dams planned for the mainstem Mekong River.⁵

Across South-East Asia, as floodplains are developed for irrigation and river flows are regulated, river communities are at risk of losing fishing income and an important source of protein and essential nutrients. Previous ACIAR projects showed that fishways, which facilitate passage of migratory fish up and down regulated rivers, can have lasting economic and social benefits for river communities. Professor Lee Baumgartner of Charles Sturt University is leading a project to develop a platform for sound decision-making on fish passage construction programs across South-East Asia, a targeted capacity-building program to address institutional needs for the integration of fish passages into irrigation infrastructure and guidelines for the development of fish passage policy and legislation in Cambodia, Laos, Myanmar and Indonesia.⁶

Forestry

Lao wood manufacturing industries are yet to adopt contemporary processing technologies used in neighbouring countries. Research led by Dr Hilary Smith of the University of Melbourne continues to develop new processing capability and engineered wood products from small-diameter timbers. Analyses to identify and remove policy, governance and administrative constraints to value-chain efficiencies have been highly effective, supporting investment in new processing facilities. This research is benefiting wood manufacturing industries in Laos by increasing capacity and growing markets for timber from new plantations, and in Australia by increasing the use of underused plantation resources.⁷

Forest plantations in Laos and Vietnam are key to achieving the development aims of both countries through building human capacity, developing industry and sustaining the environment. A small research activity led by Professor Rod Keenan of the University of Melbourne extends the impact of previous project findings. The project will engage policymakers and stakeholders to contribute to the development of new laws, decrees and regulations for forest plantations, consider new policy options for forest plantations and share information on regional and national economic impacts of forest plantations.⁸

The Lao Government has set ambitious targets to restore forest cover in the country. Agroforestry will be fundamental to this process, allowing joint cultivation of trees and agricultural crops across the landscape, reducing logging pressure on residual natural forests and not adversely affecting food security. A small research activity led by Associate Professor Mark Dieters of the University of Queensland will build on achievements of previous ACIAR projects. The project will provide genetically improved planting materials of teak through clonal propagation and development of improved seed sources. Provenance stands will be established for Mai Tae Kha and Mai Du.⁹

A small research activity, headed by Dr Madaline Healey of the University of the Sunshine Coast, has gathered data from the ASEAN countries around priorities, capacities and perceived risk pathways in forest biosecurity. Biosecurity investment and biosecurity regulations within the region are being reviewed. These analyses will underpin initiation of a regional biosecurity network that will link the agriculture and forestry agencies of the national partners.¹⁰

Regional collaboration in South-East Asia is urgently needed to create a unified network to respond to forest pest and disease incursions. This new project, led by Professor Simon Lawson of the University of the Sunshine Coast, aims to foster such a network. The project will reduce the risk of forest pest and disease incursion and the impacts of established pests and diseases by developing enhanced techniques and capacities in pest risk analysis, surveillance and diagnostics and deploying these through the regional network. Research results will support evidence-based forest biosecurity policy for the region.¹¹

Horticulture

Fusarium wilt (Panama disease) has become widespread throughout South-East Asia. The disease is threatening smallholder banana production in countries including Indonesia, the Philippines and, more recently, Laos. A project led by Dr Anthony Pattison of the Queensland Department of Agriculture and Fisheries aims to develop an integrated management response to the spread of the disease. The research will investigate the effects on banana production of altering the banana microbiome to suppress disease and increase plant resistance to *Fusarium* wilt.¹²

Livestock Systems

Laos is a comparatively small producer of pork compared with Vietnam and China, but pork production has grown significantly in recent years, including a growing cross-border trade into Vietnam. Improved safety of animal source foods, including pork that is free from zoonotic parasites such as *Taenia solium*, is gaining greater attention in the region. A new project, led by Dr Amanda Ash of Murdoch University, aims to identify and recommend interventions to mitigate the risk of disease from food-borne parasites in pigs, adding value to cross-border pig trade between northern Laos and Vietnam.¹³

Goat production in Laos has more than doubled over the past 10 years, largely driven by high demand for goat meat from Vietnam. Expanded goat production using traditional extensive goat-raising methods has the potential to result in overgrazing of feed resources, negative consequences for the environment and higher incidence of diseases and parasites in livestock. A project led by Dr Stephen Walkden-Brown of the University of New England is developing new practices that are sustainable and productive.¹⁴

A stocktake of the potential of forage production by smallholders in Cambodia, Laos and Vietnam is the focus of a small research activity that concludes in 2020. Dr Lava Yadav of the University of Queensland has analysed factors that contribute to, and constrain, forage production and development of related enterprises. The work will report on the constraints and opportunities for more effective uptake and use of forages and identify potential business models for more demand-driven development.¹⁵

There is an urgent need to consolidate existing evidence and identify gaps in global research to demonstrate the scale of reductions in greenhouse gas emissions that occur with more efficient livestock production systems. Using the expertise and capabilities of Australian and New Zealand climate science, Dr Paul (Long) Chen of the University of Melbourne will lead a new project developing methods and models that apply to livestock development projects to quantify real and potential reductions in emissions and determine the opportunities and trade-offs between productivity gain and economic returns. The results will help determine if greenhouse gas offsets can be captured and linked with nationally determined contributions (NDCs) of partner countries, and if there is potential for voluntary carbon-credit trading to diversify smallholders' income.¹⁶

Social Sciences

The prevalence of food insecurity in Laos remains largely unchanged, despite strong economic growth and reductions in poverty over the past decade. The drivers of food insecurity in the northern uplands of Laos are being identified in a project, led by Dr Paulo Santos of Monash University, to provide evidence to guide the scaling up of interventions aimed at improving food security in vulnerable households. In the final year of the project, pilot interventions to improve food security will be implemented and evaluated.¹⁷

With the rapid growth of the cassava sector across South-East Asia, various arrangements emerged between industry and smallholder farmers, varying from large estates to smallholder-oriented models. There are considerable opportunities to increase the productivity, profitability and sustainability of the cassava industry. Dr Dominic Smith of the University of Queensland will complete a project in 2020 that has identified the socioeconomic conditions under which improved technology and market booms in commercial crops, such as cassava, can be harnessed to increase the profitability and sustainability of smallholder farming systems.¹⁸

Previous ACIAR work reported that turning research into practical innovation is increasingly challenging in an era of accelerating global resource demand and climate change, creating an imperative for transformational change across farms, landscapes, markets, institutions and populations.

A small research activity will generate practical insights and actionable recommendations for ACIAR programs to better integrate agricultural practice change and community engagement. Dr Mary Johnson of RMIT University will lead a literature study from the Mekong region, comparing and contrasting public health promotion approaches and agricultural extension to find practical lessons and areas for cross-disciplinary learning and innovation. A diagnostic framework and supporting resources will be produced for use by ACIAR to assess project proposals to ensure that agricultural practice change and community engagement are at, or redefining, the cutting edge of agricultural extension.¹⁹

The Government of Lao PDR increasingly demands evidence to support policy development. The relationship between research-for-development and policy has not been clear-cut and there is an identified need for ACIAR projects to adopt more effective research-to-policy approaches in the Lao context. A small research activity will examine ACIAR-commissioned research projects in relation to the processes of Lao policymaking, through analysis of case studies and in-depth interviews with key stakeholders. Through the Australian National University, Dr Hilary Smith and Dr Holly High will investigate the processes, practices and circumstances that facilitate or hinder the influence and uptake of ACIAR-commissioned research within Lao policy contexts.²⁰



Enterprise diversification is a benefit of increased mechanisation of rice farming. Photo: Massimo Municchi.

Soil and Land Management

Practices to increase the overall productivity of crop-livestock systems in rice-growing areas of Cambodia and Laos were investigated in a project led by Dr Matthew Denton of the University of Adelaide. The project will report on soil and water management practices to improve sustainability, productivity and profitability, and on social and economic impacts of adoption of forages. Farmers will be provided with practical information and technologies from the research, and local scientists and extension officers are being trained to conduct ongoing research and promote outcomes.²¹

Increasing numbers of smallholder farmers in Laos and northern Vietnam are growing maize on sloping land to meet demand for livestock feeds by Chinese and South-East Asian poultry, pig and cattle industries.

A project, led by Professor Michael Bell of the University of Queensland, is helping farmers adopt maize-based farming systems that reduce soil degradation and improve smallholder livelihoods and economic viability. The project concludes in 2020, with the delivery of outreach models to support the adoption of more diversified maize-based farming systems and bioeconomic frameworks to structure the assessment of different crop and forage options.²²

Water

Previous research in ACIAR-funded projects found substantial promise for groundwater development in Laos; however, further work is needed to better understand how groundwater irrigation can support agricultural development in drought-prone southern Laos. A small research activity led by Dr Paul Pavelic of the International Water Management Institute will examine the three most promising aquifer systems in the lowlands of southern Laos. The project will conduct surveys to establish groundwater development potential, a review of groundwater planning and development practices and analysis of opportunities and constraints to applying small-scale, solar-powered pumped irrigation from groundwater.²³

