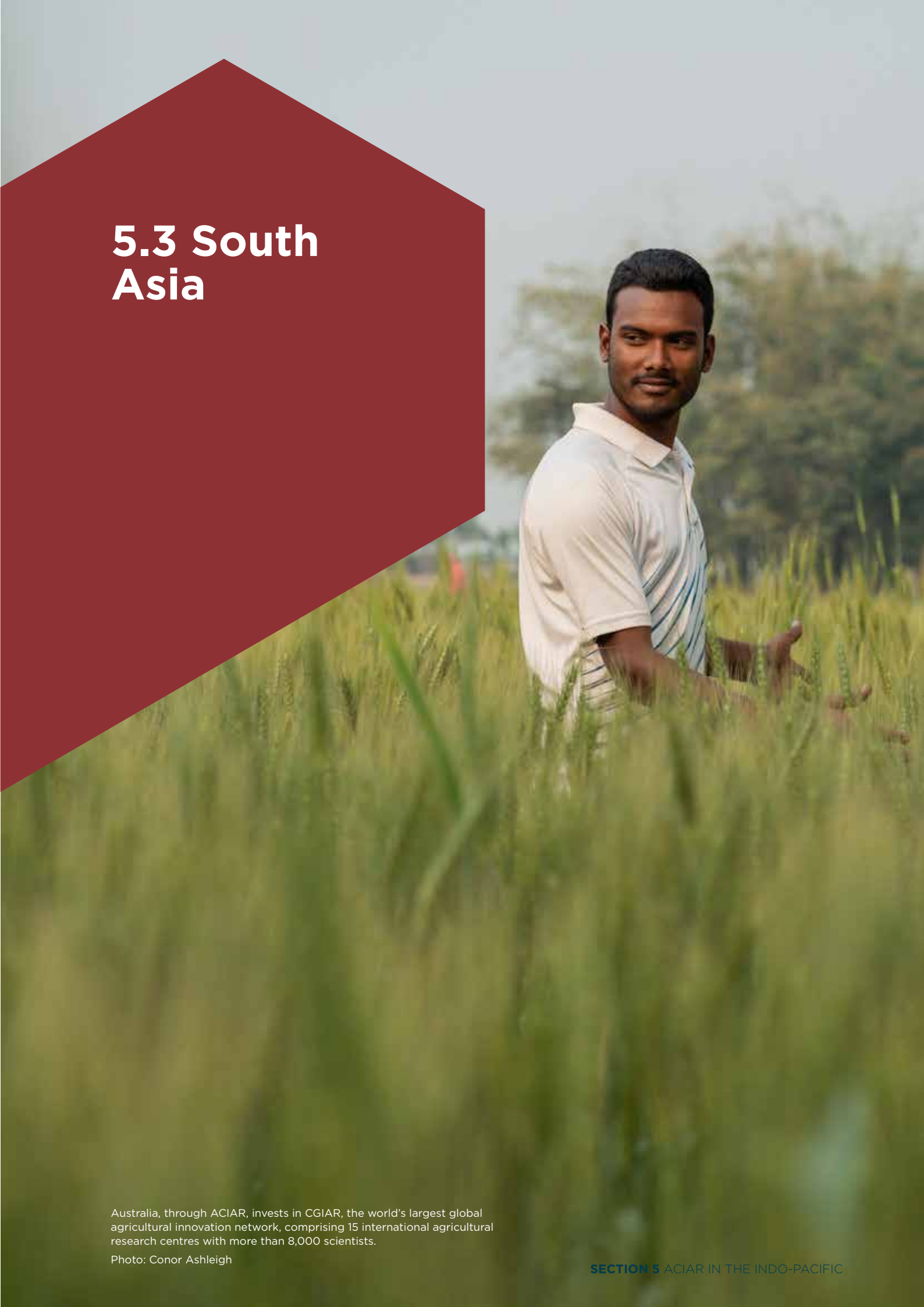
5.3 South Asia



Australia, through ACIAR, invests in CGIAR, the world's largest global agricultural innovation network, comprising 15 international agricultural research centres with more than 8,000 scientists.

Photo: Conor Ashleigh

South Asia

Regional summary

While there are common challenges and opportunities in agriculture in the countries of South Asia, there are also fundamental differences between and within these countries in terms of the broad characteristics that influence the nature and success of agriculture.

The population of countries in the region ranges from 21.4 million in Sri Lanka to 1.3 billion in India. Land area ranges from 6.6 million hectares in Sri Lanka to 329 million hectares in India. The northern hilly region of Bangladesh is geographically distinct from the southern coastal areas. India is divided into 15 distinct agroecological zones. Nepal has three distinct topographical zones: the mountainous Himalayan region of the north, the Hill region and the low-lying land of the Terai region in the south. Bangladesh is a small country that is mostly alluvial, with fertile floodplains associated with three 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. The regional variations throughout South Asia must be taken into account when designing a meaningful program for research collaboration to accommodate regional distinctions and varying degrees of vulnerability of the local population.

The Australian Government's Sustainable Development Investment Portfolio (SDIP) and the South Asia Regional Trade Facilitation Program seek to address key region-wide barriers to sustainable economic growth and connectivity. Photo: Conor Ashleigh.
ACIAR projects: see page 132.

South Asia has the highest concentration of poor people in the world. More than 500 million people live in 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 total population of 1.5 billion depends on agriculture for its livelihood. Although the share of agriculture in rural employment remains high, growth of the rural non-farm sector is accelerating and now provides a sizable share of rural income and employment, primarily in services. The rural non-farm sector has grown more quickly than agricultural employment in recent years and now generates about 60% of rural income in India and Nepal and 57% in Pakistan and Bangladesh.

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 five 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, an indicator of acute malnutrition. South Asia also has a high prevalence of micronutrient deficiencies, overconsumption and diet-related non-communicable disease.

The frequency of climate-related disasters and the damage they cause is rising in the region, negatively affecting food security and nutrition. Despite these many challenges, South Asia remains the fastest growing region in the world as its economic growth strengthens. However, growth rates vary greatly across the region—exceeding 7.0% in Bangladesh, India and Nepal and reaching 5.8% in Pakistan. Growth in most South Asian nations was driven primarily by domestic consumption, with limited contributions from exports and investments.

The COVID-19 pandemic is an unprecedented challenge for South Asia. Large and dense populations make social distancing difficult. Agriculture is highly dependent on informal labour, which is severely limited during lockdowns and restricted by social-distancing measures. These are all disruptive factors for supply chains and agriculture markets.

Countries in the ACIAR 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 are 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 the watertable is 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. Governments must allocate and provide significant resources to cope with frequent natural disasters.

Climate variability, competing and increasing demands from agriculture and industry (including energy production) and population growth are creating very severe demands on water availability. Regional cooperation is increasingly essential to manage these shared resources. 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.

ACIAR program in the region

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 region-wide barriers to sustainable economic growth and connectivity through the Sustainable Development Investment Portfolio (SDIP) and South Asia Regional Trade Facilitation Program. Gender equality is a focus in all the investments under the regional program.

The ACIAR regional strategy in South Asia focuses on communities, production systems and resource management in the three 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 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, which 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.

During 2020–21, 32 ACIAR-supported projects will be active in the South Asia region (Table 5.3).

