5.3

South Asia

Photo: Conor Ashleigh

South Asia

South Asia is an immensely diverse and densely populated region. It is home to 1.5 billion people – one-quarter of the world's population. The region has the highest concentration of poor people in the world, with more than 500 million people living in extreme poverty.

Despite the population pressure, the region has shown impressive annual economic growth at an average of 6.7%. However, the COVID-19 pandemic is projected to significantly and negatively impact the region's economic growth, pushing another 71 million people into extreme poverty. Many more people, particularly women, live marginally above the poverty line but do not have the opportunity to participate in the process of economic growth.

Compared with other regions in the world, South Asia has the highest regional Global Hunger Index and a very low Human Development Index. Half of the population depends on agriculture for their livelihood. Although the share of agriculture in rural employment remains high, growth of the rural non-farm sector is accelerating and now provides a sizeable share of rural income and employment, primarily in services.

Malnutrition is prevalent in South Asia. The region has among the highest burdens of child undernutrition in the world. Thirty-six per cent of children under age 5 are stunted, or too short for their age, which is an indicator of chronic undernutrition. Sixteen per cent are wasted, or too thin for their height, which is an indicator of acute malnutrition. South Asia also has a high prevalence of micronutrient deficiencies, overconsumption and diet-related non-communicable disease.

While the countries of South Asia face common challenges and opportunities in agriculture, there are also fundamental differences between and within these countries in terms of the broad characteristics that influence the nature and success of agriculture. India has 15 distinct agroecological zones. Nepal has 3 distinct topographical zones. The northern hilly region of Bangladesh is geographically distinct from the southern coastal areas, mostly alluvial, with fertile floodplains associated with 3 major rivers. Pakistan's Indus plains are in sharp contrast to the arid regions of Sindh and the hilly and semi-arid areas of the north-west. Sri Lanka's landscape is clearly defined by its dry and wet zones. These regional variations throughout South Asia must be considered when designing a meaningful program for research collaboration to accommodate regional distinctions and varying degrees of vulnerability of the local population.

According to the International Food Policy Research Institute's 2021 Global food policy report: Transforming food systems after COVID-19, South Asia faces continuing and, in some cases, intensifying problems related to climate change, natural disasters, poor food safety and distortionary policies. Fall armyworm devastated Afghanistan, Pakistan and parts of India and Nepal in 2020. Bangladesh and India struggled with flooding during the pandemic, and bird flu caused a nationwide food-safety scare in India. Distortionary policies, and the increasing costs of implementing them, remain, despite overwhelming evidence of their negative impacts and the potential to repurpose these much-needed resources for climate-smart investments or to build robust food-safety institutions. A perplexing reality remains the relatively low volume of agricultural trade among the countries of South Asia.

Given the high population densities and large numbers of vulnerable people, the COVID-19 pandemic has been a huge challenge for South Asia. Agriculture is highly dependent on informal labour, which has been severely limited during lockdowns and restricted by social distancing measures. These were all disruptive factors for supply chains and agriculture markets.

India aims to export a record 10 million tonnes of wheat in 2022–23 amid rising global demand exacerbated by the Ukraine crisis, which will impact buffer stocks and pricing and threaten the region's food security, significantly impacting low-income groups.

Partner countries in the South Asia region

- Bangladesh
- India
- Nepal
- Pakistan
- Sri Lanka

Drivers of regional collaboration

Countries in South Asia share many opportunities and threats that drive the need for regional cooperation, especially in the Eastern Gangetic Plains. Rice and wheat are the region's major staple crops, accounting for about two-thirds of total dietary energy. However, food consumption patterns have changed in the region over the past few decades, and the changes are most apparent in rural areas. Consumption of cereals is declining while consumption of animal-sourced foods, fruits, vegetables and processed foods is increasing.

Pressure to expand food production to meet growing demand is putting stress on natural resources. The resulting expansion and intensification of agriculture is leading to land degradation, deterioration of soil quality and loss of biodiversity, potentially jeopardising the region's capacity to meet future food demand.

Agricultural growth also poses risks for water resources. Facing the world's lowest per capita renewable freshwater resources, millions of rural people in South Asia have benefited from the growing use of groundwater. But aquifers are being depleted and, across the region, watertables are falling, particularly in India. Water quality is also deteriorating throughout the region due to nutrient overloads and industrial pollution, raising concerns about food safety and drinking water quality.

Large areas in several countries of South Asia are prone to natural disasters. Bangladesh and coastal parts of India are threatened frequently by cyclones and floods. Recurring droughts are a common feature in the arid and semi-arid parts of India and Pakistan. The impact of natural calamities is most severe on food-insecure households.

Climate variability, competing and increasing demands from agriculture and industry (including energy production) and population growth are creating severe demands on water availability. Regional cooperation is increasingly essential to manage these shared resources and address shared issues. There are also significant opportunities in regional cooperation to improve the productivity and diversification of agricultural crops, especially beyond cereals, and to improve the sustainability of farming systems through technical, institutional, value-chain and policy research and development.

Sri Lanka is witnessing one of the worst economic and political crises in its history, and the Ukraine crisis has further amplified uncertainty in the region, with oil and fertiliser prices rising.

ACIAR South Asia region program

Australian agricultural and resource management expertise is highly regarded in the South Asia region. ACIAR has a long history of research collaboration in improving crop productivity, forestry, water use efficiency and policy reforms. The South Asia regional program of the Australian Government seeks to underpin Australia's economic engagement in the region by addressing some of the key regionwide barriers to sustainable economic growth and connectivity. Gender equality is a focus in all the investments under the regional program.

The ACIAR strategy in South Asia focuses on communities, production systems and resource management in the 3 main ecosystems of the region – highlands, plains and coastal areas – that are common to Pakistan, India, Bangladesh, Nepal and Sri Lanka.

Research in these areas looks to identify appropriate reform policy, increase adoption of technology (including post-harvest management), improve productivity and livelihoods in marginalised communities, and improve the productivity of crop, livestock, forestry and fisheries systems.

The major pathways of development in the region are modernisation of agrifood systems, technology support, strengthening service providers, developing rural non-farm sector, and local governance at district and state level. Overproduction in some areas and unequal distribution networks due to poorly developed supply-chain management are the major issues in India. Addressing these could play a major role in achieving food and nutrition security and stability in the region.

The medium to long-term strategy in the region focuses on creating regional collaborations that:

- sustainably intensify and diversify cropping systems using conservation agriculture/zero tillage, farm mechanisation, saline land management and adaptation to climate change
- eradicate extreme poverty through improved productivity of food-grain crops (especially wheat and pulses), livestock (in Pakistan), agroforestry (in Nepal) and fisheries (in Sri Lanka)
- better manage agricultural water, including rainfed areas in the Eastern Gangetic Plains and coastal zone
- influence policy about agricultural and farmers' livelihoods and climate change
- increase the emphasis on meaningful gender inclusion and empowerment.

South Asia region program 2022–23

Partner country	No. projects
Bangladesh	12
India	6
Nepal	3
Pakistan	13
Sri Lanka	2

Note that a project may be conducted in several countries, therefore the total number of projects in this table will be greater than the number of projects in the region.