Regional Manager, East and South-East Asia

Ms Dulce Carandang Simmanivong

Research Program Managers

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Crops: Dr Eric Huttner

Fisheries: Dr Ann Fleming

Forestry: Dr Nora Devoe

Horticulture: Ms Irene Kernot

Livestock Systems: Dr Anna Okello

Social Sciences: Dr Jayne Curnow

Soil and Land Management: Dr James Quilty

Water: Dr Robyn Johnston

See page 209 for contact details

Current and proposed projects

1. Establishing sustainable solutions to cassava diseases in mainland South-East Asia [Cambodia, Laos, Myanmar, Vietnam] (AGB/2018/172)
2. Weed management techniques for mechanised and broadcast lowland crop production systems in Cambodia and Laos (CROP/2019/145)
3. Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC) [Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia] (CROP/2020/144)
4. Quantifying biophysical and community impacts of improved fish passage in Laos and Myanmar (FIS/2014/041)
5. Assessing upstream fish migration measures at Xayaburi Dam in Laos (FIS/2017/017)
6. Translating fish passage research outcomes into policy and legislation across South-East Asia [Cambodia, Indonesia, Laos, Myanmar] (FIS/2018/153)
7. Advancing enhanced wood manufacturing industries in Laos and Australia (FST/2016/151)
8. Policy analysis for forest plantations in Laos and Vietnam (FST/2019/121)
9. Supporting agroforestry through tree improvement and gene conservation in Laos (FST/2020/119)
10. Scoping for a forest biosecurity network in South-East Asia [Cambodia, Laos, Vietnam] (FST/2020/102)
11. Building effective forest health and biosecurity networks in South-East Asia [Cambodia, Laos, Vietnam] (FST/2020/123)
12. An integrated management response to the spread of fusarium wilt of banana in South-East Asia [Laos, Philippines] (HORT/2018/192)
13. Investigating and developing interventions to mitigate food borne parasitic disease in production animals in Laos [Laos, Vietnam] (LS/2014/055)
14. Goat production systems and marketing in Laos and Vietnam (LS/2017/034)
15. Forages—taking stock and identifying research needs [Cambodia, Laos, Vietnam] (LS/2018/186)
16. Value-adding to existing livestock programs to understand and quantify the implications of greenhouse gas emissions, provide options for emissions reduction and inform in-country policy development [Cambodia, Ethiopia, Indonesia, Laos, Myanmar, Pakistan, Tanzania, Timor-Leste, Vanuatu, Vietnam, Zambia] (LS/2019/159)
17. Improving food security in the northern uplands of Laos: identifying drivers and overcoming barriers (ASEM/2012/073)
18. Developing cassava production and marketing systems to enhance smallholder livelihoods in Cambodia and Laos (ASEM/2014/053)
19. A framework for assessing agricultural extension approaches and an analysis of transferrable public health approaches [Australia, Cambodia, Laos, Myanmar, Thailand, Vietnam] (SSS/2019/186)
20. Policy impact in Laos: from research to practice (SSS/2020/142)
21. Management practices for profitable crop–livestock systems for Cambodia and Laos (SMCN/2012/075)
22. Improving maize-based farming systems on sloping lands in Vietnam and Laos (SMCN/2014/049)
23. Expanding opportunities to use groundwater for poverty alleviation and climate-change adaptation in Laos (WAC/2018/167)

Myanmar

 **A\$4.4** million
Budgeted funding

 **16**
Bilateral and regional
research projects

 **5**
Small projects and
activities

Despite recent positive economic growth, Myanmar is developing from a very low base. Myanmar still has the second lowest GDP per capita in South-East Asia, and most development indicators lag behind regional neighbours. The Myanmar economy is undergoing complex reforms, including improving the transparency of the government budget, establishing a more independent central bank, improving the tax system and enacting foreign investment laws. Australian aid is helping to create a legislative and policy environment that incentivises inclusive investment, trade and economic reform. We also promote women's economic empowerment and support partners to facilitate increased engagement between government, the private sector and civil society. In rural development, Australia is committed to increasing incomes and access to finance for rural households.

An overview of Australia's aid program in Myanmar is available on the DFAT website.

Despite its past isolation, Myanmar is steadily catching up economically with its ASEAN neighbours. As global growth weakened, Myanmar's economy has grown at around 6% per annum in recent years.

Myanmar's service sector remains the main driver of growth, followed by the industrial and agriculture sectors. While Myanmar registers among the top 10 global growth performers, more than one-third of its population remains in poverty, with 6.2% in extreme poverty.

Myanmar is strongly reliant on intra-ASEAN trade of agricultural products. In 2018, within the ASEAN region, Myanmar exported the largest share of agricultural products (28%) and imported the largest share of agricultural products in total imports (13%). While ASEAN neighbours are among its top investors in recent years, China has the largest economic footprint in the country.

Parliamentary elections are scheduled for November 2020, but this will depend on the situation of the COVID-19 pandemic in Myanmar at the time. In the light of the pandemic and the poor state of the country's healthcare system, GDP growth forecasts are being lowered.

Despite the economic shift away from agriculture, the sector remains a high priority for the Government of Myanmar. Agriculture contributes about 30% of the GDP. Almost 70% of Myanmar's 54 million people live in rural areas and rely on crop husbandry and livestock for their livelihoods and incomes. The fishery and livestock sectors are considered the most important, after agriculture, to meet the protein needs of the population, enhance food security and provide employment for rural communities.

Foreign investment has played a key role in the mechanisation of agriculture and the extension of agricultural value chains. In 2019, foreign investments in agriculture, livestock and fisheries rose to 6.4% of foreign direct investment. However, local credit growth in agriculture declined in 2018-19 from 13% to 11%. According to the World Bank, increased foreign and domestic investment in higher-quality seeds, mechanisation and improved irrigation could boost agricultural production. The World Bank also stated that the expanded use of digital technologies could increase agricultural productivity and household revenue in the rural sector by providing better information to farmers and broadening market access.

Myanmar is vulnerable to natural hazards, including cyclones, storms, floods and earthquakes. In addition to limited investment in disaster risk reduction, much of the state's farmland is poorly adapted to these challenges. The FAO stated that the promotion of water management and conservation practices to help rebuild productive infrastructure, improve water storage, rehabilitate agricultural land and reduce the impact of potential disasters remains critical.

The main policy document guiding the agriculture sector in Myanmar is the Agricultural Development Strategy and Investment Plan (2018–2023) which has three pillars: governance, productivity, and market linkages and competitiveness. The long-term plan is intended to be a guide towards inclusive development of agriculture in Myanmar that is based on cooperation between government, farmers and private businesses.

Country priorities

Myanmar is an important partner for Australia. Australia's engagement with Myanmar aligns with the *Australian Government 2017 Foreign Policy White Paper* priorities, including the promotion of a prosperous and stable Indo-Pacific region, liberal democratic principles and rules-based norms. Australia's aid program in Myanmar helps support inclusive economic growth and increased trade by strengthening government capacity, promoting peace and stability, and supporting the development of an educated and competitive workforce.

To support the agricultural development goals of the Government of Myanmar, and consistent with Australia's strategic objective on inclusive economic growth, a long-term country program strategy finalised in 2019–20 will guide the ACIAR program during 2020–21. Research priorities for the ACIAR program in Myanmar will focus on:

- » increasing net production of food and cash incomes of rural households in the Central Dry Zone and Ayeyarwady Delta, through improvements in, and adoption of, production and post-harvest technologies in agriculture, including livestock and fisheries
- » building capacity in agricultural, livestock and fisheries research, development and evaluation through program activities and postgraduate and short-term training
- » providing technical assistance and advice on policy strengthening to relevant Government of Myanmar departments.

2020–21 research program

ACIAR supports 21 projects in Myanmar, nine of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Myanmar. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

Improving the agricultural value chain and developing trade models are ways of improving the livelihoods of farmers across many industries. A project in Myanmar and Vietnam, led by Dr Gordon Rogers of Applied Horticultural Research, aims to develop an understanding of vegetable markets and value chains, and identify opportunities for safe and off-season vegetable production for urban, wholesale and retail markets. In its final stages, the project will document and publish a scalable model for production, marketing and supply of high-quality vegetables in Myanmar. The model is informed by experience and protocols developed previously for smallholder vegetable growers in Northwest Vietnam.¹

Smallholder farmers in South-East Asia often cannot access credit to invest in new crops or technologies, deal with risks and shocks, and safely carry wealth from harvest to planting. To help smallholders reach their production potential, a project led by Dr Alan de Brauw of the International Food Policy Research Institute will review and research financing models for agricultural value chains and evaluate specific interventions in Indonesia, Myanmar and Vietnam. Based on evaluation of agricultural value-chain financing models, the project will work with project partners to design and implement innovative and inclusive models.²

Cassava witches' broom disease and Sri Lanka cassava mosaic virus are spreading rapidly in South-East Asia. A project led by Dr Jonathan Newby of the International Center for Tropical Agriculture is developing technically viable and economically and socially sustainable ways to improve the resilience of cassava production systems and value chains in Cambodia, Laos, Myanmar and Vietnam. During 2020–21, the project will test and evaluate methods to slow the spread of the diseases, such as virus-free planting material and resistant varieties, and strengthen capacity and regional networks to reduce new pest and disease incursions.³



Pulses are one of Myanmar's most important crop groups in terms of production and exports. A significant proportion of smallholder farmers grow pulses, with the area harvested second only to rice. Export markets rely heavily on India and China; however, as these countries make concerted efforts towards self-sufficiency, the pulses and broader agriculture sectors in Myanmar need greater resilience. Ms Deb Doan of Business for Millennium Development will conduct a pulses market development analysis to understand Myanmar's export/domestic market opportunities, identify areas across the value chain that require investment and identify potential partners who can help drive the required value-chain changes.⁴

Crops

Mungbean is an ideal rotation crop for smallholder farmers. The International Mungbean Improvement Network, established through an ACIAR-supported project led by Dr Ramakrishnan Nair of the World Vegetable Center, helped realise the potential of mungbean to improve cropping system productivity and livelihoods by improving researchers' access to genetic material, and coordinating and providing technical support to variety development work in Bangladesh, India, Myanmar and Australia.⁵ Phase 2 of the network commences in July 2020, continuing variety development for another five years and extending the network to Kenya and Indonesia, providing access to new genetic material and improved cropping options for smallholder farmers in eastern Africa and South-East Asia.⁶

High labour costs and labour shortages at harvest time constrain mungbean production in Bangladesh, Myanmar and Pakistan. A project led by Dr Ramakrishnan Nair aims to establish and validate a practical and economically viable system for smallholders to mechanically harvest mungbean.