Table 5.3 **Current and proposed projects in the South 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
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
Crops		
Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh	CIM/2014/076	Bangladesh
Establishing the International Mungbean Improvement Network	CIM/2014/079	Bangladesh, India, Myanmar
Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa	CIM/2014/081	Ethiopia, India, Nepal, Pakistan
Increasing productivity and profitability of pulse production in cereal based cropping systems in Pakistan	CIM/2015/041	Pakistan
Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan	CIM/2016/174	Bangladesh, Myanmar, Pakistan
Identification of sources of resistance to wheat blast and their deployment in wheat varieties adapted to Bangladesh	CIM/2016/219	Bangladesh
Identifying soil constraints in the Eastern Gangetic Plains (SDIP)	CROP/2018/210	Bangladesh, India, Nepal
International Mungbean Improvement Network – phase 2	CROP/2019/144	Bangladesh, India, Indonesia, Kenya, Myanmar
Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains (SRFSI) (SDIP)	CSE/2011/077	Bangladesh, India, Nepal
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
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
Livestock Systems		
Improving smallholder dairy and beef profitability by enhancing farm production and value chain management in Pakistan	LPS/2016/011	Pakistan
Enhancing small ruminant production to benefit farming families in Sindh and Punjab, Pakistan	LS/2018/105	Pakistan
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
Water		
Promoting socially inclusive and sustainable agricultural intensification in West Bengal and Bangladesh	LWR/2014/072	Bangladesh, India
Developing approaches to enhance farmer water management skills in Balochistan, Punjab and Sindh in Pakistan	LWR/2014/074	Pakistan
Improving groundwater management to enhance agriculture and farming livelihoods in Pakistan	LWR/2015/036	Pakistan
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 Andhra Pradesh drought mitigation program	WAC/2018/164	India
Quantifying crop yield gaps across the Indo-Gangetic Plain from new perspectives—production, farmer profit and sustainability of water use (SDIP)	WAC/2018/169	Bangladesh, India, Nepal
Aquifer characterisation, artificial recharge and reuse of suddenly available water in South Bihar (SDIP)	WAC/2018/211	India
Building provincial capacity for sustainable agricultural mechanisation in Nepal (SDIP)	WAC/2018/220	Nepal
The implications of sustainable intensification on weed dynamics in the Eastern Gangetic Plains (SDIP)	WAC/2018/221	India, Nepal
Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta	WAC/2019/134	Bangladesh, India
Regional foresight for food systems in the Eastern Gangetic Plains (SDIP)	WAC/2019/136	Bangladesh, India, Nepal
Food futures for the food systems in the Eastern Gangetic Plains (SDIP)	WAC/2020/158	Bangladesh, India, Nepal

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.

Many projects in the South Asia region focus on sustainable intensification and mechanisation of crop management practices.
Photo: Conor Ashleigh

Sustainable Development Investment Portfolio

The SDIP is an Australian Government initiative funded by DFAT that brings together partners in Australia and South Asia to improve integrated management of water, energy and food in three major Himalayan river basins—the Indus, Ganges and Brahmaputra. The initiative includes eastern Afghanistan, Pakistan, northern India, Bangladesh, Nepal and Bhutan. It draws on Australia's expertise and technologies in the water, food and energy sectors.

The component of SDIP focused on food and agriculture is co-funded and coordinated by ACIAR. It aims to improve the integrated management of food, energy and water in the Eastern Gangetic Plains, which lie in the Ganges and Brahmaputra basins.

ACIAR supports 10 projects within the portfolio in Bangladesh, India and Nepal. These projects are managed by two ACIAR research programs: Crops and Water. Many of these projects are close to completion; however, due to the COVID-19 pandemic, some may extend into the 2020–21 year for a short time.

SDIP projects in Bangladesh, India and Nepal

- Sustainable and resilient farming system intensification (SRSFI) (CSE/2011/077)
- Identifying Eastern Gangetic Plains soil constraints (CROP/2018/210)
- Institutions to support intensification, integrated decision-making and inclusiveness in agriculture in the East Gangetic Plains (LWR/2018/104)
- Quantifying crop yield gaps across the Indo-Gangetic Plains from new perspectives: production, farmer profit and sustainability of water use (WAC/2018/169)
- The regional hydrological impact of farm-scale water saving measures in the Eastern Gangetic Plains (WAC/2019/104)
- Regional foresight for food systems in the Eastern Gangetic Plains (WAC/2019/136)

SDIP project in India and Nepal

- The implications of sustainable intensification on weed dynamics in the Eastern Gangetic Plains (WAC/2018/211)

SDIP project in India

- Aquifer characterisation, artificial recharge and reuse of suddenly available water in South Bihar, India (WAC/2018/211)

SDIP project in Nepal

- Building provincial capacity for sustainable agricultural mechanisation in Nepal (WAC/2018/220)

SDIP project in Bangladesh

- Pilot project on commercialisation of smallholder conservation-based planters in Bangladesh (LWR/2018/111)

Bangladesh

A$2.7 million
Budgeted funding

11
Bilateral and regional research projects

4
Small projects and activities

Poverty has steadily declined over the past 20 or more years in Bangladesh. However, 47 million people still live in poverty—the highest levels in South Asia—and 28 million of these people are classified as extremely poor, which means they are not able to satisfy their minimum food needs. Another 26 million people are also at risk of falling into poverty. Elimination of extreme poverty is seen by many as one of the greatest challenges facing Bangladesh. A key driver of economic growth in Bangladesh is investment and opportunities created by the private sector, through productivity gains in agriculture, small-scale entrepreneurship and garment export. Agriculture remains the largest employer in Bangladesh with approximately 22.7 million people working in the sector. Australia's support to Bangladesh aligns with the Bangladesh Government's vision for the country, outlined in the 7th Five-Year Plan 2016–2020, in which the Bangladesh Government has committed to boost economic growth and empower citizens as part of the government's long-term vision for eliminating poverty.

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

Agriculture plays a pivotal role in the Bangladesh economy and in the lives of the vast majority of its population. A key development challenge for Bangladesh is to improve farm incomes within the context of climate change.

Low-lying areas and rainfed cropping systems in Bangladesh are negatively affected by seasonal climate variability, reduced freshwater river flows and seawater intrusion. The population is projected to grow to about 193 million by 2050, placing further demands on food systems. Climate change has introduced risks from floods, droughts and sea-level rise.

Despite these challenges, 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, which account for more than half of agricultural GDP. Poverty is steadily declining, but many people still live below the poverty line.

Climate change is the most pressing issue, 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 needs to develop adequate adaptive capacity to protect its people and economy against the impacts of climate change. 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 key challenges identified in the National Agriculture Policy 2018 are:

- diversification of crops including production of high-value crops
- development and promotion of stress-tolerant crop varieties and production technology
- development of modern techniques including biotechnology and disease-resistant and nutritious crop varieties
- improvement of crop production systems for market-oriented agriculture
- emphasising the importance of innovation and extension of technology to increase overall productivity growth and reduce the difference between research farm and field-level yield
- identification of opportunities for improving living standards of coastal population by accumulation of marine resources—in addition to fisheries, there are prospects for seaweed cultivation including production of plankton in the oceans, rivers and wetlands.

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 with Bangladesh 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.

The Australian aid program 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. With 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 north and north-west 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 ACIAR support.

Key agricultural production challenges are common to many countries of South Asia, and ACIAR plays a role in strengthening 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 confirmed the following priorities as the focus of research collaboration between ACIAR and Bangladesh for the 2019–28 period:

- 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.

The Krishi Gobeshona Foundation is a strategic partner of ACIAR in Bangladesh. It is an agricultural research funding organisation that has made major investments in funding research and capacity building in ACIAR-supported projects. As a major partner and co-investor, ACIAR will seek to refresh and then renew the partnership in 2020–21.