28 projects

20 research projects

8 small research activities

This data was compiled in August 2022. Additional projects may be commissioned during 2022–23.

Research portfolio

3 Agribusiness projects

3 Climate Change projects

7 Crops projects

1 Fisheries project

1 Forestry project

2 Horticulture projects

0 Livestock Systems projects

0 Social Systems projects

1 Soil and Land Management project

10 Water projects

Table 5.3 Current and proposed projects in the South Asia region, 2022–23

Project title	Project code	Country
Agribusiness		
Developing competitive and inclusive value chains of pulses in Pakistan	ADP/2017/004	Pakistan
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
Developing food loss reduction pathways through smart business practices in mango and tomato value chains in Pakistan and Sri Lanka (Food Loss Program)	CS/2020/193	Pakistan, Sri Lanka
Climate Change		
MAC-B: Mitigation adaptation co-benefits modelling trial in Bangladesh	CLIM/2021/109	Bangladesh
Locally led learning to turn polders into flexible assets for adaptation	CLIM/2021/137	Bangladesh
Supporting the tracking sharing learning platform of the Adaptation Research Alliance	CLIM/2022/108	Global
Crops		
Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh	CIM/2014/076	Bangaladesh
Increasing productivity and profitability of pulse production in cereal based cropping systems in Pakistan	CIM/2015/041	Pakistan
International Mungbean Improvement Network 2	CROP/2019/144	Bangladesh, India, Indonesia, Kenya, Myanmar
Managing wheat blast in Bangladesh: Identification and introgression of wheat blast resistance for rapid varietal development and dissemination	CROP/2020/165	Bangladesh
Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan	CROP/2020/167	Bangladesh, Ethiopia, Pakistan
Intercropping for intensification and diversification in the Eastern Gangetic Plains	CROP/2021/155	Bangladesh, India
Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains	CSE/2012/108	Bangladesh, India, Nepal
Fisheries		
Improved productivity, efficiency and sustainability of the culture-based fishery for finfish and giant freshwater prawn in Sri Lankan reservoirs	FIS/2018/157	Sri Lanka
Forestry		
Enhancing livelihoods through improved forest management in Nepal	FST/2017/037	Nepal
Horticulture		
Strengthening vegetable value chains in Pakistan for greater community livelihood benefits	HORT/2016/012	Pakistan
Improving smallholder wellbeing through participation in modern value chains: sustaining future growth in the Pakistan citrus industry	HORT/2020/129	Pakistan
Soil and Land Management		
Developing and translating soil health information in Bangladesh with farmers and for farmers to build resilient agricultural systems	SLAM/2021/107	Bangladesh
Water		
Cropping system intensification in the salt-affected coastal zones of Bangladesh and West Bengal, India	LWR/2014/073	Bangladesh, India
Nutrient management for diversified cropping in Bangladesh	LWR/2016/136	Bangladesh
Adapting to salinity in the southern Indus Basin	LWR/2017/027	Pakistan
Water management for smallholder farmers: Outscaling ACIAR research in the Andhra Pradesh Drought Mitigation Program	WAC/2018/164	India
Transforming smallholder food systems in the Eastern Gangetic Plain	WAC/2020/148	Bangladesh, India, Nepal
Opportunities for brackish and saline aquaculture in Pakistan	WAC/2020/179	Pakistan
Virtual Irrigation Academy business models in Pakistan	WAC/2020/180	Pakistan
Supporting inter-provincial water allocation decision making in Pakistan	WAC/2021/103	Pakistan
Groundwater management in Pakistan	WAC/2021/134	Pakistan
Trees for salinity management, Sindh, Pakistan	WAC/2021/136	Pakistan

Bangladesh

A$2.11 million
Budgeted funding

11
Bilateral and regional research projects

2
Small projects and activities

Agriculture plays a pivotal role in the Bangladesh economy and in the lives of the vast majority of the population.

The agriculture sector accounts for more than half of employment in Bangladesh. Notwithstanding its transformation from a country of chronic food shortages to one of net food grain self-sufficiency, Bangladesh still faces very substantial food security challenges. While poverty is steadily declining, many people still live below the poverty line.

Recently, Bangladesh has made impressive progress in achieving national food security. Investments in agricultural research have played a pivotal role in driving productivity increases of major crops. The ongoing challenge is to improve productivity of low-lying areas and rainfed cropping systems and increase rural incomes. This goal is adversely affected by increasing seasonal climate variability, reduced freshwater river flows and seawater intrusion.

Climate change is the most pressing issue for Bangladesh, with varying levels of vulnerability and impacts across the country. Coastal areas are prone to salinity intrusion and tropical cyclones, the floodplains in the central areas are prone to floods, the north-western region is prone to drought, the north-eastern region is prone to flash floods and the hilly regions are prone to erosion and landslides.

Bangladesh is an active participant in the global effort to combat climate change and must develop adequate adaptive capacity to protect its people and economy. In view of the substantial long-term challenges presented by climate change, the government has developed a long-term Bangladesh Delta Plan 2100 that focuses on developing approaches to sustainable management of water, environment and land resources.

The Bangladesh Climate Change Strategy and Action Plan is the de facto policy document that provides strategic direction for work on climate-change related issues. Many elements of climate-change adaptation in the country are also being addressed through specific sectoral policies. Recent consultations highlighted that the consequences of climate change on rural livelihoods is the most pressing issue facing Bangladesh and is likely to drive thinking about future priorities for research collaboration with ACIAR.

Key priorities for Bangladesh (National Agriculture Policy 2018) that align with ACIAR objectives are:

- diversification of crops, including production of high-value crops
- development and promotion of stress-tolerant, disease-resistant and nutritious crop varieties
- improvement of crop production systems for market-oriented agriculture
- building national capacity in innovation
- extension of technologies to increase overall productivity growth and reduce the difference between research farm and field-level yields.

ACIAR supports regional approaches to assisting Bangladesh, including in the areas of natural resource management, improving trade connectivity and encouraging investments to empower women to participate in cross-regional trade opportunities.

Country priorities

Bangladesh has been an ACIAR partner country since the mid-1990s. Over time, the ACIAR program has shifted towards a farming systems approach supporting broader food security aspects, improved production and diversification of the rice-based farming systems, and adaptation to climate change. This approach includes research on short-duration varieties of pulses to fit the farming system, conservation agriculture-based technologies and related mechanisation, saline land management and adaptation to climate change. ACIAR-supported programs in Bangladesh have focused on the undulating lands of the north and north-west regions and the coastal region (which is the poorest and most vulnerable region in the country). Bangladesh's ability to maintain food security given its high vulnerability to the impacts of climate change underpins the priorities for our support.

Key agricultural production challenges are common to many countries of South Asia, and we play a role in strengthening regional research linkages between Bangladesh and other countries, particularly India (Bihar and West Bengal states) and Nepal (eastern Terai region).