During 2020–21, final evaluations of combine harvesters adapted for local conditions and farming systems will occur, as well as final research to understand the current role of women in mungbean harvesting and the likely impacts of mechanical harvesting on their livelihoods.⁷

Appropriate use of pesticide contributes to food security but misuse, or use of particular products, can compromise food safety, human health, water and soil quality, and non-target organisms, including pollinators. While pesticide use (and misuse) have been comparatively low in Myanmar, increasing suspected pesticide-related poisoning in rural communities is a national concern. Benchmarking current pest-management practices and pesticide use/misuse in food crops was the first step of a small research activity led by Dr Sivapragasam Annamalai of the Centre for Agriculture and Bioscience International. By the end of 2020, the project will develop practical recommendations and actions to address current and potential future problems.⁸

A new species of armyworm, the fall armyworm (*Spodoptera frugiperda*), has caused serious damage to rice, sugarcane, sorghum, beet, tomato, potato and cotton crops throughout the Indo-Pacific region, and individuals have been recorded in northern Australia. The species poses a serious challenge to smallholder farmers in terms of sustainable management practices. A small research activity, led by Dr Wee Tek Tay of CSIRO and co-funded with the Australian Grains Research and Development Corporation, will investigate current successful management options for the pest and determine genetic differences between populations of the pest in South-East Asia and Australia—particularly to understand existing levels of insecticide resistance. The knowledge generated will be useful for future integrated pest-management approaches and the development of a draft resistance management plan.⁹



Mungbean is an ideal rotation crop for smallholder farmers. The International Mungbean Improvement Network established through an ACIAR-supported project works to improve cropping system productivity and livelihoods. Photo: Conor Ashleigh. ACIAR project: CROP/2019/144.



Fisheries and irrigation experts in the field, assessing river barriers and speaking with fisherfolk about changes in fish populations and other observations due to barriers in waterways. The survey precedes the installation of fishways (ladders) to restore migratory fish communities. Photo: Candice Bartlett. ACIAR project: FIS/2014/041.

Fisheries

Rice and fish are two essential components of nutritious diets in the Lower Mekong Basin, with fish from the Mekong River system providing the main source of animal protein. Thousands of low-level irrigation barriers have been installed in the Lower Mekong Basin to regulate water flow for rice cultivation and control flooding. These structures create barriers to fish attempting to migrate to and from floodplains, which are vital breeding and nursery habitats. Fish ladders for upstream fish passage, based on designs used in the Murray-Darling Basin in Australia, have been applied successfully in the Mekong system. To complement this work, Professor Lee Baumgartner of Charles Sturt University and teams are developing fish-friendly downstream regulators. These new designs improve fish survival as they allow fish to pass without injury.¹⁰

Despite the importance of small-scale fisheries to the Myanmar economy and people's livelihoods, there is scope to strengthen fishery management in Myanmar. Poor management has put important fish-production areas at risk, and the people who rely upon them are increasingly vulnerable. A project led by Dr Michael Akester of the WorldFish Center is assisting Myanmar's Department of Fisheries identify suitable co-management approaches and fisheries access arrangements to secure maximum benefits for small-scale fishers. The project will also build the capabilities of government and fisheries organisations to conduct fisheries research and develop policy.¹¹

Rice and fish are key elements of diets in Myanmar, as well as major agriculture sectors. Rice-fish systems encompass a spectrum of farming and fishing practices from traditional capture of fish in rice-dominated landscapes to controlled farming of fish in rice fields. With recent policy shifts in Myanmar, farmers are encouraged to diversify farming systems in agriculture, livestock and fisheries, presenting an opportunity for more productive rice-fish systems. A project led by Dr Michael Phillips of the WorldFish Center is finding ways to improve rice-fish systems in the Ayeyarwady Delta to enhance production and management and optimise income, food and nutritional outcomes for households. The project will also support policymakers develop enabling policy for land use, rice production and fisheries.¹²

Across South-East Asia, as floodplains are developed for irrigation and river flows are regulated, river communities are at risk of losing fishing income and an important source of protein and essential nutrients. Previous ACIAR projects showed that fishways, which facilitate passage of migratory fish up and down regulated rivers, can have lasting economic and social benefits for river communities. Professor Lee Baumgartner of Charles Sturt University is leading a project to develop a platform for sound decision-making on fish passage construction programs across South-East Asia, a targeted capacity-building program to address institutional needs for the integration of fish passages into irrigation infrastructure and guidelines for the development of fish passage policy and legislation in Cambodia, Laos, Myanmar and Indonesia.¹³

Livestock Systems

Goats and sheep (small ruminants) are an important income source and asset for rural and peri-urban smallholders in many parts of the world, including Myanmar. Cattle are often kept for draught power, but small ruminants are a source of income and food for many households. A project, led by Dr Angus Campbell of the University of Melbourne, will help farmers in Myanmar improve goat and sheep production, transforming their herd from an opportunistic, low-input/low-output activity to a profitable market-focused enterprise, through more efficient management of animal production and health.¹⁴

About half of Myanmar's 15 million cattle are in the Central Dry Zone, and their primary use is to provide draught power, transportation and manure for fertiliser. Myanmar is undergoing significant transformation. Mechanisation is expected to quickly reduce the need for draught animals over the next decade. This provides a unique opportunity for smallholder farmers to move from keeping draught animals to producing beef cattle. Dr Dianne Mayberry of CSIRO Agriculture and Food leads a project to support smallholder farmers by identifying the opportunities and constraints for developing a beef enterprise, developing management systems to meet production goals and quantifying potential impacts of improved forage and animal management packages on livelihoods.¹⁵

Poultry enterprises are increasingly recognised as a way to improve the nutrition of poor households, while economically empowering women, who are the key custodians of smallholder poultry. However, low-producing chicken genotypes typically dominate smallholder or family production systems. Dr Tadelle Dessie of the International Livestock Research Institute will lead a new project that aims to test and make available high-producing, farmer-preferred genotypes of chickens to increase smallholder productivity as a pathway out of poverty in Cambodia, Myanmar and Vietnam. The project will also strengthen the capacity of young scientists in the project countries to conduct high-quality research on village poultry systems to benefit smallholder farmers in their countries.¹⁶

There is an urgent need to consolidate existing evidence and identify gaps in global research to demonstrate the scale of reductions in greenhouse gas emissions that occur with more efficient livestock production systems. Using the expertise and capabilities of Australian and New Zealand climate science, Dr Paul (Long) Chen of the University of Melbourne will lead a new project developing methods and models that apply to livestock development projects to quantify real and potential reductions in emissions and determine the opportunities and trade-offs between productivity gain and economic returns. The results will help determine if greenhouse gas offsets can be captured and linked with nationally determined contributions (NDCs) of partner countries, and if there is potential for voluntary carbon-credit trading to diversify smallholders' income.¹⁷



Socially inclusive and technically appropriate institutional arrangements are being developed and tested to restore artesian groundwater pressure in the Central Dry Zone of Myanmar. Photo: ACIAR. ACIAR project: SSS/2018/135.

Social Sciences

About 300,000 people derive their livelihoods within artesian groundwater zones of the Central Dry Zone of Myanmar. However, both the pressure and flow rate of this naturally pressurised water source are declining due to overexploitation. The Irrigation and Water Utilization Management Department has highlighted the urgent need to rehabilitate both private and public free-flowing artesian tube wells. A project led by Dr Sonali Senaratna-Sellamuttu and Mr Sanjiv de Silva of the International Water Management Institute will develop and test socially inclusive and technically appropriate institutional arrangements, and support targeted communication strategies to restore artesian pressure in the Central Dry Zone.¹⁸

Previous ACIAR work reported that turning research into practical innovation is increasingly challenging in an era of accelerating global resource demand and climate change, creating an imperative for transformational change across farms, landscapes, markets, institutions and populations. A small research activity will generate practical insights and actionable recommendations for ACIAR programs to better integrate agricultural practice change and community engagement. Dr Mary Johnson of RMIT University will lead a literature study from the Mekong region, comparing and contrasting public health promotion approaches and agricultural extension to find practical lessons and areas for cross-disciplinary learning and innovation. A diagnostic framework and supporting resources will be produced for use by ACIAR to assess project proposals to ensure that agricultural practice change and community engagement are at, or redefining, the cutting edge of agricultural extension.¹⁹

Soil and Land Management

Agriculture is a dominant economic sector of Myanmar, but it is currently characterised by some of the lowest levels of productivity in the Asian region, and is growing at a lower rate than the Myanmar economy in general. The only providers of agricultural and veterinary tertiary education in Myanmar are Yezin Agricultural University and the University of Veterinary Science. A project led by Professor Kaye Basford of the University of Queensland will address the low productivity of agriculture by increasing the capacity of both universities so that they can deliver graduates with the research skills and knowledge to identify constraints to agricultural production and develop pragmatic solutions.²⁰

Agriculture in Shan State, Myanmar, has enormous potential to help people out of poverty, but productivity and efficiency are constrained by many factors. Soil-based challenges include poor nutrient acquisition by plants, infertile soil due to removal of nutrients in residues and continual erosion of topsoil. Dr Terry Rose of Southern Cross University leads a project that will assess variety and nutrition interactions in upland rice to increase yields, demonstrate hedgerows and legume-based pasture to reduce erosion on sloping lands, and understand, through farmer survey, potential barriers to adoption of legume-based pastures, livestock in farming systems and uptake of new rice varieties.²¹

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Fisheries: Dr Ann Fleming

Livestock Systems: Dr Anna Okello

Social Sciences: Dr Jayne Curnow

Soil and Land Management: Dr James Quilty

See page 209 for contact details

Current and proposed projects

1. Improving livelihoods in Myanmar and Vietnam through vegetable value chains (AGB/2014/035)
2. Inclusive agriculture value chain financing [Indonesia, Myanmar, Vietnam] (AGB/2016/163)
3. Establishing sustainable solutions to cassava diseases in mainland South-East Asia [Cambodia, Laos, Myanmar, Vietnam] (AGB/2018/172)
4. Market and opportunity analysis to guide market-led development of the Myanmar pulse sector (AGB/2019/154)
5. Establishing the International Mungbean Improvement Network [Bangladesh, India, Myanmar] (CIM/2014/079)
6. International Mungbean Improvement Network – phase 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
7. Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan (CIM/2016/174)
8. Plant health – a major challenge to achieving sustainable “green” agriculture in Myanmar (CROP/2019/103)
9. Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC) [Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia] (CROP/2020/144)
10. Quantifying biophysical and community impacts of improved fish passage in Laos and Myanmar (FIS/2014/041)
11. Improving fishery management in support of better governance of Myanmar’s inland and delta fisheries (FIS/2015/046)
12. Development of rice-fish systems in the Ayeyarwady Delta, Myanmar (FIS/2016/135)
13. Translating fish passage research outcomes into policy and legislation across South-East Asia [Cambodia, Indonesia, Laos, Myanmar] (FIS/2018/153)
14. Improving farmer livelihoods by developing market-oriented small ruminant production systems in Myanmar (LS/2014/056)
15. Improving cattle production in the Myanmar Central Dry Zone through improved animal nutrition, health and management (LS/2016/132)
16. Asian chicken genetic gains: a platform for testing, delivering, and improving chickens for enhanced livelihood outcomes in South-East Asia [Cambodia, Myanmar, Vietnam] (LS/2019/142)
17. Value-adding to existing livestock programs to understand and quantify the implications of greenhouse gas emissions, provide options for emissions reduction and inform in-country policy development [Cambodia, Indonesia, Kenya, Laos, Myanmar, Pakistan, South Africa, Tanzania, Timor-Leste, Vanuatu, Vietnam, Zambia] (LS/2019/159)
18. Building institutions for the sustainable management of artesian groundwater in Myanmar (SSS/2018/135)
19. A framework for assessing agricultural extension approaches and an analysis of transferrable public health approaches [Australia, Cambodia, Laos, Myanmar, Thailand, Vietnam] (SSS/2019/186)
20. Mainstreaming research in Myanmar’s agricultural and veterinary universities (SLAM/2017/041)
21. Soil-based challenges for cropping in Shan State, Myanmar (SLAM/2018/190)