Projects in the Sustainable Development Investment Portfolio (SDIP) program have a common theme of optimising the management of natural resources and adopting new practices to increase productivity and sustainability on the Eastern Gangetic Plains in Bangladesh, India and Nepal. Photo: Conor Ashleigh. ACIAR projects: see page 132.

2020–21 research program

ACIAR supports 15 projects in Bangladesh, three 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 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 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]

Crops

The Sustainable and Resilient Farming Systems Intensification project is a large collaborative venture between ACIAR, the International Maize and Wheat Improvement Center (CIMMYT) and more than 20 partners from the research, development and educational sectors. The project aims to reduce poverty in the Eastern Gangetic Plains by making smallholder agriculture more productive, profitable and sustainable, while safeguarding the environment and involving women. Dr Brendan Brown of CIMMYT will lead the project in its final year to consolidate capacity development and credible pathways to scale out and support the widespread adoption of conservation agriculture for sustainable intensification methods, designed and validated by the project over the past six years.[2] This project is part of the SDIP, facilitated in the region by the Australian Government (see page 132).

Supporting the Sustainable and Resilient Farming Systems Intensification project, a small research activity led by Dr Neal Menzies of the University of Queensland, will identify future soil health research needs, focusing on soil acidification in areas where nitrogen fertiliser use has increased, the potential for zinc fertiliser to increase rice yields, changes in soil structure under conservation tillage practice and understanding system sustainability through partial nutrient budgets.[3]

In South Asia, adoption and adaptation of many farming system innovations are variable and low outside project areas, particularly for conservation agriculture-based sustainable intensification. A project, led by Dr Fay Rola-Rubzen of the University of Western Australia, will complete its research on understanding decision-making behaviour of farm households using a behavioural economics framework. The project will test interventions on agricultural extension, input provision and service delivery, which are designed to encourage smallholder farmers' uptake of innovations. The project, which is also part of SDIP, will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.[4]

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. Salinity varies spatially and temporally and there are opportunities for more profitable dry-season cropping on fallow land between rice crops. In its final year, a project led by Professor William Erskine of the University of Western Australia will identify cropping practices and germplasm for salt-tolerant wheat, pulses and forages, which are adapted to southern Bangladesh and have the potential to lift productivity and profitability.[5]

Wheat blast is a serious threat to smallholder farmers in South Asia, a region where 300 million people are undernourished and the population consumes over 100 million tonnes of wheat each year. Dr Pawan Singh of CIMMYT leads a project to reduce the threat of the disease by identifying new sources of genetic resistance. The project is supporting the operation by Bangladesh Wheat and Maize Research Institute of the wheat blast phenotyping platform, an international public-good facility for screening global germplasm. Ultimately, the project will enable the development and release of agronomically superior wheat blast resistant varieties with appropriate maturity and other traits critical for the Bangladesh environment.[6]

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.[7] 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.[8]

ACIAR supports a project led by CIMMYT to identify sources of resistance to wheat blast and their deployment in wheat varieties adapted to Bangladesh. Photo: Conor Ashleigh. ACIAR project: CIM/2016/219.

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.[9]

Water

About 65% of people living in the coastal zones of Bangladesh and West Bengal in India live below the poverty line. Owners of marginal land, those without land, tribal people, women and those who rely on ecosystem services (such as fishing communities) often do not benefit from agricultural development. A project led by Dr Christian Roth of CSIRO Agriculture and Food has investigated ways to provide more equitable and less-risky development pathways for marginalised communities. During 2020–21, this research will support the design and delivery of agricultural intensification programs that are more socially inclusive.[10]

In the same region, a project conducted over the past five years clearly demonstrated that improved crop, water and salt management strategies can lift agricultural productivity and rural welfare when projects engage with farmers to understand their needs and priorities. A second phase of this work, led by Dr Mohammed Mainuddin of CSIRO Agriculture and Food, will use predictive modelling techniques, field trials and targeted demonstration to identify and implement packages of technologies, such as new cropping systems and improved water management that are tailored to the characteristics of different parts of the Ganges delta region. Key to process will be identification of risks to adoption due to variable climate and variable environments. The outputs of this project will provide information to support implementation of the Bangladesh Delta Plan 2100.[11]

A project underway in the coastal zone of Bangladesh, led by Professor Richard Bell of Murdoch University, aims to increase the profitability and sustainability of intensive and emerging cropping systems through improved nutrient management. During 2020–21, the project will conduct activities to scale out the use of tools developed by the project and inform the development of fertiliser policies to advance practice change, as well as activities to improve the knowledge of soil resources and capability for nutrient management by farmers, research partners and key stakeholders.[12]

A suite of projects with a common theme of optimising the management of natural resources and adopting new practices to increase productivity and sustainability will operate on the Eastern Gangetic Plains in Bangladesh, India and Nepal during 2020–21. These projects ultimately aim to improve the livelihoods of the many and varied communities of the plains and are part of the SDIP program (see page 132).

The traditional concept of a physiological crop yield gap is considered useful in national food security planning but, across the Indo–Gangetic Plains, socioeconomic constraints often limit production and overexploitation of regional water resources causes environmental problems. A project led by Dr Donald Gaydon of CSIRO Agriculture and Food will determine if there are feasible alternatives to quantify yield gaps in terms of economics and water use sustainability. The project will make a preliminary assessment of the effects of conservation agriculture and sustainable intensification, future climate scenarios and some economic variables on food production capacity.[13]

A small project was developed to encourage and support a core team of local partners in Bangladesh, India and Nepal to undertake participatory ‘foresight for food’ exercises in their respective domains using scenario-based approaches and systems thinking. Dr Avinash Kishore of the International Food Policy Research Institute leads the project, which continues to build the capacity of national partner institutions and support young farmers to communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.[14] The project will be extended until the end of the 2020–21 year, to allow time to consider the impact of the COVID-19 pandemic on regional food systems.[15]

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Dr Pratibha Singh

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Agribusiness: Mr Howard Hall
Crops: Dr Eric Huttner
Water: Dr Robyn Johnston

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. Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains (SRFSI) (SDIP) [Bangladesh, India, Nepal] (CSE/2011/077)
3. Identifying soil constraints in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CROP/2018/210)
4. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CSE/2012/108)
5. Incorporating salt-tolerant wheat and pulses into smallholder farming systems in southern Bangladesh (CIM/2014/076)
6. Identification of sources of resistance to wheat blast and their deployment in wheat varieties adapted to Bangladesh (CIM/2016/219)
7. Establishing the International Mungbean Improvement Network [Bangladesh, India, Myanmar] (CIM/2014/079)
8. International Mungbean Improvement Network – phase 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
9. Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan (CIM/2016/174)
10. Promoting socially inclusive and sustainable agricultural intensification in West Bengal, India and Bangladesh (LWR/2014/072)
11. Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta [Bangladesh, India] (WAC/2019/134)
12. Nutrient management for diversified cropping in Bangladesh (LWR/2016/136)
13. Quantifying crop yield gaps across the Indo-Gangetic Plain from new perspectives – production, farmer profit and sustainability of water use (SDIP) [Bangladesh, India, Nepal] (WAC/2018/169)
14. Regional foresight for food systems in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (WAC/2019/136)
15. Food futures for the food systems in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (WAC/2020/158)

India

A$0.8 million
Budgeted funding

8
Bilateral and regional research projects

6
Small projects and activities

Australia and India are strategic partners with strong political, economic and community ties, and these extend to shared values in relation to the challenges and opportunities arising in the Indo-Pacific region. Over the next 20 years, a growing India will need many of Australia's goods and services, including agriculture, education and skills training and healthcare. Australia does not have a bilateral development assistance program with India; however, ACIAR does work with partners in India and South Asia to support programs to facilitate economic growth and improve the livelihoods of the poor and venerable (especially women and girls). Tens of millions of people in India have been lifted out of poverty since the 1990s, but economic growth in the country remains uneven. Australia's engagement with India and its support of India's economic development is guided by *An India Economic Strategy to 2035*, which is available on the DFAT website.