Consultation with key research and development stakeholders in Bangladesh and Australia established the ACIAR–Bangladesh Collaboration Strategy 2021–2030 and confirmed the following priorities for research collaboration:

- crop improvement, with a focus on wheat, maize and pulses
- improved farming systems, with a focus on cropping systems and diversification
- water management, with a focus on managing both quantity (scarcity, groundwater and waterlogging) and quality (salinity)
- soil fertility and soil management
- markets, diversification and agricultural value chains
- agricultural mechanisation.

Research will focus on farming systems of north, north-west and coastal Bangladesh.

The Krishi Gobeshona Foundation is a strategic partner and co-investor with ACIAR in Bangladesh. The foundation is an agricultural research funding organisation that has made major investments in funding research and capacity building in ACIAR-supported projects. The partnership with the foundation for collaboration in agriculture research and development in Bangladesh was renewed in January 2021 for 5 years.

2022–23 research program

- **13 ACIAR-supported projects in Bangladesh**
- **6 projects are specific to this country**
- **7 projects are part of regional projects**

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations. The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Bangladesh. 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 measured not only by income growth in the rural population, but also by the degree of inclusiveness in the 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. During 2022–23, researchers will analyse and report on the results of their study into the components of success and the different impacts of rural transformation on women and men.[1]

The priorities of the ACIAR research program in Bangladesh focus on supporting the country to maintain food security given its high vulnerability to the impacts of climate change. Photo: Conor Ashleigh

Climate Change

There are many potential agricultural management changes that could help farmers adapt to and mitigate climate change, but the pace of climate response is slow. Co-benefits modelling could help accelerate climate response by allowing more efficient screening of many potential interventions at once and comparing them to identify the most promising subset, including those that also deliver social and economic benefits. The Agricultural Model Intercomparison and Improvement Project (AgMIP) is a global collaborative initiative that has developed such a co-benefits modelling approach. A small research activity led by Dr Jonas Jaegermeyr and Erik Mencos Contreras of Columbia University and colleagues in Bangladesh has been trialling these modelling methods in rice production systems. In the final stages of the project, the researchers will identify climate responses with the greatest potential for multiple benefits and revise and validate the methods for application globally.[2]

In south-west Bangladesh, polders are potentially an important feature of agricultural production systems that could facilitate ongoing learning, adjustment and adaptation to climate change. Polders can be managed in various ways to support different types of agricultural production, but previous research has focused on optimising management for current conditions rather than building local capacity to change management as conditions change, including sea levels, tidal surge and patterns of river flows. Led by Mr T.S. Amjath Babu of CIMMYT with the International Centre for Climate Change and Development as well as Australian agricultural learning systems expert Dr Christine King, a new project will co-develop targeted processes and local governing organisations so that locally led social learning can support adaptive management of polders as baseline climate conditions continue to change.[3]

Crops

In the coastal regions of southern Bangladesh, agriculture centres on the annual cropping of rice in the monsoon season and other crops in the dry (rabi) season. While the system is profitable, it is limited by topography, soil salinity and irrigation availability. A 5-year project led by Professor William Erskine of the University of Western Australia aims to improve productivity and profitability of dry-season cropping on non-saline land, and introduce pulses and wheat with improved salinity tolerance for saline land. Final-year activities for the project include demonstrations of best practice for mungbean, cowpea, garden pea and wheat production, field validation of wheat lines for salinity tolerance, and piloting the deployment of mini-mills to process pulse grains.[4]

Mungbean is an ideal rotation crop for smallholder farmers throughout the Indian Ocean Rim region. The International Mungbean Improvement Network, established through a 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 in Bangladesh, India, Myanmar and Australia. Phase 2 of the project extends the network to Kenya and Indonesia, expanding the source of germplasm to develop new mungbean varieties, as well as strengthening the capacity of more national mungbean breeding programs.[5]

Hybrid wheat has the potential to produce more grain from the same or less land, significantly contributing to food security and land sustainability. However, technical difficulties of hybrid wheat development and the high cost of hybrid seed have constrained the commercial development of new varieties for many decades. Professor Richard Trethowan of the University of Sydney leads a project that aims to extend the benefits of new hybrid wheat systems to researchers, wheat breeders, farmers and consumers in Pakistan, Bangladesh and Ethiopia. The university has developed a novel, cost-effective and practical system to rapidly produce large numbers of wheat hybrid combinations for testing in breeding programs, and to produce large amounts of hybrid seed for sale to farmers at an acceptable cost. The project will establish the performance of the hybrids, and determine effective technical processes and business models to produce the seed in collaboration with the national programs and local seed providers in each country.[6]

Wheat blast is a fungal disease now established in Bangladesh which continues to threaten crops throughout South Asia. A large-scale epidemic is inevitable in conducive conditions, and this will have a large impact on wheat production and food security in the region. Dr Pawan Kumar Singh of CIMMYT leads an ACIAR-funded project to support the operation of the wheat blast screening platform established under a previous ACIAR project. The platform is operated in Jashore by Bangladesh researchers, with support from CIMMYT, and is being used by the global wheat research community. The new project will identify new sources of resistance to wheat blast by continuing to support the platform, map the resistance genes, facilitate the rapid breeding of elite varieties for Bangladesh farmers, and document adoption by farmers of new varieties resistant to wheat blast.[7]

The practice of intercropping (growing 2 crops concurrently in one field) was widespread in the northern cereal-growing belt of the Eastern Gangetic Plains until the early 2000s, when disease restricted the area of wheat production. The recent and widespread production of maize – a wider row crop compared to wheat – creates new possibilities for intercropping. While wide-row intercropping has been investigated in North Asia and South America, little research has been conducted in South Asia. Potential benefits include increased cropping system productivity, increased water, labour and energy-use efficiencies, improved nutrition and food security for rural households, economic empowerment for women, and over the longer term, increased soil health. Ms Alison Laing of CSIRO is leading a small research activity on wide-row intercropping to test initial ideas and prepare a research project to design effective wide-row intercropping and determine its agronomic, social and economic implications in the Eastern-Gangetic Plains.[8]

Previous ACIAR projects have identified crop management options to increase productivity in the Eastern Gangetic Plains. This project led by Professor Fay Rola-Rubzen is identifying behavioural components of household decision-making about the adoption of new practices to support sustainable intensification based on conservation agriculture. In its final year, the project will collect evidence of the outcome of behavioural science-inspired methods to inform and engage farming families.[9]

Soil and Land Management

The translation of soil health information, particularly soil resilience, is generally of low value to smallholder farmers due to significant knowledge and language differences between those producing the information and their target audience. A new project led by Professor Chengrong Chen of Griffith University will take a transdisciplinary approach to develop soil health information. The project will bring researchers, farmers, extension agents and other stakeholders together to develop a shared understanding of soil-related problems and risks, particularly abiotic climate induced stress factors. The project will improve soil health and the resilience of farming systems in Bangladesh by developing co-designed solutions appropriate for smallholders.[10]

Improved nutrient management for emerging and more intensive cropping systems is the focus of a project in the coastal zone of Bangladesh, led by Murdoch University. Photo: Conor Ashleigh