Philippines

 **A\$3.2** million
Budgeted funding

 **13**
Bilateral and regional
research projects

 **5**
Small projects and
activities

The Philippines is one of Australia's longest-standing bilateral relationships and is supported by strong people-to-people links. Australia delivers targeted advice and technical assistance that aims to have a catalytic effect on reform efforts and capacity development of the Philippine Government. Australia's Philippines program is designed to meet the key objectives of inclusive economic growth, effective governance and peace and stability. This reflects a transition from a traditional donor-recipient partnership to an economic partnership, with an emphasis on investments that are targeted and catalytic, leverage the Philippine Government's own resources and are based on the Philippines' own commitments in the Filipino Development Plan.

An overview of Australia's aid program in the Philippines is available on the DFAT website.

The Philippines has maintained good economic growth in recent years. Robust domestic consumption, low inflation, improving labour market conditions, strong remittances and ongoing public investment continue to drive the country's economy.

However, this growth has not resulted in commensurate reductions in poverty and broader social inclusion, especially for smallholder farmers and fisherfolks, who are among the poorest of the poor.

To address these economic and welfare disparities, the Philippine Development Plan 2017–2022 outlined the country's pathway to a 'more inclusive growth, high-trust and resilient society, and globally-competitive knowledge economy'. In the medium term, the targets are for the economy to grow by 6–7% annually, and for poverty to be reduced to 14% by 2022.

Central to achieving these targets is harnessing the growth potential of the agriculture sector by creating opportunities, facilitating access and ensuring inclusivity. Achievement of targets also requires sustainable intensification of production practices.

Although its contribution to GDP is modest (10%), the agriculture sector employs almost one-third of the labour force (about 11 million annually), most of whom are from the rural countryside. Agriculture is also the major supplier of raw materials for the manufacturing sector, and a food source for over 100 million people.

Despite its economic importance and food security role, the agriculture sector continues to be weighed down by low productivity and limited diversification, natural resource degradation, high incidence of poverty and vulnerability to external shocks (e.g. disaster and climate risks).

To address these constraints, the Philippine Government is working to revitalise and modernise the sector, increase productivity, ensure food security and, most importantly, improve the welfare of the millions of farmers and fisherfolk who depend on it. Moreover, there is a need to identify investment areas that will enhance the sector's competitiveness, profitability and resilience. Agricultural transformation also requires significant and sustained investments in science, technology and innovation.

In recent years, the Philippine government invested substantially in agriculture R&D with the aim of reducing production and post-harvest losses, maintaining quality and food safety, increasing the market value of agricultural and fishery products along the supply chain, building a critical mass of human resources in science and technology and improving research infrastructure.

Our main government partner, the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) identifies a future focus on the 'use of advanced and emerging technologies such as biotechnology, genomics, bioinformatics, nanotechnology, and information and community technology as tools to find science and technology solutions to agricultural, fishery and forestry problems and to develop new products with significant impact to the sector'.

Country priorities

For more than 30 years, ACIAR has been an active partner of the Philippine Government in agricultural research-for-development. Since 1984, we have invested more than A\$150 million in more than 220 projects across agribusiness, crops, fisheries, forestry, horticulture, livestock, impact evaluation, social sciences, soil and land management, water and climate management.

In December 2018, ACIAR and PCAARRD signed a partnering agreement that aims to further strengthen the Australia-Philippines scientific and technical cooperation for agriculture, aquatic and natural resources. This relationship continues to grow and pursue innovations and new models of cooperation, particularly on co-investment on research and capacity building. ACIAR currently works with over 34 partners in the Philippines from government, research and academic institutions, private sector and civil society. These partnerships drive ACIAR-supported research-for-development work in the Philippines.

ACIAR support to the Philippines will continue to focus on research to enhance agricultural productivity and ensure food safety, improve the marketability and competitiveness of agricultural products, and protect rural households, especially the poor, from negative impacts of natural disasters, climate change and other external shocks. Higher-value products and market competitiveness would improve food security by enabling smallholder farmers and traders to increase their income and their access to other basic services and economic opportunities.

Our portfolio of work in the Philippines covers all aspects of agriculture, fisheries and forestry, with the common theme of improving livelihoods and opportunities for smallholder farmers. During 2020–21, ACIAR research initiatives in the Philippines will include:

- » working with PCAARRD to build the skills and knowledge of Philippine researchers and agribusiness specialists to analyse and improve processes along agriculture value chains so that they better respond to industry and market needs
- » supporting the development and improvement of technologies for the culture and grow-out of high-value marine species and consolidating approaches and technology for the restoration of damaged coral reefs, which has more importantly, improved fish catch and enhanced coastal biodiversity in northern Philippines
- » supporting action research to develop a transferable methodology for socioeconomic and livelihood impact analysis of African swine fever to inform future investments by governments and donors in addressing this biosecurity in Australia and South-East Asia. To test and refine the approach, the Philippines and Timor-Leste will be among the pilot areas.
- » supporting research to understand how agricultural development can draw on lessons from disaster risk reduction to minimise climate-related damage and build more climate-resilient farming systems.

The COVID-19 pandemic is having a major impact on Philippine food systems and the economy. ACIAR is supporting an Assessment of Food System Security, Resilience and Emerging Risks in the Indo-Pacific in the context of COVID-19 which will help identify areas of focus for our research collaboration with the Philippines that might increase food systems resilience in the face of future shocks.





Improving the performance of smallholder value chains for fruit and vegetables and building community capacity through learning alliances is the focus of a project in the southern Philippines. Photo: ACIAR. ACIAR project: AGB/2017/039.

2020–21 research program

ACIAR supports 18 projects and programs in the Philippines, 13 of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in the Philippines. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

Fruit and vegetable production are important economic activities in the southern Philippines but are limited by small farm size, poor adoption of technology, low productivity and product quality, and high post-harvest losses. Improving the performance of smallholder value chains for fruit and vegetables, and building community capacity, is the focus of a project led by Dr Gomathy Palaniappan of the University of Queensland. During 2020–21, there will be ongoing facilitation of learning alliances with private sector and grower groups, and community, government and research stakeholders to improve smallholders' income, livelihoods and community wellbeing through the value-chain improvements implemented.¹

Research in the southern Philippines shows that integrating vegetable value-chain development and community engagement leads to improved innovation, competitiveness, quality and value. However, success has occurred at very local scales and, in general, the majority of smallholder horticulture growers in the Philippines are often not able to compete in higher-value, more-demanding markets. Supporting the design of a new project, Dr Oleg Nicetic of the University of Queensland is investigating agribusiness-led development in inclusive value chains to develop a theory of change for inclusive agribusiness models for market-oriented value chains in the Philippines.² This will inform a project starting in 2021 to identify opportunities for inclusive agribusiness-led market development, evaluate opportunities for digital technologies to increase competitiveness and farm-to-market linkages, and evaluate models for public-private learning alliances and innovative co-investment with agribusiness firms. Led by Dr Lilly Lim-Camacho of CSIRO Agriculture and Food, the project will work with producers of high-value fruits and vegetables in the southern Philippines. This project aligns directly with two research priorities of PCAARRD.³

Despite persistent poverty and malnutrition in the Philippines, there is also economic growth and a growing middle class, which has a rapidly increasing demand for dairy-based products. The increase in domestic consumption presents an opportunity for significant growth in the Philippines dairy farming sector, particularly for smallholder dairy farmers, but there are many barriers to growth. The same barriers have been observed in Indonesia, Pakistan, Thailand and Bhutan. Professor Wendy Umberger of the University of Adelaide will undertake a small research activity to identify and analyse constraints along the dairy value chain. The project will identify key research priorities and potential partnerships for the development of the smallholder dairy sector in the Philippines, with an emphasis on the commercial sector.⁴

Crops

A new species of armyworm, the fall armyworm (*Spodoptera frugiperda*), has caused serious damage to rice, sugarcane, sorghum, beet, tomato, potato and cotton crops throughout the Indo-Pacific region, and individuals have been recorded in northern Australia. The species poses a serious challenge to smallholder farmers in terms of sustainable management practices. A small research activity, led by Dr Wee Tek Tay of CSIRO and co-funded with the Australian Grains Research and Development Corporation, will investigate current successful management options for the pest and determine genetic differences between populations of the pest in South-East Asia and Australia—particularly to understand existing levels of insecticide resistance. The knowledge generated will be useful for future integrated pest-management approaches and the development of a draft resistance management plan.⁵

Fisheries

Dried sea cucumbers are highly valued in China and South-East Asian markets, but overfishing throughout the Asia-Pacific region and poor fisheries management have resulted in the severe decline of sea cucumber stocks and even fishery closures. This has reduced income-generating opportunities for coastal communities. Building on previous ACIAR-supported projects, a project led by Professor Paul Southgate of the University of the Sunshine Coast will develop technical skills to improve the reliability of culture methods. This will support increased production capacity and further expansion of community-based sea cucumber farming in Vietnam and the Philippines.⁶