India is the seventh largest country in the world by land area. With more than 1.3 billion people, it is the second most populous country after China, and accounts for 18% of the world's population.

Worth US$2.94 trillion, India is the world's fifth largest economy overtaking the United Kingdom and France. The level of urbanisation in India has increased from 28% to 31% over the past decade, but two-thirds of the population still lives in rural areas. Agricultural land is very scarce, with the average size of landholdings being 1.08 hectares. The proportion of the population that is undernourished is declining.

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 of cotton. Owing to a new agriculture export policy, agricultural exports are anticipated to grow in the future. However, the contribution of the agriculture sector to India's GDP has declined from 18% in 2014–15 to 16% in 2019–20. Regardless, agriculture remains a major source of employment, accounting for about 43% of the total national workforce.

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 country is still plagued with issues of low market prices, distorted subsidies, lack of storage infrastructure, inefficient use of natural resources and susceptibility to climate change and extreme weather events. The country has approximately 126 million small and marginal farmers with 86% of the total land holdings. Of these, 14% of operational landholders are female.

The Indian Government is focusing efforts largely on increasing the income of farmers, with a target of doubling incomes by 2022–23. An inter-ministerial committee, set up in April 2016, identified seven major sources of growth in the agriculture sector related to increasing crop and livestock productivity, decreasing cost of production, increasing cropping intensity, diversification and the shift to non-farm operations. Several initiatives have been taken to realise the above goal:

- minimum support prices of several kharif and rabi crops increased by 1.5 times of the all-India weighted average cost of production
- Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Yojana providing INR 6,000 per year to all farmer families across the country in three equal instalments every four months

- formation of Electronic National Agriculture Market (e-Nam), an online trading platform for buyers and sellers without having to share the same geographic location
- formation of 10,000 new farmer producer organisations by 2024
- direct benefit transfer of fertiliser subsidy in the whole country
- creation of a 16-point program to encourage the agriculture sector in the budget 2020–21, which includes creating cold storage facilities, promoting the village storage scheme, creating cold supply chains on trains and aircrafts, promoting horticulture and zero budget natural farming, providing support to two million farmers in setting up stand-alone solar pumps and a further 1.5 million farmers for grid connected pumps.

The Government of India, in its various policies and schemes, has recognised the role of women in agriculture. It advocates for mainstreaming of women's role in agriculture and has highlighted incorporation of gender issues 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. At this meeting, the two Prime Ministers 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. The leaders committed to a new phase of the Australia–India Strategic Research Fund to promote innovative solutions for responding to and treating COVID-19, as well as other jointly determined priorities, to be preceded by a one-off Special COVID-19 Collaboration Round in 2020.

Country priorities

The ACIAR research program with India is delivered totally through a regional collaborative approach involving neighbouring countries with shared issues and opportunities. A report to the Australian Government, *An India Economic Strategy to 2035,* identified agribusiness development as one of the lead sectors of focus for collaboration. Substantial co-investment from India will become a prerequisite 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 wheat and 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. In 2020–21, as part of a partnership refresh and mitigation of COVID-19 pandemic impacts (as highlighted in the new Comprehensive Strategic Partnership between the two countries), we may explore the possibilities of:

- sustainable intensification with a nutrition framework
- diversification into new dry-season crops
- the role of biotechnology (BT chickpea, Omega 3 canola, higher nutritive value feed oil enriched crops (rice and wheat))
- new mechanisation opportunities including farm robotics
- a next phase of mungbean breeding for high yielding varieties
- groundwater management (over- and under-exploitation)
- co-investment and trilateral collaboration.

The International Mungbean Improvement Network has helped realise the potential of mungbean to improve cropping system productivity and livelihoods. Phase 2 of the network commenced in July 2020. ACIAR project: CROP/2019/144.

2020–21 research program

ACIAR supports 14 projects in India, two 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 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

The Sustainable and Resilient Farming Systems Intensification project is a large collaborative venture between ACIAR, the International Maize and Wheat Improvement Center (CIMMYT) and more than 20 partners from the research, development and educational sectors. The project aims to reduce poverty in the Eastern Gangetic Plains by making smallholder agriculture more productive, profitable and sustainable, while safeguarding the environment and involving women. Dr Brendan Brown of CIMMYT will lead the project in its final year to consolidate capacity development and credible pathways to scale out and support the widespread adoption of conservation agriculture for sustainable intensification methods, designed and validated by the project over the past six years.[1] This project is part of the SDIP, facilitated in the region by the Australian Government (see page 132).

Supporting the Sustainable and Resilient Farming Systems Intensification project, a small research activity led by Dr Neal Menzies of the University of Queensland, will identify future soil health research needs, focusing on soil acidification in areas where nitrogen fertiliser use has increased, the potential for zinc fertiliser to increase rice yields, changes in soil structure under conservation tillage practice and understanding system sustainability through partial nutrient budgets.[2]

In South Asia, adoption and adaptation of many farming system innovations are variable and low outside project areas, particularly for conservation agriculture-based sustainable intensification. A project, led by Dr Fay Rola-Rubzen of the University of Western Australia, will complete its research on understanding decision-making behaviour of farm households using a behavioural economics framework. The project will test interventions on agricultural extension, input provision and service delivery, which are designed to encourage smallholder farmers' uptake of innovations. The project, which is also part of SDIP, will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.[3]

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.[4] 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.[5]

Stripe rust (also called yellow rust) is a common and important disease of wheat worldwide. While fungicides can be used for in-crop control, genetic resistance is more economically and environmentally sound. A project, led by Professor Robert Park of the University of Sydney, has established and equipped a collaborative network of key wheat improvement centres across South Asia and eastern Africa. In its final year, it will consolidate the knowledge base to enable ongoing research and development at the centres. The project has identified markers linked to effective resistance genes, which can be used in pre-emptive breeding and the development of rapid diagnostic tests. The project, set to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.[6]

Water

About 65% of people living in the coastal zones of Bangladesh and West Bengal in India live below the poverty line. Owners of marginal land, those without land, tribal people, women and those who rely on ecosystem services (such as fishing communities) often do not benefit from agricultural development. A project led by Dr Christian Roth of CSIRO Agriculture and Food has investigated ways to provide more equitable and less-risky development pathways for marginalised communities. During 2020–21, this research will support the design and delivery of agricultural intensification programs that are more socially inclusive.[7]

In the same region, a project conducted over the past five years clearly demonstrated that improved crop, water and salt management strategies can lift agricultural productivity and rural welfare when projects engage with farmers to understand their needs and priorities. A second phase of this work, led by Dr Mohammed Mainuddin of CSIRO Agriculture and Food, will use predictive modelling techniques, field trials and targeted demonstration to identify and implement packages of technologies, such as new cropping systems and improved water management that are tailored to the characteristics of different parts of the Ganges delta region. Key to process will be identification of risks to adoption due to variable climate and variable environments. The outputs of this project will provide information to support implementation of the Bangladesh Delta Plan 2100.[8]

The Andhra Pradesh Drought Mitigation Program was implemented to strengthen the adaptive capacity and productivity of agriculture in the rainfed areas of five districts in the south of Andhra Pradesh. Australian experts are providing technical support to the program, drawing 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.[9]

A suite of projects with a common theme of optimising the management of natural resources and adopting new practices to increase productivity and sustainability will operate on the Eastern Gangetic Plains in Bangladesh, India and Nepal during 2020–21. These projects ultimately aim to improve the livelihoods of the many and varied communities of the plains, and are part of the SDIP program (see page 132).