Water

Improved nutrient management to increase the profitability and sustainability of intensive and emerging cropping systems is the focus of a project in the coastal zone of Bangladesh, led by Professor Richard Bell of Murdoch University. The first phase of the project (2017 to 2021) established that the adoption of fertiliser recommendation tools can decrease production costs and increase income and yield for smallholder farmers. The project has been extended until the end of 2022 to scale out the use of tools developed by the project and advance practice change. The final phase of the project will test a collective action approach for nutrient management and expand the scope for monitoring and evaluation of the innovations.[11]

The Ganges Delta region, in Bangladesh and India, is characterised by poverty, food insecurity, environmental vulnerability and limited livelihood opportunities, and is highly vulnerable to inundation from rising sea levels. Since 2016, ACIAR has partnered with the Krishi Gobeshona Foundation of Bangladesh to lift agricultural productivity, and hence rural welfare, by increasing cropping intensification. A new phase of the partnership, starting in 2022, aims to strengthen farmer confidence in the technologies introduced previously and demonstrate practices that may mitigate or avoid risks due to untimely rainfall and drainage management. Dr Mohammed Mainuddin of CSIRO leads the project that will also provide information to support the implementation of development plans in the region.[12]

The Eastern Gangetic Plains straddles Bangladesh, India and Nepal. The region is home to 450 million people and has the world's highest concentration of rural poverty. People in this region have a high dependence on agriculture for food and livelihood security. Dr Tamara Jackson of the University of Adelaide leads a project to understand the processes and practices of transforming food systems through diversification to improve farm livelihoods while reducing inequity, production risk and unsustainable resource use. By gaining an understanding of the existing context for diversification in the region, and associated technologies, scaling interventions, and policies and programs, the project will consider these elements individually and demonstrate the interactions between them using case studies to highlight where and how diversification has occurred in the past. In subsequent phases, the project will identify priority opportunities with communities and determine their fit with projected climate change and water availability, and the impact of high-level policies.[13]

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Water: Dr Neil Lazarow

See page 186 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. MAC-B: Mitigation adaptation co-benefits modelling trial in Bangladesh (CLIM/2021/109)
3. Locally led learning to turn polders into flexible assets for adaptation [Bangladesh] (CLIM/2021/137)
4. Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh (CIM/2014/076)
5. International Mungbean Improvement Network 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
6. Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan (CROP/2020/167)
7. Managing wheat blast in Bangladesh: identification and introgression of wheat blast resistance for rapid varietal development and dissemination (CROP/2020/165)
8. Intercropping for intensification and diversification in the Eastern Gangetic Plains [Bangladesh, India] (CROP/2021/155)
9. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (CSE/2012/108)
10. Developing and translating soil health information in Bangladesh with farmers and for farmers to build resilient agricultural systems (SLAM/2021/107)
11. Nutrient management for diversified cropping in Bangladesh (LWR/2016/136)
12. Cropping system intensification in the salt-affected coastal zones of Bangladesh and West Bengal, India (LWR/2014/073)
13. Transforming smallholder food systems in the Eastern Gangetic Plain [Bangladesh, India, Nepal] (WAC/2020/148)

India

A$0.67 million
Budgeted funding

4
Bilateral and regional research projects

2
Small projects and activities

With more than 1.3 billion people, India is the second most populous country in the world, after China, and accounts for 18% of the world's population. Two-thirds of India's population live in rural areas, with landholdings averaging 1.1 hectares. The rural population is highly vulnerable to the impacts of a declining natural resource base, biosecurity threats and climate change.

Worth US$2.94 trillion, India is the world's fifth largest economy, overtaking the United Kingdom and France. India is emerging as a major agricultural exporter of several key commodities and is currently the largest exporter of rice globally and the second largest exporter of cotton. While the contribution of the agriculture sector to GDP is declining, agriculture remains a major source of employment and accounts for 42% of the total national workforce.

The COVID-19 pandemic and associated lockdowns affected all sectors of the Indian economy; however, agriculture emerged as the main driver of economic growth, recording positive growth of 3.4% (at constant prices) in 2020–21.

Agricultural production has been increasing by an average of 3.6% per year since 2011, due to improved access to inputs such as fertiliser and seed, irrigation and credit facilities. The sector has also diversified from cereal grains to pulses, fruit, vegetables and livestock products, largely driven by evolving demographics, urbanisation and changing consumer demand patterns. However, the sector is still challenged by inefficient market mechanisms, subsidy distortions, lack of storage infrastructure, inefficient use of natural resources and susceptibility to climate change and extreme weather events.

In response to the COVID-19 pandemic, the government announced the 'Atmanirbhar Bharat Abhiyan' (Self-Reliant India) program in 2020. The initiative included institutional credit facilities at concessional rates, creation of an Agriculture Infrastructure Development Fund for projects at farm-gate and aggregation points, and release of emergency funds to provide working capital to farmers through crop loans. The initiative continued into 2021 with increased allocation to the infrastructure fund.

The Government of India, in its various policies and schemes, focuses closely on the role of women in agriculture. It advocates mainstreaming of women's role in agriculture as part of all programs in the agricultural development agenda.

Although 30% of budgetary allocations under various schemes have been made for women farmers, fund utilisation under these schemes has declined. Moreover, due to the complex and varied nature of agriculture in India, there has been a trend of defeminisation in certain pockets of the country. Although policy articulation by the government on the rights of women farmers has shifted, there is still a huge knowledge gap and limited resources to implement gender-inclusive agricultural development strategies.

In June 2020, the leaders of both countries participated in the Australia–India Leaders' Virtual Summit, where they elevated the bilateral Strategic Partnership to a Comprehensive Strategic Partnership. One initiative agreed under the partnership is that India and Australia will boost collaboration on science, technology and research, initially focused on COVID-19 responses. As part of the response being coordinated by Australia's High Commission, in 2022–23 ACIAR is working to clarify the role we can play in supporting the ambition for increased research collaboration between India and Australia.

In April 2022, the Australia–India Economic Cooperation and Trade Agreement was signed. The agreement includes a provision that both countries will cooperate to promote agricultural trade as part of the agreement and will work toward concluding an enhanced agricultural Memorandum of Understanding (MoU). An update to An India Economic Strategy 2035, an ambitious plan to transform Australia's economic partnership with India out to 2035, was also launched in April 2022. The Strategy was an independent report submitted to the Australian Government in 2018.

Country priorities

ACIAR has supported a program of collaborative research with India since 1983. Presently, the ACIAR research program with India is delivered entirely through a regional collaborative approach involving neighbouring countries with shared issues and opportunities. Substantial co-investment from India will increasingly become a desired characteristic of our partnership to maintain an ongoing program of collaboration in future.

The geographic focus on the eastern regions of India and its neighbours will remain the same, with a thematic focus on:

- management of agricultural water, including rainfed areas in the Eastern Gangetic Plains and coastal zone
- sustainable intensification and diversification of cropping systems with support of conservation agriculture/zero tillage
- breeding of improved varieties of mungbean
- assisted policy development for farmers' livelihoods and climate change.