An innovative conservation project in the northern Luzon region of the Philippines, led by Professor Peter Harrison of the Southern Cross University, has successfully developed methods to restore coral reefs damaged by past dynamite fishing practices. Having determined requirements for survival and growth of juvenile branching and massive corals, this project finishes in 2020–21 with stakeholder training and an evaluation of the socioeconomic benefits of reef restoration to coastal communities. Formulation of policy advice on alternative reef management strategies in the Philippines, and potentially in Australia, will be finalised.⁷

The successful restoration of coral in experimental plots has led to notable increases in reef fish abundance and fish species richness, compared with control plots where coral was not restored. This project, led by Professor Harrison of the Southern Cross University, has established rigorous protocols and long-term monitoring and evaluation of the impacts on fish communities and other reef resources from coral restoration in the northern Luzon region. The project provides globally significant advances in understanding the impacts of active coral restoration on fish communities, and will enhance capacity of communities to better manage reef fish resources and reef restoration activities in the future.⁸

Building on the success of previous ACIAR project partnerships in demonstrating rapid coral population recovery, re-establishment of breeding populations and increased fish abundance from larval coral restoration interventions, Professor Peter Harrison of the Southern Cross University will lead a new five-year project to significantly increase the scale, efficiency, resilience and sustainability of restoration interventions. The project will establish coral restoration networks with communities and local government units and apply an innovative multidisciplinary strategy to rapidly reverse declining coral and fish assemblages and restore essential reef ecosystem services in four regions of the Philippines.⁹

Horticulture

About 40 species of tropical fruit flies damage horticultural crops and impede trade throughout South-East Asia. A project in Indonesia and the Philippines builds on the success of previous ACIAR projects, and links to fruit-fly work in other ACIAR partner countries and Australia. The project, led by Mr Stefano De Faveri of the Queensland Department of Agriculture and Fisheries, aims to reduce fruit-fly infestation of mango crops through area-wide management of the pest, and improve pre-harvest and post-harvest practices. The ultimate aim is to improve the yield and quality of crops in order to improve livelihoods and trade opportunities.¹⁰

Vegetable consumption is low in the Philippines for several reasons, including the perception of poor quality and safety of vegetables. Vegetable farmers are not well trained in the appropriate use of pesticides, resulting in pesticide residues above permissible limits in harvested crops, exposure of farm workers to pesticide poisoning and contamination of soil and water. Dr Gordon Rogers of Applied Horticultural Research leads a project to improve the capacity of selected vegetable supply chains to deliver vegetables that better meet consumer expectations in terms of quality, food safety, nutritional value and price.¹¹

Mango production in the Asia-Pacific region accounts for about two-thirds of global production. Much of the crop is produced by smallholders, who achieve relatively modest yields and participate in traditional value-chain arrangements that offer producers little incentive to innovate or pursue higher quality. Some producers seek better returns by supplying higher-value export markets (such as Korea), but they have struggled to deliver fruit that meets market or regulatory standards. A project in Cambodia and the Philippines, led by Dr Cameron McConchie of the Northern Territory Department of Primary Industry and Fisheries, aims to improve the ability of selected mango supply chains to deliver fruit that better meets consumer expectations of quality and value, and provide smallholder growers with a better return on investment.¹²

Fusarium wilt (Panama disease) has become widespread throughout South-East Asia. The disease is threatening smallholder banana production in countries including Indonesia, the Philippines and, more recently, Laos. A project led by Dr Anthony Pattison of the Queensland Department of Agriculture and Fisheries aims to develop an integrated management response to the spread of the disease. The research will investigate the effects on banana production of altering the banana microbiome to suppress disease and increase plant resistance to *Fusarium* wilt.¹³

Social Sciences

Previous ACIAR investment in Mindanao highlighted how community-based extension methods can rapidly improve agricultural livelihoods. A project led by Dr Mary Johnson of RMIT University is comprehensively testing and evaluating these improved extension methods in conflict-vulnerable areas in the southern and western Philippines. The project team continues its specialist mentoring and support to PCAARRD in their research to validate the LIFE Extension Model (developed by the project), and to understand the potential for scaling up the model to the national government level.¹⁴

Agriculture in the Philippines is especially susceptible to the adverse effects of climate change, through increasing weather variability, higher incidence of climate-related disasters and longer-term changes. Smallholder farmers and fishers need access to evidence-based options for managing the effects of climate change. As part of a whole-of-government approach, Dr Peter Hayman of the South Australian Research and Development Institute leads a project to improve the exchange of information between the provider of climate and weather information and decision-makers involved in managing climate and weather risk of smallholder farmers. The project will consolidate its research findings during 2020 and pilot communication material and scale up the project findings to other local government units and community-based organisations.¹⁵

Improving livelihoods of low-income residents of rural area remains a critical issue in the Philippines, especially in the country's rural uplands. More than 24 million people rely on subsistence agriculture, most of whom are below the poverty line. In addition, deforestation and land degradation in the uplands are major national environmental and social issues. A project led by Dr John Herbohn of the University of the Sunshine Coast focuses on forest landscape restoration to enhance livelihoods. During 2020–21, assessment and data collection will continue in field trials that are testing smallholder-based tree-crop farming systems to improve food security and livelihoods. Pilot testing of changes to policy at the local and provincial levels to address social, institutional and political problems will also continue.¹⁶



Vidal Moreno, Mindanao, has participated in a project that is validating a community-based extension model to improve agricultural livelihoods. Photo: Jeffrey Maitem. ACIAR project ASEM/2012/063.

Soil and Land Management

Rubber is the fourth largest crop in Agusan del Sur in the southern Philippines, but only 50% of the total rubber area planted is productive or tappable, and average yield in the province is much lower than the national average. The province is considered the poorest in the southern Philippines. By introducing improved profitable rubber intercropping systems and sustainable management regimes, a project led by Professor Chengrong Chen of Griffith University aims to boost household incomes for Indigenous smallholder farmers, who have poor access to technology and are totally dependent on subsistence farming on their small piece of land. The project is identifying economic opportunities, characterising key soil constraints and identifying the most suitable lands for rubber-based cropping systems.¹⁷

ACIAR is supporting a small research activity, led by Associate Professor Anik Bhaduri of Griffith University, that will bring together expertise from across Australia and internationally to develop a comprehensive framework of response assessment by which interventions and responses to degradation of land and water resources can be assessed and valued considering future climate scenarios. The project will be a fast-track and intensive synthesis, based on existing work on the social, economic and environmental costs of land, water and soil degradation. The project will contribute to the second edition of the State of the World's Land and Water Resources for Food and Agriculture, which is currently under development and led by FAO.¹⁸

Country Manager, Philippines

Ms Gay (Mai) Maureen Alagcan

Research Program Managers

Agribusiness: Mr Howard Hall

Crops: Dr Eric Huttner

Fisheries: Dr Ann Fleming

Horticulture: Ms Irene Kernot

Social Sciences: Dr Jayne Curnow

Soil and Land Management: Dr James Quilty

See page 209 for contact details

Current and proposed projects

1. Developing vegetable and fruit value chains and integrating them with community development in the southern Philippines (AGB/2017/039)
2. A theory of change for inclusive value chains in the Philippines (AGB/2019/100)
3. Inclusive agribusiness-led development for high-value fruit and vegetable in the southern Philippines (AGB/2018/196)
4. Philippines smallholder dairy: landscape analysis and research priorities (AGB/2020/120)
5. Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC) [Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia] (CROP/2020/144)
6. Increasing technical skills supporting community-based sea cucumber production in Vietnam and the Philippines (FIS/2016/122)
7. Restoring damaged coral reefs using mass coral larval reseeded [Philippines] (FIS/2014/063)
8. Baseline monitoring and evaluation of long-term impacts on fish stocks from coral restoration [Philippines] (FIS/2018/128)
9. Regional networks for large-scale coral and fish habitat restoration in the Philippines (FIS/2019/123)
10. Development of area-wide management approaches for fruit flies in mango for Indonesia, Philippines, Australia and the Asia-Pacific region (HORT/2015/042)
11. Developing vegetable value chains to meet evolving market expectations in the Philippines (HORT/2016/188)
12. Integrated crop management for mango in Cambodia and the Philippines to meet market quality standards (HORT/2016/190)
13. An integrated management response to the spread of fusarium wilt of banana in South-East Asia [Laos, Philippines] (HORT/2018/192)
14. Improving the methods and impacts of agricultural extension in conflict areas of Mindanao, Philippines (ASEM/2012/063)
15. Action ready climate knowledge to improve disaster risk management for smallholder farmers in the Philippines (ASEM/2014/051)
16. Enhancing livelihoods through forest and landscape restoration [Philippines] (ASEM/2016/103)
17. Land management of diverse rubber-based systems in the southern Philippines (SLAM/2017/040)
18. State of land and water assessment framework [Philippines] (SLAM/2020/138)

Thailand



A\$0.2 million
Budgeted funding



1

**Bilateral and regional
research projects**

Australia and Thailand have longstanding and deep connections. Formal diplomatic relations commenced in 1952. We cooperate in a broad range of areas of mutual interest, including trade and investment, law enforcement, counterterrorism, education, security, migration and tourism. The bilateral relationship is supported by mutual membership of international and regional organisations. Thailand moved from being an aid recipient to an aid donor in 2003.

An overview of Australia's relationship with Thailand is available on the DFAT website.

Thailand is one of five original members of ASEAN and has nurtured close ties with other member states over the years. As the second-biggest economy in ASEAN, Thailand actively promotes integration efforts under the ASEAN Economic Community.

Over the last four decades, Thailand has made significant progress in social and economic development and moved from a low-income to an upper-middle-income country.

The agriculture sector of Thailand contributes only 8% to the national GDP but agriculture plays two essential roles in Thai society. First, as a major source of food supply, not only for its own people but also globally; and second, as a major source of employment. About 30% of the population is engaged in agricultural production. In 2018, agricultural products made up approximately 17% of total exports. Many of these, such as natural rubber, rice, cassava, sugar and canned pineapple, are ranked first or in the top 10 of market share in the world market.

Just like its neighbours, Thailand's agriculture sector faces problems such as fluctuating prices of agricultural products, inappropriate use of farm inputs, lack of water, depleted natural resources and ageing farmers. Thailand is also facing the effect of climate change and natural disasters such as floods and droughts. In early 2020, Thailand was hit with possibly its worst drought in 40 years.