The traditional concept of a physiological crop yield gap is considered useful in national food security planning but, across the Indo–Gangetic Plains, socioeconomic constraints often limit production and overexploitation of regional water resources causes environmental problems. A project led by Dr Donald Gaydon of CSIRO Agriculture and Food will determine if there are feasible alternatives to quantify yield gaps in terms of economics and water use sustainability. The project will make a preliminary assessment of the effects of conservation agriculture and sustainable intensification, future climate scenarios and some economic variables on food production capacity.[10]

A suite of projects in the Sustainable Development Investment Portfolio (SDIP) program has identified technologies and practices, as well as levels of individual and institutional capacity, required to sustainably improve agricultural production and livelihoods. Photo: Conor Ashleigh. ACIAR projects: see page 132.

Aquifer storage and recovery may be effective for storing large volumes of water at relatively low cost, without the need to build large surface reservoirs. Dr Prabhakar Sharma of Nalanda University completes a project during 2020–21 that will report on the technical viability of such systems, based on an indigenously developed system at several sites in South Bihar. The project will deliver a hydrogeological map and an operating manual for long-term monitoring of the system. It will also report on benefits and key social factors that will encourage adoption by smallholder farmers.[11]

There are proven benefits of conservation agriculture-based sustainable intensification systems in the Eastern Gangetic Plains but there are also potential trade-offs. Weed control is one of the biggest challenges when these systems are implemented. A project led by Dr Brendan Brown of CIMMYT has documented farmers' knowledge, attitude and practices around weed management under conservation agriculture and sustainable intensification systems, and will report on the gendered implications for equitable and sustainable intensification in the Eastern Gangetic Plains of South Asia.[12]

A small project was developed to encourage and support a core team of local partners in Bangladesh, India and Nepal to undertake participatory 'foresight for food' exercises in their respective domains using scenario-based approaches and systems thinking. Dr Avinash Kishore of the International Food Policy Research Institute leads the project, which continues to build the capacity of national partner institutions and support young farmers to communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.[13] The project will be extended until the end of the 2020–21 year, to allow time to consider the impact of the COVID-19 pandemic on regional food systems.[14]

Regional Manager, South Asia
Dr Pratibha Singh

Research Program Managers
Crops: Dr Eric Huttner
Water: Dr Robyn Johnston

See page 209 for contact details

Current and proposed projects

1. Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains (SRFSI) (SDIP) [Bangladesh, India, Nepal] (CSE/2011/077)
2. Identifying soil constraints in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CROP/2018/210)
3. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CSE/2012/108)
4. Establishing the International Mungbean Improvement Network [Bangladesh, India, Myanmar] (CIM/2014/079)
5. International Mungbean Improvement Network – phase 2 [Bangladesh, India, Indonesia, Kenya, Myanmar] (CROP/2019/144)
6. Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
7. Promoting socially inclusive and sustainable agricultural intensification in West Bengal, India and Bangladesh (LWR/2014/072)
8. Mitigating risk and scaling-out profitable cropping system intensification practices in the salt-affected coastal zones of the Ganges Delta [Bangladesh, India] (WAC/2019/134)
9. Water management for smallholder farmers – outscaling ACIAR research in Andhra Pradesh drought mitigation program [India] (WAC/2018/164)
10. Quantifying crop yield gaps across the Indo-Gangetic Plain from new perspectives – production, farmer profit and sustainability of water use (SDIP) [Bangladesh, India, Nepal] (WAC/2018/169)
11. Aquifer characterisation, artificial recharge and reuse of suddenly available water in South Bihar (SDIP) [India] (WAC/2018/211)
12. The implications of sustainable intensification on weed dynamics in the Eastern Gangetic Plains (SDIP) [India, Nepal] (WAC/2018/221)
13. Regional foresight for food systems in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (WAC/2019/136)
14. Food futures for the food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/158)

Nepal

A$1.0 million
Budgeted funding

4
Bilateral and regional research projects

6
Small projects and activities

Australia is a longstanding and committed development partner of Nepal. Australia's aid program focuses on areas where our experience and expertise can make a difference to the lives of the poorest, particularly women and girls, marginalised communities and people with disabilities. Underscoring all investments is support for improved governance and public financial management along with gender equality. The bilateral program is complemented by investments through the South Asia regional program in trade, water, energy and connectivity as well as support through global programs for non-government organisation activities and volunteers. A particular focus of the program is to expand economic opportunities for the poor, particularly women, by promoting enterprise and job creation.

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

Nepal is among the least developed countries in the world, with about one-quarter of its population living below the poverty line. Its overall development has been slow, and its development indicators are among the lowest in South Asia. It ranks 147 out of 189 countries on the Human Development Index 2019.

Nepal has seen much political change in recent decades. In 2008, the country became a republic, ending 240 years of monarchy. In 2015, after a series of short-term governments, Nepal's new constitution established a secular democratic republic with a federal system of three tiers of government: local, provincial and federal.

Natural disasters also frame the recent history of the country. In 2015, a magnitude 7.8 earthquake struck Nepal. This was the deadliest earthquake in 81 years. Hundreds of aftershocks followed, and then a 7.3 earthquake, 17 days after the first one. 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.

Agriculture is the largest economic sector of Nepal, supporting the livelihoods of 66% of the population and contributing 36% of national GDP. Farming is largely subsistence in nature 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 These characteristics provide both opportunities and challenges for agricultural development in Nepal. 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:

- degradation of natural resources
- underdeveloped agricultural institutions and policies
- declining availability of labour
- lack of productive technologies and mechanisation that limit the improvement of farm household livelihoods.

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 2020–21 continues the engagement of Nepal in a regional program to improve integration of soil, water, crop, livestock and tree components of the farming systems. The SDIP, a regional multiagency program in which ACIAR is a partner (see page 132), has a significant component in Nepal, addressing water and energy integration.

Priorities for ACIAR collaboration are identified through consultations with ACIAR senior research staff and stakeholders in Nepal. Increased farm and forest productivity is a core approach to improved food and nutrition security and enhanced livelihoods. In the Middle Hills districts affected by recent earthquakes and floods, the ACIAR program supports the request of the Nepalese Government to focus primarily on research to support increased timber production from community forests. Another area that requires focus is understanding the implications of new federalism on agriculture in Nepal, as this is one of the important factors in the future development of 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 2020–21. 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.

For Nepal, the World Food Program highlights that the agriculture sectors that will be most affected by the COVID-19 pandemic are poultry, dairy, vegetables and livestock production.

2020–21 research program

ACIAR supports 10 projects in Nepal, two 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 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.

A farmer discusses crop management with researchers from CIMMYT, as part of a project building capacity to support mechanisation of conservation agriculture-based sustainable intensification. Photo: Conor Ashleigh. ACIAR project: WAC/2018/220.