Existing collaboration between ACIAR and organisations in India has the potential to evolve into a substantial co-invested partnership providing benefits for both countries. As a result of a recent partnership refresh between ACIAR and Indian Council of Agricultural Research, in 2022–23 we will explore, at India's request, the possibilities for enhanced collaboration in:

- sustainable intensification with a nutrition framework
- diversification into new dry-season crops
- the role of biotechnology in crop development
- new mechanisation opportunities including farm robotics
- a next phase of mungbean breeding for high-yielding varieties
- groundwater management (overexploitation and under-exploitation)
- co-investment and trilateral collaboration.

2022–23 research program

- **6 ACIAR-supported projects in India**
- **1 project is specific to this country**
- **5 projects are part of regional projects**

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations. The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in India. 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.

Crops

Mungbean is an ideal rotation crop for smallholder farmers throughout the Indian Ocean Rim region. The International Mungbean Improvement Network, established through a 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 in Bangladesh, India, Myanmar and Australia. Phase 2 of the project extends the network to Kenya and Indonesia, expanding the source of germplasm to develop new mungbean varieties, as well as strengthening the capacity of more national mungbean breeding programs.[1]

The practice of intercropping (growing 2 crops concurrently in one field) was widespread in the northern cereal-growing belt of the Eastern Gangetic Plains until the early 2000s, when disease restricted the area of wheat production. The recent and widespread production of maize – a wider row crop compared to wheat – creates new possibilities for intercropping. While wide-row intercropping has been investigated in North Asia and South America, little research has been conducted in South Asia. Potential benefits include increased cropping system productivity, increased water, labour and energy-use efficiencies, improved nutrition and food security for rural households, economic empowerment for women, and over the longer term, increased soil health. Ms Alison Laing of CSIRO is leading a small research activity on wide-row intercropping to test initial ideas and prepare a research project to design effective wide-row intercropping and determine its agronomic, social and economic implications in the Eastern-Gangetic Plains.[2]

Previous ACIAR projects have identified crop management options to increase productivity in the Eastern Gangetic Plains. This project led by Professor Fay Rola-Rubzen is identifying behavioural components of household decision-making about the adoption of new practices to support sustainable intensification based on conservation agriculture. In its final year, the project will collect evidence of the outcome of behavioural science-inspired methods to inform and engage farming families.[3]

Water

The Ganges Delta region, in Bangladesh and India, is characterised by poverty, food insecurity, environmental vulnerability and limited livelihood opportunities, and is highly vulnerable to inundation from rising sea levels. Since 2016, ACIAR has partnered with the Krishi Gobeshona Foundation of Bangladesh to lift agricultural productivity, and hence rural welfare, by increasing cropping intensification. A new phase of the partnership, starting in 2022, aims to strengthen farmer confidence in the technologies introduced previously and demonstrate practices that may mitigate or avoid risks due to untimely rainfall and drainage management. Dr Mohammed Mainuddin of CSIRO leads the project that will also provide information to support the implementation of development plans in the region.[4]

The Eastern Gangetic Plains straddles Bangladesh, India and Nepal. The region is home to 450 million people and has the world's highest concentration of rural poverty. People in this region have a high dependence on agriculture for food and livelihood security. Dr Tamara Jackson of the University of Adelaide leads a project to understand the processes and practices of transforming food systems through diversification to improve farm livelihoods while reducing inequity, production risk and unsustainable resource use. By gaining an understanding of the existing context for diversification in the region, and associated technologies, scaling interventions, and policies and programs, the project will consider these elements individually and demonstrate the interactions between them using case studies to highlight where and how diversification has occurred in the past. In subsequent phases, the project will identify priority opportunities with communities and determine their fit with projected climate change and water availability, and the impact of high-level policies.[5]

Australian experts are providing technical support to 5 large land and water management programs in the Indian states of Andhra Pradesh and Odisha. These programs draw on previous ACIAR-supported projects on climate risk management, participatory groundwater management and social learning for irrigation management and governance. Dr Uday Nidumolu of CSIRO Agriculture and Food leads the project, which will work with Indian counterparts to integrate the research, support out-scaling and then co-learn about out-scaling. COVID-19 outbreaks in South Asia mean that training will be delivered online and field activities have been postponed.[6]

Regional Manager, South Asia
Dr Pratibha Singh

Research Program Managers
Crops: Dr Eric Huttner
Water: Dr Neil Lazarow

See page 186 for contact details.

Current and proposed projects

1. International Mungbean Improvement Network 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
2. Intercropping for intensification and diversification in the Eastern Gangetic Plains [Bangladesh, India] (CROP/2021/155)
3. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (CSE/2012/108)
4. Cropping system intensification in the salt-affected coastal zones of Bangladesh and West Bengal, India (LWR/2014/073)
5. Transforming smallholder food systems in the Eastern Gangetic Plain [Bangladesh, India, Nepal] (WAC/2020/148)
6. Water management for smallholder farmers: Outscaling ACIAR research in Andhra Pradesh Drought Mitigation Program [India] (WAC/2018/164)

Nepal

A$0.77 million
Budgeted funding

3
Bilateral and regional research projects

Agriculture is the largest economic sector of Nepal. It supports livelihoods of 66% of the population and contributes 36% of national GDP. Farming is largely subsistence and cropping is mostly integrated with livestock production.

Agriculture in Nepal is highly diverse due to the wide range of climates and geographies in the country. The challenges facing agriculture in the lowland Terai rice–wheat farming systems (part of the Eastern Gangetic Plains) are vastly different to those in the mixed crop–livestock–tree farming systems of the hill and mountain areas. Broadly, however, the challenges include:

- the need for seed system improvements
- degradation of natural resources
- underdeveloped agricultural institutions and policies
- declining availability of labour
- access to productive technologies and mechanisation to improve farm household livelihoods.

Natural disasters frame the recent history of the country. In 2015, the deadliest earthquake in 81 years struck Nepal, followed by hundreds of aftershocks and another severe earthquake 17 days later. The process of recovery continues. In 2017, Nepal was hit by devastating floods, causing US$172 million in losses and damage to the agriculture sector alone.

Nepal's Agriculture Development Strategy 2015–2035 outlines a vision for a self-reliant, sustainable, competitive and inclusive agriculture sector that drives economic growth and contributes to improved livelihoods and food and nutrition security. It conceptualises transformation of Nepal from a society primarily based on agriculture to one that derives most of its income from services and industry. The 20-year strategy aims to halve poverty in less than 10 years through an agriculture-led economy achieving improved governance, higher productivity, profitable commercialisation and increased competitiveness.

The Agriculture Development Strategy also guides policies that include women, and states that all agricultural programs will be designed to benefit women. It promotes women's organisations and agroenterprises led by women through specific programs and recommends equal wages for women labourers. The strategy also promotes action to raise awareness of women's rights to land, and builds the capacity of women to manage irrigation, water resources and finances.

Country priorities

ACIAR has supported collaborative research with Nepal since the early 1990s, including projects on small ruminants, wheat and legumes. The focus for ACIAR during 2022–23 continues to be the engagement of Nepal in a regional program to improve integration of soil, water, crop, livestock and tree components of the farming systems.