To lay a foundation for long-term development leading to systematic growth and solutions to these problems, the Ministry of Agriculture and Cooperatives is implementing a 20-year Agriculture and Cooperatives Strategy (2017-2036). The development plan envisions to secure farmers' livelihoods, grow the agriculture sector and sustain agricultural resources. Last year, the Bangkok Bank of Agriculture and Agricultural Cooperatives announced plans to allocate as much as A\$5.4 billion to boost the Thai agriculture sector. The organisation plans to introduce and implement smart farming to 4,500 Thai communities nationwide, starting in 2020.

Country priorities

Since transitioning from aid recipient to aid donor in 2003, Thailand maintains a strong technical cooperation program that includes development projects, volunteer and expert programs, fellowships, scholarship and training courses. Thailand works with ACIAR to share its technical expertise with neighbouring countries and support regional economic growth.

2020–21 research program

ACIAR works with Thailand on one regional-scale project that addresses our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Social Sciences

Previous ACIAR work reported that turning research into practical innovation is increasingly challenging in an era of accelerating global resource demand and climate change, creating an imperative for transformational change across farms, landscapes, markets, institutions and populations. A small research activity will generate practical insights and actionable recommendations for ACIAR programs to better integrate agricultural practice change and community engagement. Dr Mary Johnson of RMIT University will lead a literature study from the Mekong region, comparing and contrasting public health promotion approaches and agricultural extension to find practical lessons and areas for cross-disciplinary learning and innovation. A diagnostic framework and supporting resources will be produced for use by ACIAR to assess project proposals to ensure that agricultural practice change and community engagement are at, or redefining, the cutting edge of agricultural extension.¹

Current project

1. A framework for assessing agricultural extension approaches and an analysis of transferrable public health approaches [Australia, Cambodia, Laos, Myanmar, Thailand, Vietnam] (SSS/2019/186)

Regional Manager, East and South-East Asia

Ms Dulce Carandang Simmanivong

Research Program Manager

Social Sciences: Dr Jayne Curnow

See page 209 for contact details



Vietnam

 **A\$4.5** million
Budgeted funding

 **22**
Bilateral and regional
research projects

 **9**
Small projects and
activities

While Vietnam has experienced remarkably rapid economic growth in past decades, there are risks to the medium-term economic outlook. Businesses are constrained by the lack of a skilled workforce, and investments in infrastructure and deeper economic reforms are needed to sustain private sector growth. Inequality is a continuing challenge, with 10% of the population living below the poverty line.

Vietnam is one of few countries in which the gender pay gap has widened over the last decade. Ethnic minorities have still not benefited equally from economic growth; although they comprise 15% of the population, they account for around half of those living in poverty. Australia's commitment to development cooperation with Vietnam is ongoing. Reflecting our maturing economic partnership, we will continue to leverage Vietnam's significant domestic resources and foreign investment, and support Vietnam's efforts to enter a new phase of economic development. By helping to stimulate the private sector, upskill the workforce and support inclusive growth, we will contribute to achieving our shared, overarching goal of promoting prosperity and reducing poverty in Vietnam.

An overview of Australia's relationship with Vietnam is available on the DFAT website.

During 2019, Vietnam became more deeply integrated in international markets as a result of two new free trade agreements: the Comprehensive and Progressive Agreement for Trans-Pacific Partnership and the EU-Vietnam Free Trade Agreement.

Vietnam achieved impressive economic growth in 2019 with GDP increasing 7%. Agriculture, fisheries and forestry accounted for 14% of GDP and exported products were valued at US\$41.3 billion. However, these sectors face a number of challenges. Three key examples are:

- » climate change that is leading to more extreme weather events such as severe drought, flood, saline intrusion and forest fire that affect large areas of agricultural land
- » pest and disease outbreaks in crops and animals that remain unresolved in 2020, especially yellow leaf and root rot on coffee, quick wilt and slow decline on black pepper, cassava mosaic disease, fall armyworm on maize and African swine fever (causing losses of at least 20% of the total pig herd)
- » post-farm issues such as weak linkages of value chains, lagging agricultural processing and a high rate of post-harvest losses.

In addition, the most recent COVID-19 pandemic has affected all sectors, including agriculture, both in production and commercialisation.

Vietnam's five-year Socio-Economic Development Plan 2016–2020 is in its last year of implementation. For 2020, science and technology were identified as key to increasing productivity, quality, efficiency and competitiveness in the sector. Focal points of research include product quality improvement throughout supply and added-value chains; seeds and breeds for high quality, disease resistance and climate-change adaptation; post-harvest management, processing and storage technologies; and ongoing productivity improvement.

Vietnam is the ASEAN chair in 2020, and therefore has an opportunity to enhance regional collaboration by sharing expertise and disseminating research results within the ASEAN countries.

The Ministry of Agriculture and Rural Development is expected to continue to focus on developing higher-quality and value products in the coming years, targeting an increase of 3% in the agricultural GDP with US\$43 billion of exporting value in 2020.

Country priorities

Bilateral cooperation between Australia and Vietnam to achieve agricultural development has been carried out through trade and joint research and innovation programs. ACIAR has managed agricultural research and development activities for the past 27 years.

The strategy for research collaboration between Vietnam and ACIAR from 2017 to 2027 was developed on the basis of mutual acknowledgment that the relationship between ACIAR and Vietnam has evolved from donor–recipient to partnership, co-investment and, possibly, through this period, to trilateral collaboration. The strategy confirms the desire of both parties to join with the private sector, wherever possible, to create opportunities for poorer residents in rural and urban areas through inclusive agribusiness systems. It also focuses on transformational opportunities for women in research and agribusiness systems and on farms.

The strategy's 10-year goals are to:

- » establish and sustain long-term international partnerships in research and technology development
- » improve the capacity of Vietnamese researchers, research managers and development partners to support sustainable and equitable growth through agricultural research
- » improve the skills, livelihoods and incomes of smallholder farmers, including ethnic minorities in the mountainous areas of Central Highland (Tay Nguyen) and North West (Tay Bac), supported by knowledge networks that allow profitable engagement in domestic and international markets
- » improve human health and nutrition, through research on integrated farming systems, nutrition-sensitive agriculture and One Health
- » improve the quality and safety of meat, fish, vegetables and fruit for domestic consumption
- » develop deeper knowledge of markets to help prevent and reduce economic shocks for participants in agricultural supply chains
- » reduce inputs of chemicals and fertiliser for a cleaner environment, safer produce, improved soil health and more-profitable sustainable production systems
- » improve resource use efficiency to produce more food with fewer resources
- » implement practices and inform policymakers to manage climate change impacts on agriculture.

The strategy focuses on:

- » food safety
- » climate change
- » soil fertility and efficiency of crop–livestock systems
- » market knowledge, access to markets and skills for better policy analysis
- » increasing value from forests
- » increasing value from aquaculture.

Research collaborations focus on the Mekong River Delta, Central Highlands and Northwest. While the Mekong River Delta and Central Highlands have export capacity, they face climate-change challenges and share similar developmental challenges. These include land conservation, generating better livelihoods for ethnic minorities and economically empowering women.

In early 2020, ACIAR and its Vietnam partners reviewed the strategy implementation and priorities for the coming period. The Ministry of Agriculture and Rural Development, the Ministry of Science Technology, the Ministry of Planning and Investment and ACIAR affirmed that the strategy is current and agreed to focus on the following elements:

- » achievement of the shared goal that 75% of projects will be co-funded by Australia and Vietnam during the 10-year period
- » research into climate change, especially drought-tolerant cropping systems (in the Mekong River Delta and the Central Highlands) and saline-cropping systems for the Mekong River Delta (i.e. to continue the work on rice–shrimp systems)
- » research into the development of fruits from the Northwest region, especially farming systems on sloping lands, storage and post-harvest management, processing and market access for the region's popular produce, which includes mango, avocado and longan
- » continued research into mariculture and improve chemical and antibiotic residue control in aquaculture produce
- » development of local forest tree species, value chains of non-timber forest products and forest tree pests and diseases
- » biosecurity research (especially cattle and chicken), disease forecasting and disease management—taking advantage of Australian expertise
- » improvement of information exchange through a taskforce to support project development, approval and implementation
- » improvement of project outcome communication and involve alumni in research and partnership activities.

2020–21 research program

ACIAR supports 31 projects and programs in Vietnam, 11 of which are specific to this country. The remainder are part of regional projects. The projects address our high-level objectives, as outlined in the 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Vietnam. The projects are grouped according to research program. Each project description is referenced in a list at the end of this section, which provides the project title and code.

Agribusiness

Mango production makes a significant contribution to Vietnam's economy, with nearly half of the crop produced in the Mekong River Delta region. New opportunities in the fresh and processed mango value chain will be identified to improve net income and livelihoods of smallholder mango growers in southern Vietnam in a project led by Dr Robin Roberts of Griffith University. The research has focused on roles and opportunities for women in the industry. The project will conclude in 2020–21, reporting on options to overcome barriers to competitiveness and ways to improve capacity, industry stakeholder linkages and knowledge sharing.¹

Cassava is an increasingly important crop throughout South-East Asia in terms of both rural livelihoods and regional economic development, and it remains an important food-security crop in specific subregions. The market outlook for cassava, and the prospects for smallholder producers, are strongly linked to supply and demand in global starch, grain and energy markets. A project in Indonesia and Vietnam, led by Dr Dominic Smith of the University of Queensland, aims to make smallholder cassava production more profitable and sustainable, by linking value-chain actors to increase the adoption of improved technologies. The project finishes in 2020 with the delivery of policy recommendations and the development of learning alliances.²

Improving the agricultural value chain and developing trade models are ways of improving the livelihoods of farmers across many industries. A project in Myanmar and Vietnam, led by Dr Gordon Rogers of Applied Horticultural Research, aims to develop an understanding of vegetable markets and value chains, and identify opportunities for safe and off-season vegetable production for urban, wholesale and retail markets. In its final stages, the project will document and publish a scalable model for production, marketing and supply of high-quality vegetables in Myanmar. The model is informed by experience and protocols developed previously for smallholder vegetable growers in Northwest Vietnam.³



Nguyen Thi Mien is an active member of Tu Nhien safe vegetables cooperative in Son La province. Her family income has increased up to seven times per hectares by participating in safe vegetable production. Photo: Khanh Long. ACIAR project: AGB/2014/035.