Crops

The Sustainable and Resilient Farming Systems Intensification project is a large collaborative venture between ACIAR, the International Maize and Wheat Improvement Center (CIMMYT) and more than 20 partners from the research, development and educational sectors. The project aims to reduce poverty in the Eastern Gangetic Plains by making smallholder agriculture more productive, profitable and sustainable, while safeguarding the environment and involving women. Dr Brendan Brown of CIMMYT will lead the project in its final year to consolidate capacity development and credible pathways to scale out and support the widespread adoption of conservation agriculture for sustainable intensification methods, designed and validated by the project over the past six years.[1] This project is part of the SDIP, facilitated in the region by the Australian Government (see page 132).

Supporting the Sustainable and Resilient Farming Systems Intensification project, a small research activity led by Dr Neal Menzies of the University of Queensland, will identify future soil health research needs, focusing on soil acidification in areas where nitrogen fertiliser use has increased, the potential for zinc fertiliser to increase rice yields, changes in soil structure under conservation tillage practice and understanding system sustainability through partial nutrient budgets.[2]

In South Asia, adoption and adaptation of many farming system innovations are variable and low outside project areas, particularly for conservation agriculture-based sustainable intensification. A project, led by Dr Fay Rola-Rubzen of the University of Western Australia, will complete its research on understanding decision-making behaviour of farm households using a behavioural economics framework. The project will test interventions on agricultural extension, input provision and service delivery, which are designed to encourage smallholder farmers' uptake of innovations. The project, which is also part of SDIP, will also strengthen organisational and institutional capacity to better target interventions in the Eastern Gangetic Plains.[3]

Stripe rust (also called yellow rust) is a common and important disease of wheat worldwide. While fungicides can be used for in-crop control, genetic resistance is more economically and environmentally sound. A project, led by Professor Robert Park of the University of Sydney, has established and equipped a collaborative network of key wheat improvement centres across South Asia and eastern Africa. In its final year, it will consolidate the knowledge base to enable ongoing research and development at the centres. The project has identified markers linked to effective resistance genes, which can be used in pre-emptive breeding and the development of rapid diagnostic tests. The project, set to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.[4]

Forestry

The Middle Hills of Nepal are home to 44% of the country's population, where most people gain their livelihoods from a combination of agricultural and forest products. Most forest lands have been handed over to community forest user groups, largely with suboptimal management and very limited timber harvest. Previous work supported by ACIAR 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 to facilitate the adoption of the package, in order to improve forest management practices in community forests and on private land in Kahbre Palanchok and Sindhu Palchok districts. The project is working with 15 community forest user groups in each district, focusing on adoption of improved forestry practices; development of community forestry planning, governance and gender equity frameworks; and establishment of pro-poor, small-scale forest enterprises.[5]

Water

A suite of projects with a common theme of optimising the management of natural resources and adopting new practices to increase productivity and sustainability will operate on the Eastern Gangetic Plains in Bangladesh, India and Nepal during 2020–21. These projects ultimately aim to improve the livelihoods of the many and varied communities of the plains, and are part of the SDIP program (see page 132).

The traditional concept of a physiological crop yield gap is considered useful in national food security planning but, across the Indo–Gangetic Plains, socioeconomic constraints often limit production and overexploitation of regional water resources causes environmental problems. A project led by Dr Donald Gaydon of CSIRO Agriculture and Food will determine if there are feasible alternatives to quantify yield gaps in terms of economics and water use sustainability. The project will make a preliminary assessment of the effects of conservation agriculture and sustainable intensification, future climate scenarios and some economic variables on food production capacity.[6]

The benefit of conservation agriculture-based sustainable intensification practices in improving livelihoods in rural areas of the Eastern Gangetic Plains has been demonstrated by considerable work in the region, including projects within SDIP. A small research activity, led by Dr Brendan Brown of CIMMYT, aims to build capacity to support mechanisation of conservation agriculture-based sustainable intensification. The project is studying the institutional landscape to understand the potential for mechanisation at the provincial level, facilitate the development of multi-stakeholder platforms and support the development of a road map to help roll out mechanisation.[7]

There are proven benefits of conservation agriculture-based sustainable intensification systems in the Eastern Gangetic Plains but there are also potential trade-offs. Weed control is one of the biggest challenges when these systems are implemented. A project led by Dr Brendan Brown of CIMMYT has documented farmers' knowledge, attitude and practices around weed management under conservation agriculture and sustainable intensification systems, and will report on the gendered implications for equitable and sustainable intensification in the Eastern Gangetic Plains of South Asia.[8]

A small project was developed to encourage and support a core team of local partners in Bangladesh, India and Nepal to undertake participatory 'foresight for food' exercises in their respective domains using scenario-based approaches and systems thinking. Dr Avinash Kishore of the International Food Policy Research Institute leads the project, which continues to build the capacity of national partner institutions and support young farmers to communicate their aspirations and concerns to policymakers and other stakeholders in the regional food systems.[9] The project will be extended until the end of the 2020–21 year, to allow time to consider the impact of the COVID-19 pandemic on regional food systems.[10]

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See page 209 for contact details

Current and proposed projects

1. Sustainable and resilient farming systems intensification in the Eastern Gangetic Plains (SRFSI) (SDIP) [Bangladesh, India, Nepal] (CSE/2011/077)
2. Identifying soil constraints in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CROP/2018/210)
3. Enhancing farm-household management decision-making for increased productivity in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (CSE/2012/108)
4. Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
5. Enhancing livelihoods through improved forest management in Nepal (FST/2017/037)
6. Quantifying crop yield gaps across the Indo-Gangetic Plain from new perspectives – production, farmer profit and sustainability of water use (SDIP) [Bangladesh, India, Nepal] (WAC/2018/169)
7. Building provincial capacity for sustainable agricultural mechanisation in Nepal (SDIP) (WAC/2018/220)
8. The implications of sustainable intensification on weed dynamics in the Eastern Gangetic Plains (SDIP) [India, Nepal] (WAC/2018/221)
9. Regional foresight for food systems in the Eastern Gangetic Plains (SDIP) [Bangladesh, India, Nepal] (WAC/2019/136)
10. Food futures for the food systems in the Eastern Gangetic Plains [Bangladesh, India, Nepal] (WAC/2020/158)

Pakistan

A$3.6 million
Budgeted funding

13
Bilateral and regional research projects

Australia has a 70-year development assistance relationship with Pakistan. Our longstanding cooperation has contributed to building Pakistan's long-term economic prosperity, stability and resilience, and investing in people, especially women and girls. Future areas of assistance will focus on consolidating our shared achievements and centre on a small number of areas where Australia can make the most difference in Pakistan. Generating economic growth is the centrepiece of the Pakistan Vision 2025 statement but economic growth continues to be constrained by energy and infrastructure deficits, skills shortages, regional instability and other barriers to trade. In rural areas, Australia works to help Pakistan increase livelihood opportunities for poor men and women by enhancing agricultural productivity and expanding revenue streams for farmers, including through improved water management practices, adding value to raw agricultural products and improved access to markets for those products. Australia's involvement will also contribute to improving Pakistan's food security and nutrition levels, and women's economic empowerment.

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

Despite its contribution to GDP halving over the last decades, agriculture is still 18% of Pakistan's GDP and remains key to economic stability. With two-thirds of the population living in rural areas, the agriculture sector engages around 67% women while overall employment is 38% of the national labour force. The sector constitutes 53% of total exports of the country.