Increased farm and forest productivity remains a core priority of Nepal for collaboration with ACIAR to improve food and nutrition security of the rural poor. In the Middle Hills districts, where the impacts of earthquakes and floods remain, our program supports the request of the Nepalese Government to focus primarily on research to support increased timber production from community forests. Another area of requested focus is understanding the implications of federalism on agriculture in Nepal.

Given the common agricultural production challenges across the alluvial plains of Nepal, eastern India and Bangladesh, cooperative research linkages with neighbouring countries will be explored further during 2022–23. The focus will be on conservation agriculture, to address key issues such as declining soil health, burning of rice stubble, falling groundwater levels and inequities in access to water.

Nepal hosts an important regional research body – the International Center for Integrated Mountain Development. ACIAR and DFAT are working with the center to identify prospective areas for research collaboration.

2022–23 research program

- **3 ACIAR-supported projects in Nepal**
- **1 project is specific to this country**
- **2 projects are part of regional projects**

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations. The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Nepal. 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.

Crops

Previous ACIAR projects have identified crop management options to increase productivity in the Eastern Gangetic Plains. This project led by Professor Fay Rola-Rubzen is identifying behavioural components of household decision-making about the adoption of new practices to support sustainable intensification based on conservation agriculture. In its final year, the project will collect evidence of the outcome of behavioural science-inspired methods to inform and engage farming families.[1]

Forestry

The Middle Hills of Nepal are home to 44% of the country's population, and most people gain their livelihoods from a combination of agricultural and forest products. Most forest lands have been returned to community forest user groups, with suboptimal management and minimal timber harvest. Previous ACIAR-supported work demonstrated the effectiveness of a silvicultural management package called Active and Equitable Forest Management to improve livelihoods, social equity and environmental impacts. Dr Ian Nuberg of the University of Adelaide leads a project focusing on adopting improved forestry practices, developing community forestry planning, governance and gender equity frameworks, and poverty-reducing, small-scale forest enterprises in Kahbre Palanchok and Sindhu Palchok districts. In 2022–23, researchers will document case studies and report on the policy implications of research on community forest enterprises.[2]

Water

The Eastern Gangetic Plains straddles Bangladesh, India and Nepal. The region is home to 450 million people and has the world's highest concentration of rural poverty. People in this region have a high dependence on agriculture for food and livelihood security. Dr Tamara Jackson of the University of Adelaide leads a project to understand the processes and practices of transforming of food systems through diversification to improve farm livelihoods while reducing inequity, production risk and unsustainable resource use. By gaining an understanding of the existing context for diversification in the region, and associated technologies, scaling interventions, and policies and programs, the project will consider these elements individually and demonstrate the interactions between them using case studies to highlight where and how diversification has occurred in the past. In subsequent phases, the project will identify priority opportunities with communities and determine their fit with projected climate change and water availability, and the impact of high-level policies.[3]

Regional Manager, South Asia
Dr Pratibha Singh

Research Program Managers
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Forestry: Dr Nora Devoe
Water: Dr Neil Lazarow

See page 186 for contact details.

Current and proposed projects

1. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (CSE/2012/108)
2. Enhancing livelihoods through improved forest management in Nepal (FST/2017/037)
3. Transforming smallholder food systems in the Eastern Gangetic Plain [Bangladesh, India, Nepal] (WAC/2020/148)

Pakistan

A$3.59 million
Budgeted funding

9
Bilateral and regional research projects

4
Small projects and activities

Agriculture is the largest sector of Pakistan's economy, contributing 19% to GDP and engaging 38% of the national workforce. This is the largest segment of the workforce and two-thirds are women. Pakistan's strong research system has been driving innovation and improvements in this sector.

The COVID-19 pandemic has put significant pressure on the economy of Pakistan. Drastic measures to control the pandemic significantly reduced economic activity (including activity in agrifood systems), with consequent impacts on livelihoods, food security and nutrition.

Before the pandemic, about 25% of the population lived below the national poverty line. Food insecurity is typically high, with 20–30% of the population (40 to 62 million people) experiencing some form of food insecurity and chronic vulnerability through natural hazards and shocks, including the ongoing pandemic. The continued lockdown has affected the demand for food. This is due not only to limited physical access but also declining financial resources. Lockdown reduced or eliminated the earnings of almost 3 million informal daily wage labourers working in agriculture and other related activities.

Food market mechanisms in Pakistan are strong and well-integrated but temporary supply shocks occurred due to disturbance in logistics. This affected the price and supply of perishable goods, imported food and processed food. Along with a high rate of population growth, food and water security are among the most pressing challenges for Pakistan in the current circumstances.

Pakistan recognises that cost-effective availability of energy, water and food is essential to ensure sustainable economic growth and development. Sizeable national and provincial programs are being funded to revolutionise the agriculture and livestock sectors. These programs are aimed at increasing agricultural productivity and value addition, reducing dependence on imports, supporting and stimulating agriculture-based industries, and improving the livelihoods and wellbeing of farming communities.

Pakistan is ranked third in the world of countries facing water shortages. It is estimated that Pakistan will become the most water-stressed country in South Asia by 2040, with absolute water scarcity by 2025. There are many reasons for the country's water scarcity. The most important are climate change, urbanisation and high dependence on groundwater for agriculture and other operations.

Country priorities

Australia has a 70-year development assistance relationship with Pakistan, which has contributed to Pakistan's long-term economic prosperity, stability and resilience. ACIAR is regarded as a key international partner supporting agricultural research in Pakistan. Australia is seen as a country with deep, relevant expertise in agriculture, livestock production and water management. Our work is high profile and regularly gains the attention of policymakers at national and provincial levels.

Australia has helped Pakistan increase livelihood opportunities for men and women living in poverty by enhancing agricultural productivity and expanding revenue streams for farmers through improved water management practices, adding value to raw agricultural products and improving access to markets. Our programs have invested in the people of Pakistan, especially women and girls.

Our program with Pakistan is based on Australia's global expertise in areas that are high-priority concerns for Pakistan, and the recognition that water and food security are critical to Pakistan's long-term stability. Pakistan's strong network of researchers has a longstanding platform of collaboration with Australian researchers, which is highly valued by both countries.

The ongoing focus of our research collaboration is:

- empowering women to enhance farm incomes
- water management, particularly horizontal expansion, salinity management, water harvesting, and low-cost/high-efficiency irrigation systems
- crop improvement, particularly productivity enhancement and access to novel breeding techniques
- horticulture, including fresh produce and nursery certification systems
- agribusiness development, including background research in value-adding, product development, branding and traceability systems for growing private sector needs, which the national system cannot provide
- models for rural transformation.

When pandemic conditions permit, we will recalibrate our relationship with Pakistan with a 10-year plan for research cooperation. This will enable a stronger equal partnership of international research collaboration with substantial co-investment for mutual benefit.

2022–23 research program

- **13 ACIAR-supported projects in Pakistan**
- **10 projects are specific to this country**
- **3 projects are part of regional projects**

The research program addresses our high-level objectives, as outlined in the ACIAR 10-Year Strategy 2018–2027, as well as specific issues and opportunities identified by ACIAR and our partner organisations.