Smallholder farmers in South-East Asia often cannot access credit to invest in new crops or technologies, deal with risks and shocks, and safely carry wealth from harvest to planting. To help smallholders reach their production potential, a project led by Dr Alan de Brauw of the International Food Policy Research Institute will review and research financing models for agricultural value chains and evaluate specific interventions in Indonesia, Myanmar and Vietnam. Based on evaluation of agricultural value-chain financing models, the project will work with project partners to design and implement innovative and inclusive models.⁴

A small research activity, led by Dr Chris Chilcott of CSIRO Land and Water, evaluated opportunities to reduce logistics costs to small-scale farmers to contribute to more-informed policy on infrastructure that promotes development and access to markets in Indonesia and Vietnam. The project will further develop an adapted logistics model to better understand links, stakeholders and requirements to operate the model in the two countries.⁵

The most important constraint to the development of a temperate fruit industry in northern Vietnam is the lack of coordination between stakeholders in the private sector (seedling producers, growers, traders and retailers), and between the private sector and local government. A small research activity, led by Mr Oleg Nicetic of the University of Queensland, is strengthening leadership, coordination and economic development of the industry by forming and developing a professional and inclusive multi-stakeholder industry association.⁶

Cassava witches' broom disease and Sri Lanka cassava mosaic virus are spreading rapidly in South-East Asia. A project led by Dr Jonathan Newby of the International Center for Tropical Agriculture is developing technically viable and economically and socially sustainable ways to improve the resilience of cassava production systems and value chains in Cambodia, Laos, Myanmar and Vietnam. During 2020–21, the project will test and evaluate methods to slow the spread of the diseases, such as virus-free planting material and resistant varieties, and strengthen capacity and regional networks to reduce new pest and disease incursions.⁷

Vietnam is the world's top producer (by volume) of robusta coffee and black pepper. Production is concentrated in the Central Highlands, and both crops are often grown on the same farm and plots by smallholder farmers. A small research activity, led by Dr Estelle Biénabe of the World Agroforestry Centre, will collect baseline information and analyse the agribusiness contexts for the two crops to identify opportunities and bottlenecks affecting the value chains.⁸

A four-year project commencing in 2020 aims to enhance smallholder livelihoods, including vulnerable populations, through improving the sustainability of coffee and black pepper farming systems and value chains. Research will commence with an investigation of soil-borne pests and diseases, on-farm and in nurseries; and the use of bio-inoculants with soil remediation strategies.⁹

Over 50% of Vietnam's rice is produced in the Mekong River Delta, of which 90% is exported. About 1.5 million smallholder farmers rely on rice for their livelihood, and rice is grown on small farms, with two or three crops produced each year. A number of issues face the industry: reduced returns to farmers, soil degradation, environmental pollution and declining seed purity and grain quality. Recognising these issues, the Government of Vietnam developed a policy in 2017 to encourage a reduction in total rice production and a focus on high-quality rice, with the aim of exporting to premium markets. A new four-year project, led by Dr Jaquie Mitchell of the University of Queensland, aims to establish a highly productive, sustainable, traceable, quality-assured value chain for tropical medium-grain rice in the Mekong River Delta, benefiting rice-farming households and meeting established market requirements of the project partner, SunRice.¹⁰

Vietnam has experienced excellent growth in agriculture, value-added agriculture and farm incomes over recent decades. Despite this, the sector faces a number of challenges, including outdated technologies, inadequate food safety and fragmented supply chains. A small research activity led by Associate Professor Tiho Ancev of the University of Sydney will support the Ministry of Planning and Investment and the Vietnamese Government to set up an adequate framework for the Agricultural and Rural Development Strategy and formulate concrete strategic directions for the sector.¹¹

Crops

A new species of armyworm, the fall armyworm (*Spodoptera frugiperda*), has caused serious damage to rice, sugarcane, sorghum, beet, tomato, potato and cotton crops throughout the Indo-Pacific region, and individuals have been recorded in northern Australia. The species poses a serious challenge to smallholder farmers in terms of sustainable management practices.

A small research activity, led by Dr Wee Tek Tay of CSIRO and co-funded with the Australian Grains Research and Development Corporation, will investigate current successful management options for the pest and determine genetic differences between populations of the pest in South-East Asia and Australia—particularly to understand existing levels of insecticide resistance. The knowledge generated will be useful for future integrated pest-management approaches and the development of a draft resistance management plan.¹²

Fisheries

Dried sea cucumbers are highly valued in China and South-East Asian markets, but overfishing throughout the Asia-Pacific region and poor fisheries management have resulted in the severe decline of sea cucumber stocks and even fishery closures. This has reduced income-generating opportunities for coastal communities. Building on previous ACIAR-supported projects, a project led by Professor Paul Southgate of the University of the Sunshine Coast will develop technical skills to improve the reliability of culture methods. This will support increased production capacity and further expansion of community-based sea cucumber farming in Vietnam and the Philippines.¹³

Production of cultured half-pearls (mabé) provides significant opportunities for coastal communities to generate an income. Oysters used for mabé production are found in Vietnam, but they are not used for mabé or handicraft production, despite a considerable tourist market. Using expertise developed in Tonga, a project, led by Professor Paul Southgate of the University of the Sunshine Coast, is assessing the feasibility of establishing community-based mabé culture in the Nha Trang area of Vietnam, in partnership with the Ministry of Fisheries' Research Institute for Aquaculture.¹⁴

Forestry

The development of market-based agroforestry in Northwest Vietnam provides an opportunity for farmers to diversify, achieve higher incomes and reduce erosion of mountainous landscapes. A project led by Dr La Nguyen of the World Agroforestry Centre will continue research on the development and adoption of locally appropriate, market-based agroforestry systems and the rehabilitation of degraded forests. Working closely with the Department of Agricultural and Rural Development offices in Son La, Yen Bai and Dien Bien provinces, the project will implement exemplar landscapes to support adoption of the new systems and improve livelihood options for the H'mong and Thai ethnic minorities living in these provinces.¹⁵

A new project in 2020–21, with activities in Indonesia and Vietnam, will underpin good plant biosecurity practices in forestry. With government and industry partners, the project led by Dr Caroline Mohammed of the University of Tasmania, will extend screening approaches from prior *Acacia/Ceratocystis* research to eucalypts that have replaced acacias in the wet tropics; develop remote-sensing software applications for cheap and rapid forest health surveillance; and, through geospatial modelling, deliver establishment (suitability and survival) risk maps under current and future climates at a regional level for the highest priority pests and pathogens.¹⁶



A project in Vietnam and the Philippines aims to increase technical skills in culture methods of sea cucumbers to increase production capacity and expand community-based sea cucumber farming. Photo: ACIAR. ACIAR project: FIS/2016/122.

A small research activity, headed by Dr Madaline Healey of the University of the Sunshine Coast, has gathered data from the ASEAN countries around priorities, capacities and perceived risk pathways in forest biosecurity. Biosecurity investment and biosecurity regulations within the region are being reviewed. These analyses will underpin initiation of a regional biosecurity network that will link the agriculture and forestry agencies of the national partners.¹⁷

Regional collaboration in South-East Asia is urgently needed to create a unified network capable of a coordinated response to forest pest and disease incursions. This new project, led by Professor Simon Lawson of the University of the Sunshine Coast, aims to foster such a network. The project will reduce the risk of forest pest and disease incursion and the impacts of established pests and diseases by developing enhanced techniques and capacities in pest risk analysis, surveillance and diagnostics and deploying these through the regional network. Research results will support evidence-based forest biosecurity policy for the region.¹⁸

Forest plantations in Laos and Vietnam are key to achieving the development aims of both countries through building human capacity, developing industry and sustaining the environment. A small research activity led by Professor Rod Keenan of the University of Melbourne extends the impact of previous project findings. The project will engage policymakers and stakeholders to contribute to the development of new laws, decrees and regulations for forest plantations, consider new policy options for forest plantations and share information on regional and national economic impacts of forest plantations.¹⁹

Livestock Systems

Market demand for beef is increasing rapidly in Vietnam, but cannot be met by current levels of domestic production. A project, led by Dr Stephen Ives of the University of Tasmania, is investigating and implementing whole-farm solutions for smallholder cattle producers in the highlands of Northwest Vietnam. This will help smallholder farmers shift from extensive to more-intensive production systems so they can meet market specifications, increase market linkages and improve profitability.²⁰

Laos is a comparatively small producer of pork compared with Vietnam and China, but pork production has grown significantly in recent years, including a growing cross-border trade into Vietnam. Improved safety of animal source foods, including pork that is free from zoonotic parasites such as *Taenia solium*, is gaining greater attention in the region. A new project, led by Dr Amanda Ash of Murdoch University, aims to identify and recommend interventions to mitigate the risk of disease from food-borne parasites in pigs, adding value to cross-border pig trade between northern Laos and Vietnam.²¹

Asia is a major global producer of pork, with South-East Asia and southern China currently providing the majority of regional production. Food safety is a significant and growing concern in Vietnam, and is a barrier to smallholder farmers wishing to sell product in high-value domestic and export markets. Through market-based approaches, the Safe Pork project, led by Dr Fred Unger of the International Livestock Research Institute, aims to reduce the burden of food-borne disease across various markets in Vietnam.²²

Goat production in Laos has more than doubled over the past 10 years, largely driven by high demand for goat meat from Vietnam. Expanded goat production using traditional extensive goat-raising methods has the potential to result in overgrazing of feed resources, negative consequences for the environment and higher incidence of diseases and parasites in livestock. A project led by Dr Stephen Walkden-Brown of the University of New England is developing new goat production practices that are sustainable and productive.²³

A stocktake of the potential of forage production by smallholders in Cambodia, Laos and Vietnam is the focus of a small research activity that concludes in 2020. Dr Lava Yadav of the University of Queensland has analysed factors that contribute to, and constrain, forage production and development of related enterprises. The work will report on the constraints and opportunities for more effective uptake and use of forages, and identify potential business models for more demand-driven development.²⁴