Food insecurity remains a major driver of public policy in Pakistan, with over 23% of households suffering from moderate to severe food insecurity. Four out of 10 children under five years of age are stunted, which impacts their cognitive ability. The impacts of malnutrition including on labour, productivity and healthcare expenses were estimated to cost Pakistan US$7.6 billion, or 3% of GDP, every year. Women's empowerment is recognised as crucial for improving nutrition outcomes. Women are often the primary caregivers and can influence children's nutrition directly through child-care practices and indirectly by improving the family nutrition status.

Increasing the focus of all action on gendered approaches to livelihood improvement has been a priority for the Government of Pakistan, emphasising its commitment to the United Nations' Sustainable Development Goal 5 (Achieve gender equality and empower all women and girls). The Government has pledged to increase women's participation in decision-making and will focus on opportunities to enhance development, adoption and growth of best-practice technologies; and support for trialling small-and-medium enterprise development and village community centres for the mobilisation and innovation of rural communities. This will provide an enabling environment and equal opportunities to women for development of their full potential.

The demand for and pressure on surface and groundwater resources is a major and complex problem for Pakistan, requiring effective management from farm to national scales. Agricultural intensification and competing demands for urban and industrial uses is exerting pressure on the availability of surface and groundwater water. Added to this are problems of low agricultural productivity and poor irrigation management practices, increasing waterlogging and salinity. Pakistan has a strong research sector addressing these challenges, with a particular focus on low productivity, lack of diversification in cropping, low adoption of efficient management practices, inefficient use and increased demand for water and, above all, climate change.

The Government of Pakistan aims to boost the agriculture sector by encouraging international investment. There has been significant investment from Saudi Arabia and Malaysia, in addition to China. The first phase of the China–Pakistan Economic Corridor covering infrastructure, energy capacity and economic growth in Pakistan has ended. It entered a second phase where agriculture has been main driver. Phase 2 is focusing on technology transfer, skill development and agricultural cooperation.

Declining subsidies on agricultural inputs as a condition of the ongoing International Monetary Fund reform program means that the cost of production for farmers is expected to increase in the near future. There has also been a significant reduction (60%) in government investment in agriculture in the post-devolution period (since 2010). Recognising the impact of reduced investment on the performance of the agriculture sector, the current government announced an Agriculture Emergency Program with a focus on agricultural production, water conservation and market-driven policy alignment. The program aims to overcome the stagnant growth and inequity that typifies much of Pakistan's agriculture sector. The policy revolves around three pillars:

- building an innovation-based sustainable agriculture sector
- using public investment to improve the profitability of agriculture
- ensuring food security and freedom from hunger.

Currently, ACIAR investments are well-aligned with this policy, through ongoing policy discussions at the national and provincial levels.

Country priorities

Australia is a key research partner for Pakistan due to its deep expertise in agriculture, livestock production and water management, which is directly relevant to the challenges faced by Pakistan agriculture. ACIAR works closely with the Pakistan Federal Government, provincial departments, NGOs, academia, the Pakistani private sector, DFAT and other donor partners to provide research and development and capacity building. Technical support and carefully targeted research and development interventions, such as those supported by ACIAR, typically underpin larger development programs in Pakistan. Pakistan invests in the research relationship with Australia, with a history of substantial in-kind contributions and aligned projects designed to take research results to scale.

The ACIAR program with Pakistan is based on:

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

The ongoing focus of our research collaboration will be water and salinity management and profitable smallholder cropping and livestock systems. This supports the realignment in thinking of the Government of Pakistan towards rural transformation and ensuring food and nutrition security through agriculture. The emphasis is on strengthening the national agriculture research system to support crop diversification (high-value horticulture, pulses), mitigation and adaptation to climate change, and the promotion of livestock, fisheries and small ruminants. Empowering women and focusing on enhancement of farm incomes will cut across all future collaboration.

The dairy sector, including small ruminant development, is a high priority of the Pakistan Government. This is the only sector that can generate daily cash income, serve as a safety net and provide self-employment opportunities for more than 12 million rural families, especially women and youth. Ongoing ACIAR projects are focused on the dairy beef value chain and the small ruminant sector.

Unregulated extraction of underground water is increasing soil salinity in Pakistan, and both national and provincial irrigation agencies have identified this as major threat. ACIAR has recently commissioned a detailed analysis of the current scenario.

Rapid rural transformation has led to a quick decline of poverty in many countries, but success varies between countries, and between regions within countries. The rural transformation of China has been rapid and comes with major benefits and some costs. The Pakistan Government is keen to learn from the Chinese model, facilitated through ACIAR.

During 2020–21, ACIAR plans to engage Chinese research agencies in trilateral collaboration focused on the horticulture sector. Long-term ACIAR support in this sector is now fully integrated with a large horticultural development program in Punjab, with CABI leading both ACIAR-supported research projects and the Punjab development projects. Also in 2020–21, ACIAR and the Pakistan Agriculture Research Council will develop a new partnership arrangement focused on co-investment and joint development of longer-term agricultural research-for-development projects.

2020–21 research program

ACIAR supports 13 projects in Pakistan, eight 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 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.

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]

The whole-family extension approach is being assessed by researchers as a way to improve on-farm profitability and marketing of dairy products. In the process, practices to improve on-farm efficiency and new value-chain opportunities will also be identified.
Photo: Conor Ashleigh. ACIAR project: LPS/2016/011.

Pulses, mainly chickpeas, lentils and mungbeans, are well suited to smallholder farming by both men and women and important in the agrifood systems of Pakistan. A project, led by Dr Rajendra Adhikari of the University of Tasmania, is developing socially inclusive and competitive value chains for pulses in Punjab and Sindh, with spillover benefits expected for the Khyber Pakhtunkhwa region. The three regions are characterised by gender inequalities within the industry and in society generally. The project will develop production and market knowledge, increase capacity of farmers and stakeholders and support industry development.[2]

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.[3]

Crops

Stripe rust (also called yellow rust) is a common and important disease of wheat worldwide. While fungicides can be used for in-crop control, genetic resistance is more economically and environmentally sound. A project, led by Professor Robert Park of the University of Sydney, has established and equipped a collaborative network of key wheat improvement centres across South Asia and eastern Africa. In its final year, it will consolidate the knowledge base to enable ongoing research and development at the centres. The project has identified markers linked to effective resistance genes, which can be used in pre-emptive breeding and the development of rapid diagnostic tests. The project, set to reduce the vulnerability of wheat to stripe rust in South Asia and eastern Africa, also benefits wheat production across the globe, including Australia.[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 progressively pushed out to the most marginal lands, with labour shortages being 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. A project, led by Dr Ata-ur Rehman of Charles Sturt University, is facilitating farmer-led research and demonstrations of improved varieties, agronomic practices and seed production to increase the production and profitability of pulses.[5]

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.[6]

Horticulture

The horticulture sector in Pakistan is significant, both domestically and for export production. Under the Australia–Pakistan Agriculture Sector Linkages Program, significant progress was made on strengthening the value chains for mango and citrus, and exploring the prospects for developing heat-tolerant varieties of vegetables. A project led by Dr Babar Bajwa of CABI is strengthening selected vegetable value chains in Punjab and Sindh provinces, as part of the Agriculture Value Chain Collaborative Research Program. Focusing on potatoes, chillies, tomatoes and onions, the project has identified opportunities for engagement and entrepreneurship, and small-scale production, post-harvest processing and trading. During 2020–21, the project will be testing and developing technical innovations and scaling out improvements to increase the capacity and incomes of farming families, traders and intermediaries.[7]