The following sections briefly describe individual ACIAR-supported projects and anticipated outputs in Pakistan. 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.

The Quaid-i-Azam University leads a new project using mango and tomato as focal commodities to map value chains in Pakistan and Sri Lanka, to identify the extent and root causes of food losses.

Agribusiness

Success in rural transformation is measured not only by income growth in the rural population, but also by the degree of inclusiveness in the 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. During 2022–23, researchers will analyse and report on the results of their study into the components of success and the different impacts of rural transformation on women and men.[1]

Pulses are important to both agricultural systems and diets in Pakistan, but domestic production has declined in recent decades. Pakistan now imports 80% of lentils and 10% of chickpeas to meet domestic demand. A project led by Dr Rajendra Adhikari of the University of Queensland is developing socially inclusive and competitive value chains for pulses in Punjab and Sindh, with spillover benefits expected for Khyber Pakhtunkhwa. These 3 regions are characterised by gender inequality within industry and society. Chickpeas, lentils and mungbean are well-suited to smallholder farming by both women and men. Before the project concludes in 2023, researchers will deliver capacity building activities for smallholder farmers to improve connections between farmers and markets and finalise policy advice and recommendations for decision-makers to assist industry development.[2]

Fresh fruits and vegetables are important food commodities in both Pakistan and Sri Lanka. Maintaining quality and freshness under humid tropical conditions presents a vast challenge in meeting the growing demand for domestic consumption and export. Supply chains are inadequate and inefficient. Food losses are large, especially during seasonal gluts. Associate Professor Anwar Shah of Quaid-i-Azam University leads a new project using mango and tomato as focal commodities to map value chains in Pakistan and Sri Lanka, to identify the extent and root causes of food losses. The project will design and demonstrate affordable technological and organisational options to mitigate losses and create new economic opportunities. Sri Lanka provides a useful case study to contrast its fruit and vegtable value chain against Pakistan. This project is part of the ACIAR–IDRC Food Loss Research Program (page 23).[3]

Crops

Hybrid wheat has the potential to produce more grain from the same or less land, significantly contributing to food security and land sustainability. However, technical difficulties of hybrid wheat development and the high cost of hybrid seed have constrained the commercial development of new varieties for many decades. Professor Richard Trethowan of the University of Sydney leads a project that aims to extend the benefits of new hybrid wheat systems to researchers, wheat breeders, farmers and consumers in Pakistan, Bangladesh and Ethiopia. The university has developed a novel, cost-effective and practical system to rapidly produce large numbers of wheat hybrid combinations for testing in breeding programs, and to produce large amounts of hybrid seed for sale to farmers at an acceptable cost. The project will establish the performance of the hybrids, and determine effective technical processes and business models to produce the seed in collaboration with the national programs and local seed providers in each country.[4]

The demand for pulses in Pakistan has been increasing, while production is decreasing. Despite relatively high prices, pulses, especially chickpea and lentils, have been pushed out to the most marginal lands, and labour shortages are a major production constraint. Reintroducing legumes into existing cropping systems would have nutritional, economic and environmental benefits and has been identified as a priority for agriculture development by the Pakistan Government. In its final year, the 6-year project led by Dr Ata-ur Rehman of Charles Sturt University will use results to engage partners and farmers in scaling out effective innovations to intensify pulses production and increase productivity. The project will also identify emerging knowledge gaps and research opportunities to improve pulses production in Pakistan.[5]

Horticulture

The horticulture sector in Pakistan is significant, both domestically and for export production. Dr Babar Ehsan Bajwa of CABI leads a project to strengthen selected vegetable value chains in Punjab and Sindh provinces as part of the Agriculture Value Chain Collaborative Research Program (Aik-Saath). Focusing on potatoes, chillies, tomatoes and onions, in 2022–23, the project team will deliver capacity building activities to support the implementation, scaling out and monitoring of interventions and improve pre and post-harvest processes, from improved seedlings and variety selection to better packaging, transport, and marketing.[6]

Citrus is Pakistan's leading fruit crop, and although production is increasing, productivity is below comparable countries, farm-gate waste is high and value is stagnant. Waste continues throughout the value chain, with post-harvest losses in citrus ranging between 23% and 38%. Despite these limitations, the industry's main product, Kinnow mandarin, has market potential at higher levels of quality and value, especially for export. Further, citrus industry development is a priority for provincial and national governments. A project led by Dr Rajendra Adhikari of the University of Queensland aims to improve the wellbeing of citrus-producing smallholder families through participation in inclusive value chains that meet market needs and provide equitable returns to farmers.[7]

Water

Salinity currently affects 4.5 million hectares of land across Pakistan and 54% of the southern Indus Basin, threatening agricultural production and livelihoods, resulting in high rates of poverty for communities living in affected areas. A project led by Dr Michael Mitchell of Charles Sturt University aims to build the adaptive capacity of farming and coastal communities in salinity-affected areas to maintain and improve their livelihoods. During 2022–23, the project will finalise analysis and report on the status and future trends of salinity in southern Indus Basin, including policy and management recommendations, and capacity building and mentoring of next users of groundwater monitoring and modelling tools. The project will report on for future research into adaptation strategies, drawing on value chain analysis; and prepare a strategy for scaling out selected adaption strategies beyond the life of the project.[8]

In Pakistan, inland groundwater reserves over a large area of the country are saline, and about 40,000 hectares of agricultural land are abandoned within the Indus Basin annually due to secondary salinisation. Aquaculture is an enterprise option for saline areas that are not suitable for crop cultivation. Scientists from the International Water Management Institute and the WorldFish Centre, led by Dr Mohsin Hafeez, reviewed the options and potential for brackish and marine aquaculture in Pakistan, and the extent to which aquaculture could provide a transformative adaptation strategy for areas affected by salinisation in the southern Indus Basin. The project concludes in 2022 with the development of practical and simple guidelines to assist farmers and local extension agents implement viable options for brackish aquaculture, for sustainable livelihoods in saline areas.[9]

Irrigated cropping is critical to Pakistan's economy and food security, and effective management of the country's irrigation is an urgent priority. While basin-level water management is efficient, distribution of water at the community level is inefficient and unfair, and yields and water productivity are low. A small project is being led by Mr Simon Dyer, Managing Director of Virtual Irrigation Academy, a company created to scale out water monitoring technology developed by CSIRO. The project aims to create viable and sustainable business models in Pakistan to supply farmers with water monitoring tools developed by the Virtual Irrigation Academy program, which provides a digital platform to monitor soil water, underpinned by a process of social learning to improve irrigation management at the farm and scheme level. The program was developed through ACIAR-supported projects in southern Africa.[10]

Irrigated cropping is critical to Pakistan's economy and food security, and effective management of the country's irrigation is an urgent priority, and a focus of several ACIAR-supported projects.