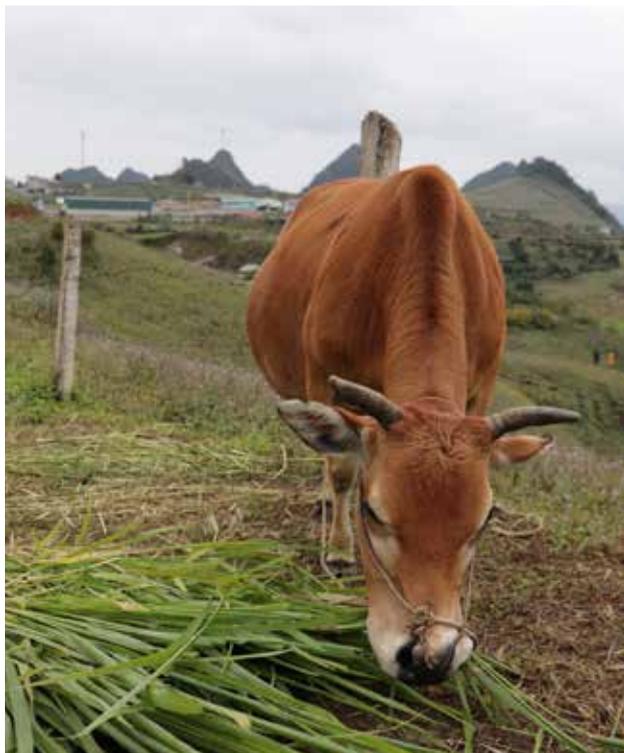
Poultry enterprises are increasingly recognised as a way to improve the nutrition of poor households, while economically empowering women, who are the key custodians of smallholder poultry. However, low-producing chicken genotypes typically dominate smallholder or family production systems. Dr Tadel Dessie of the International Livestock Research Institute will lead a new project that aims to test and make available high-producing, farmer-preferred genotypes of chickens to increase smallholder productivity as a pathway out of poverty in Cambodia, Myanmar and Vietnam. The project will also strengthen the capacity of young scientists in the project countries to conduct high-quality research on village poultry systems to benefit smallholder farmers in their countries.²⁵

There is an urgent need to consolidate existing evidence and identify gaps in global research to demonstrate the scale of reductions in greenhouse gas emissions that occur with more efficient livestock production systems. Using the expertise and capabilities of Australian and New Zealand climate science, Dr Paul (Long) Chen of the University of Melbourne will lead a new project developing methods and models that apply to livestock development projects to quantify real and potential reductions in emissions and determine the opportunities and trade-offs between productivity gain and economic returns. The results will help determine if greenhouse gas offsets can be captured and linked with nationally determined contributions of partner countries, and if there is potential for voluntary carbon-credit trading to diversify smallholders' income.²⁶

Social Sciences

A small research activity will analyse gender transformative tools designed to support ethnic minorities in the Technologically Enhanced Agricultural Livelihoods (2018–2022) project operated by CARE International in the northern uplands of Vietnam. The project, led by Dr Rochelle Spencer of Murdoch University, will determine how the tools contribute to changing gender relations and empowering women, and to what extent. The project will also build capacity of in-country partners and 10 social science researchers in the early stages of their careers, through training in mixed-method research, including participatory methods, and project-level Women's Empowerment in Agriculture Index.²⁷

Previous ACIAR work reported that turning research into practical innovation is increasingly challenging in an era of accelerating global resource demand and climate change, creating an imperative for transformational change across farms, landscapes, markets, institutions and populations. A small research activity will generate practical insights and actionable recommendations for ACIAR programs to better integrate agricultural practice change and community engagement. Dr Mary Johnson of RMIT University will lead a literature study from the Mekong region, comparing and contrasting public health promotion approaches and agricultural extension to find practical lessons and areas for cross-disciplinary learning and innovation. A diagnostic framework and supporting resources will be produced for use by ACIAR to assess project proposals to ensure that agricultural practice change and community engagement are at, or redefining, the cutting edge of agricultural extension.²⁸



Soil and Land Management

Increasing numbers of smallholder farmers in Laos and northern Vietnam are growing maize on sloping land to meet demand for livestock feeds by Chinese and South-East Asian poultry, pig and cattle industries. A project, led by Professor Michael Bell of the University of Queensland, is helping farmers adopt maize-based farming systems that reduce soil degradation and improve smallholder livelihoods and economic viability. The project concludes in 2020, with the delivery of outreach models to support the adoption of more diversified maize-based farming systems and bioeconomic frameworks to structure the assessment of different crop and forage options.²⁹

Sea-level rise and changes to seasonal rainfall patterns due to climate change result in decreased freshwater availability and higher saline intrusion of the Mekong River Delta during the dry season. Farmers and the Vietnamese Department of Agriculture and Rural Development staff are seeking better soil-management techniques and profitable alternative crops to grow in the dry season. A project led by Jason Condon of Charles Sturt University is providing evidence-based options for profitable crop diversification in the rice production areas of the Mekong River Delta. The project aims to increase production and profitability of saline-affected crop production systems and create a capacity legacy to enable these systems to adapt to ongoing climate change.³⁰

Climate Change

ACIAR will add a new research program to its portfolio in September 2020 to focus and strengthen work towards our strategic objective that addresses climate variability and climate change.

Australia is a world leader in greenhouse gas mitigation research in agriculture. A new project provides the opportunity to transfer this knowledge to assist our partner countries to identify and quantify on-farm management options that reduce emissions from farming practices and help establish national greenhouse gas accounting systems to monitor, report and verify emissions reductions to the same high standard used by Australia. This project, led by Professor Peter Grace of Queensland University of Technology, and co-funded by New Zealand, will work with government and research institutions in Fiji, Vietnam, Indonesia and Kenya to develop expertise to enable those institutions to better support their national governments in meeting current and future nationally determined emissions reduction commitments (NDCs) under the Paris Agreement.³¹

A project in northern Vietnam and Laos is helping farmers adopt maize-based farming systems that reduce soil degradation on sloping land and improve smallholder livelihoods and economic viability. Photo: Harry Campbell-Ross. ACIAR project: SMCN/2014/049.

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Current and proposed projects

1. Improving smallholder farmer incomes through strategic market development in mango supply chains in southern Vietnam (AGB/2012/061)
2. Developing value-chain linkages to enhance the adoption of profitable and sustainable cassava production systems in Vietnam and Indonesia (AGB/2012/078)
3. Improving livelihoods in Myanmar and Vietnam through vegetable value chains (AGB/2014/035)
4. Inclusive agriculture value chain financing [Indonesia, Myanmar, Vietnam] (AGB/2016/163)
5. Enhancing smallholder linkages to markets by optimising transport and logistics infrastructure [Indonesia, Vietnam] (AGB/2017/036)
6. Strengthening leadership, coordination and economic development of the temperate fruit industry in northern Vietnam (AGB/2018/171)
7. Establishing sustainable solutions to cassava diseases in mainland South-East Asia [Cambodia, Laos, Myanmar, Vietnam] (AGB/2018/172)
8. Off-farm: strategic review and planning for enhancing the livelihoods of coffee and pepper smallholders in the Central Highlands of Vietnam through improving stakeholders' participation in agribusiness led value chains (AGB/2018/208)
9. Increasing the sustainability, productivity and economic value of coffee and black pepper farming systems and value chains in the Central Highlands region of Vietnam (AGB/2018/175)
10. Planning and establishing a sustainable smallholder rice chain in the Mekong Delta [Vietnam] (AGB/2019/153)
11. Research to support agricultural policy and strategic planning: research to assist the Vietnam Government with the formulation of the 2021-2030 Agricultural Development Strategy for Vietnam (AGB/2019/185)
12. Characterisation of *Spodoptera frugiperda* (fall armyworm) populations in South-East Asia and northern Australia (co-funded with GRDC) [Indonesia, Vietnam, Laos, Myanmar, Cambodia, Philippines, Malaysia] (CROP/2020/144)
13. Increasing technical skills supporting community-based sea cucumber production in Vietnam and the Philippines (FIS/2016/122)
14. Half-pearl industry development in Tonga and Vietnam (FIS/2016/126)
15. Developing and promoting market-based agroforestry and forest rehabilitation options for Northwest Vietnam (FST/2016/152)
16. Managing risk in South-East Asian forest biosecurity [Indonesia, Vietnam] (FST/2018/179)
17. Scoping for a forest biosecurity network in South-East Asia [Cambodia, Laos, Vietnam] (FST/2020/102)
18. Building effective forest health and biosecurity networks in South-East Asia [Cambodia, Laos, Vietnam] (FST/2020/123)
19. Policy analysis for forest plantations in Laos and Vietnam (FST/2019/121)
20. Intensification of beef cattle production in upland cropping systems in Northwest Vietnam (LPS/2015/037)
21. Investigating and developing interventions to mitigate food borne parasitic disease in production animals in Laos [Laos, Vietnam] (LS/2014/055)
22. Safe pork: market-based approaches to improving the safety of pork in Vietnam (LS/2016/143)
23. Goat production systems and marketing in Laos and Vietnam (LS/2017/034)
24. Forages—taking stock and identifying research needs [Cambodia, Laos, Vietnam] (LS/2018/186)
25. Asian chicken genetic gains: a platform for testing, delivering, and improving chickens for enhanced livelihood outcomes in South-East Asia [Cambodia, Myanmar, Vietnam] (LS/2019/142)
26. Value-adding to existing livestock programs to understand and quantify the implications of greenhouse gas emissions, provide options for emissions reduction and inform in-country policy development [Cambodia, Indonesia, Kenya, Laos, Myanmar, Pakistan, South Africa, Tanzania, Timor-Leste, Vanuatu, Vietnam, Zambia] (LS/2019/159)
27. Analysing gender transformative approaches to agricultural development with ethnic minority communities in Vietnam (SSS/2018/139)
28. A framework for assessing agricultural extension approaches and an analysis of transferrable public health approaches [Australia, Cambodia, Laos, Myanmar, Thailand, Vietnam] (SSS/2019/186)
29. Improving maize-based farming systems on sloping lands in Vietnam and Laos (SMCN/2014/049)
30. Farmer options for crops under saline conditions in the Mekong River Delta, Vietnam (SLAM/2018/144)
31. Supporting greenhouse gas mitigation for sustainable farming systems in the Asia-Pacific and East Africa [Fiji, Indonesia, Kenya, Vietnam] (WAC/2019/150)