Livestock Systems

Despite the good genetic potential of dairy livestock in Pakistan, production is very low due to poor nutrition, management and marketing. Additionally, research efforts and livestock extension support services are fragmented. At the same time, demand and prices for beef are rising strongly, presenting new opportunities for smallholder farmers. Traditionally, beef is a by-product of the dairy sector, using male animals and old cows for meat, so there are trade-offs between increasing milk production and growing cattle and buffaloes for meat. A project in its final year, led by Dr David McGill of the University of Melbourne, will determine the effectiveness of the whole-family extension approach to improving on-farm profitability and marketing. Alongside this, practices to improve on-farm efficiency and new value-chain opportunities will be identified.[8]

Previous research found that poor supply (quantity, quality and consistency) of small ruminants from farms into local markets is the major restriction in many value chains. Further, extension and other services for small-ruminant farmers are very limited. A project, led by Dr Rebecca Doyle of the University of Melbourne, focuses on including women in goat (and sheep) production systems and the value chain in the Pakistani provinces of Punjab and Sindh. During 2020–21, the project will deliver strategies for higher and more sustainable production and value-chain engagement to improve the livelihoods and wellbeing of small-ruminant farming families.[9]

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.[10]

Water

Irrigation is critical to food security, poverty reduction and economic development in Pakistan, but the country's irrigation is among the least profitable in the world. Australia is well placed to help Pakistan improve its irrigation, drainage and salinity management in major cropping systems. A project, led by Dr Sandra Heaney-Mustafa of the University of Canberra, has increased the irrigation management skills of farmers and identified successful modes of extension. In the final stages of the project, scale-out models and plans will be developed for extension services for ongoing transfer of the tools and technologies beyond the project area.[11]

Groundwater use is extensive in Pakistan. Some areas are completely reliant on groundwater, while others use groundwater in conjunction with surface water. Greater use of groundwater could potentially reduce large areas of waterlogging in the Sindh province. In its final stages, a project led by Dr Michael Mitchell of Charles Sturt University will test economic and hydrogeological models, developed or customised during the project, to manage groundwater quantity and quality. Institutional arrangements will be identified for post-project adoption of tools and options.[12]

Salinisation and sodification of surface soils and waterlogging threaten agricultural production and livelihoods in the southern Indus Basin, resulting in higher rates of poverty for communities living in areas affected by salinity. A new 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. The research team will work with a broad network of local partners to develop adaptation options for living with salinity.[13]

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See page 209 for contact details

Current and proposed projects

1. Policy and institutional reforms to improve horticultural markets in Pakistan [China, Pakistan] (ADP/2014/043)
2. Developing competitive and inclusive value chains of pulses in Pakistan (ADP/2017/004)
3. Understanding the drivers of successful and inclusive rural regional transformation: sharing experiences and policy advice in Bangladesh, China, Indonesia and Pakistan (ADP/2017/024)
4. Mitigating the effects of stripe rust on wheat production in South Asia and eastern Africa [Ethiopia, India, Nepal, Pakistan] (CIM/2014/081)
5. Increasing productivity and profitability of pulse production in cereal based cropping systems in Pakistan (CIM/2015/041)
6. Improved mungbean harvesting and seed production systems for Bangladesh, Myanmar and Pakistan (CIM/2016/174)
7. Strengthening vegetable value chains in Pakistan for greater community livelihood benefits (HORT/2016/012)
8. Improving smallholder dairy and beef profitability by enhancing farm production and value chain management in Pakistan (LPS/2016/011)
9. Enhancing small ruminant production to benefit farming families in Sindh and Punjab, Pakistan (LS/2018/105)
10. 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)
11. Developing approaches to enhance farmer water management skills in Balochistan, Punjab and Sindh in Pakistan (LWR/2014/074)
12. Improving groundwater management to enhance agriculture and farming livelihoods in Pakistan (LWR/2015/036)
13. Adapting to salinity in the southern Indus Basin [Pakistan] (LWR/2017/027)

Sri Lanka

A$0.7 million
Budgeted funding

1
Bilateral and regional research projects

In line with the foreign policy White Paper, Australia's aid program assists Sri Lanka's progress as a secure, stable and prosperous partner in the Indian Ocean region. We have embedded an economic partnership approach, with the aim of maximising the number of Sri Lankans who benefit from economic growth. Australian assistance aims to catalyse reform and leverage additional resources from the Sri Lankan government, the private sector and the community sector. The program will continue support transition from post-conflict reconstruction to supporting economic growth and improving governance.

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

Economic and development growth in Sri Lanka has been strong over the past two decades, resulting in significant poverty reduction across the country. The country has overcome significant challenges in this time.

A 26-year civil war scarred the nation and a tsunami in 2004 left tens of thousands of people dead, injured or homeless. Today, Sri Lanka has achieved most of the United Nations' Millennium Development Goals and has achieved middleincome country status. But growth has not been uniform, and significant pockets of poverty exist in the former conflict districts of Mullaitivu, Manar and Kilinochchi in the Northern Province, as well as Batticaloa in the Eastern Province and Moneragala in the Uva Province.

Australia has a strong interest in ensuring Sri Lanka continues its development as a secure, stable and prosperous partner of Australia in the Indian Ocean region, underpinned by an effective postconflict reconciliation process.

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 by ACIAR concluded that there was a conducive environment to re-establish a collaborative research program with Sri Lanka, and that it should start with a multidisciplinary project in aquaculture for freshwater shrimp, focused on communities in the Northern Province. Given Sri Lanka's middle-income status, this re-engagement with Sri Lanka is incumbent on significant co-investment from Sri Lanka.

Country priorities

Improved income and employment opportunities for many Sri Lankans are currently constrained by gender, geography, ethnicity, caste, lack of productive assets and a weak private sector. The main development priority for Sri Lanka is supporting inclusive growth and human development.

ACIAR re-engagement with Sri Lanka supports Objective 1 of the Australian Government's development cooperation program with Sri Lanka: to expand economic opportunities for the poor. This objective specifically notes that the growth and competitiveness of the Sri Lanka economy, particularly small- and medium-sized enterprises, is constrained by issues such as lack of access to finance, markets, market linkages and technology, skills gaps in the workforce and lack of effectively coordinated and inclusive policy reform.

Australia will identify several target sectors and value chains that offer the highest potential to benefit the poor, and women in particular. We will work closely with the private sector and government to enhance the business-enabling environment by improving the relevance, quality and effectiveness of skills, technology, regulations and policies. The objective is for more poor Sri Lankans to receive higher wages, more stable income and rising wealth as a result of equitable engagement with the private sector.

2020–21 research program

ACIAR supports one project in Sri Lanka, which 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 Sri Lanka partners.

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. Management practices and stocking strategies for sustainable culture-based fisheries, based on a co-management strategy, have been established in two previous ACIAR projects 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. An ACIAR-supported project, led by Dr Clive Jones of James Cook University, is investigating stocking, monitoring and harvesting practices to optimise fish and prawn productivity and product quality. The project also aims to better understand the market chains, to enable further improvements in the value of the fishery and to benefit both men and women fishers and traders.[1]

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Dr Pratibha Singh

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See page 209 for contact details

Current project

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

A new project is investigating stocking, monitoring and harvesting practices to optimise fish and prawn productivity and product quality, in inland fisheries in the Northern Province of Sri Lanka. Photo: Clive Jones. ACIAR project: FIS/2018/157.