The Indus Basin Irrigation System is the world's largest continuous irrigation system and it provides water, energy and food security for Pakistan. Responsibility for the system's surface water resources is shared between the Indus River System Authority, the Water and Power Development Authority and provincial irrigation departments. Allocation of the water resource is a complex process that is only a few people understand. CSIRO, through a DFAT-funded project in close collaboration with partners in Pakistan, developed the Water Apportionment Accord Tool to enable a more transparent and consistent allocation process. Dr Mobin-ud Din Ahmad of CSIRO leads a small project that is supporting and training in-country partners to use the tool for 2 rounds of seasonal planning (Kharif and Rabi). The experience will be used to further develop and refine the software and a user guide.[11]

Groundwater is essential for more than 50% of irrigation requirements in Punjab and up to 20% in Sindh, but the resource is poorly understood and its use largely unregulated. Government and water users recognise the need to improve groundwater management but institutional frameworks for regulation and management are largely lacking. A two-level approach to groundwater management is needed: strategic planning and coordination of actions, and site-specific research and operational management. Dr Jay F Punthakey and Dr Catherine Allan of Charles Sturt University lead a new project to support knowledge creation, sharing and co-design for improved systems of sustainable groundwater management in selected farming communities in Punjab and Sindh. It is expected that this work will contribute to the development of national and provincial frameworks to sustain the long-term productive potential of groundwater and better integrate groundwater into water resource management plans. The project consolidates and builds on past and current ACIAR research investment in improving groundwater management in Pakistan.[12]

The combination of saline landscapes and low forest cover presents numerous and compounding challenges for smallholder farmers in Sindh, Pakistan. With strong linkages to existing ACIAR-supported projects, this small research activity will evaluate the potential of tree planting to manage salinity and increase income in smallholder farming systems. The project will synthesise existing knowledge of suitable species, their characteristics, uses and appropriate management; and well as identify and develop effective forestry extension methods and materials to deliver the knowledge to extension workers and educated smallholders. Concurrently, the project will engage with smallholders and extension workers to ground truth a synthesis of current literature and provide further insights into the knowledge, practices, needs and pressures of smallholders in several different landscapes.[13]

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See page 186 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. Developing competitive and inclusive value chains of pulses in Pakistan (ADP/2017/004)
3. Developing food loss reduction pathways through smart business practices in mango and tomato value chains in Pakistan and Sri Lanka (Food Loss Research Program) (CS/2020/193)
4. Accelerating genetic gain in wheat through hybrid breeding in Bangladesh, Ethiopia and Pakistan (CROP/2020/167)
5. Increasing productivity and profitability of pulse production in cereal-based cropping systems in Pakistan (CIM/2015/041)
6. Strengthening vegetable value chains in Pakistan for greater community livelihood benefits (HORT/2016/012)
7. Improving smallholder wellbeing through participation in modern value chains: sustaining future growth in the Pakistan citrus industry (HORT/2020/129)
8. Adapting to salinity in the southern Indus Basin [Pakistan] (LWR/2017/027)
9. Opportunities for brackish and saline aquaculture in Pakistan (WAC/2020/179)
10. Virtual Irrigation Academy business models in Pakistan (WAC/2020/180)
11. Supporting inter-provincial water allocation decision making in Pakistan (WAC/2021/103)
12. Groundwater management in Pakistan (WAC/2021/134)
13. Trees for salinity management, Sindh, Pakistan (WAC/2021/136)

Sri Lanka

A$0.61 million
Budgeted funding

2
Bilateral and regional research projects

After a 26-year civil war and a tsunami in 2004 that left tens of thousands of people dead, injured or homeless, Sri Lanka moved ahead rapidly to achieve middle-income country status.

Following the early optimism about prospects for the country after peace was established, in mid-2022 Sri Lanka is facing its worst ever economic crisis, with food and fuel price spikes driving civil unrest. Australia continues to have a strong interest in ensuring Sri Lanka can be a secure, stable and prosperous partner of Australia in the Indian Ocean region.

ACIAR had a broad collaborative research program with Sri Lanka from 1980 to the early 2000s, which covered fisheries, agriculture policy, forestry, animal health and crops. In 2016, Australia's Commission for International Agricultural Research requested an assessment of re-establishing a collaborative research program with Sri Lanka. A scoping study[3] identified 6 broad areas for potential future collaboration with Sri Lanka. Given that the partnership was new, we decided to start small with a single project. ACIAR was looking to this project to identify lessons for possible further re-engagement based on significant co-investment from Sri Lanka. The current economic and political crisis puts any possibility of re-engagement on hold.

3 de Meyer, J., Curnow, J., 2016. ACIAR Scoping study: Re-engagement in agricultural research for development partnerships in Sri Lanka. Australian Centre for International Agricultural Research: Canberra. 52 pp.

2022–23 research program

Agribusiness

Fresh fruits and vegetables are important food commodities in both Pakistan and Sri Lanka. Maintaining quality and freshness under humid tropical conditions presents a vast challenge in meeting the growing demand for domestic consumption and export. Supply chains are inadequate and inefficient. Food losses are large, especially during seasonal gluts. Associate Professor Anwar Shah of Quaid-i-Azam University leads a new project using mango and tomato as focal commodities to map value chains in Pakistan and Sri Lanka, to identify the extent and root causes of food losses. The project will design and demonstrate affordable technological and organisational options to mitigate losses and create new economic opportunities. Sri Lanka provides a useful case study to contrast its fruit and vegetable value chain against Pakistan, as the 2 countries are at different stages of development and face different exposure regimes and vulnerabilities. This project is part of the ACIAR–IDRC Food Loss Research Program (page 23).

Project: Developing food loss reduction pathways through smart business practices in mango and tomato value chains in Pakistan and Sri Lanka (Food Loss Research Program) (CS/2020/193)

Fisheries

Sri Lanka has a well-developed and sustainable inland reservoir fishery that makes up about 12–15% of total fish production and significantly benefits rural communities in the former conflict-affected Northern province. Based on a co-management strategy, management practices and stocking strategies for sustainable culture-based fisheries have been established in a previous ACIAR project and have increased the productivity of the reservoir fishery. The Government of Sri Lanka has long recognised the potential for the extensive culture of the indigenous giant freshwater prawn (Macrobrachium rosenbergii) in inland reservoirs, but development has been ad hoc, with productivity and returns relatively low. A project led by Dr Clive Jones of James Cook University investigates stocking, monitoring and harvesting practices to optimise fish and prawn productivity and improve product quality. The project will also conduct market-chain analysis to ensure farming practices meet market product requirements and benefits are socially equitable.

Project: Improved productivity, efficiency and sustainability of the culture-based fishery for finfish and giant freshwater prawn in Sri Lankan reservoirs (FIS/2018/157)

Regional Manager, South Asia
Dr Pratibha Singh

Research Program Manager
Agribusiness: Mr Howard Hall
Fisheries: Prof Ann Fleming

See page 186 for contact details.

Maintaining quality and freshness under humid conditions presents a vast challenge in meeting standards for domestic and export markets. Food losses are large, especially during seasonal gluts. A new project, focusing on mango and tomato, will map value chains in Pakistan and Sri Lanka, to identify the extent and root causes of food losses.