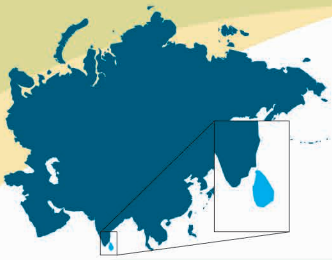

Climate-Smart Agriculture in Sri Lanka

Climate-smart agriculture (CSA) considerations

Agriculture is the mainstay of Sri Lanka's rural economy. Given the country's diverse agro-ecological conditions and landscapes, smallholder farmers, who make up the overwhelming majority of the country's 1.7 million farmers, have long sought ways to build resilience of the food system under increased change and variability in climate.

Conservation of genetic diversity of indigenous crop varieties is the foundation for the sustainable development of new varieties that address present and future challenges. Resource-poor farmers have used intelligently genetic diversity over centuries to develop varieties adapted to local environmental stresses. Similarly, the preservation of genetic variability in indigenous livestock has enhanced resilience to changing climate conditions in native dairy stocks.

Access to new, climate-adapted genetic material is ensured by the Department of Agriculture (DA), which implements crop germplasm collection and systematic crop comparison programmes that target farmers in different agro-ecological regions.

Rainwater harvesting techniques, crop diversification and livestock integration, mulching and thatching, and micro-irrigation are key CSA practices adopted in Sri Lankan homegardens. Such activities, predominantly undertaken by women, represent important entry points for advancing adaptation, mitigation, and productivity goals, but also for acknowledging and encouraging women's critical role as knowledge heirs, decision makers and environmental stewards.

Climate-resilient crop varieties, particularly in rice paddy, have helped improve both household and national food and nutrition security. Rainwater harvesting systems and micro-irrigation techniques have improved water-use efficiency, while cover crops and shade management have helped to overcome heat stress and improve productivity in several production systems.

CSA practices that address water salinization and soil degradation and erosion are critical for ensuring the productivity and sustainability of important food and export crops such as potato and tea. Reducing synthetic fertilizer and pesticide use through mulching, thatching, and agroforestry systems, among others, can ensure that water and soil quality are not compromised when aiming for productivity increases.

Land productivity and resilience has been also achieved through the adoption of perennial cropping systems and short-duration and agro-ecologically adapted plant varieties, while emissions reduction and carbon sequestration have been a consequence of CSA practices such as crop–animal integration, manure production, and reduced use of chemical inputs. However, adoption levels of these efforts are generally low, especially among small-scale farmers.

There is a need for greater state support for mitigation efforts through policies curtailing excessive use of synthetic fertilizers, which has a high share of total agricultural emissions. These should be complemented with efforts to increase public environmental protection awareness through, for instance, providing farmers with information on improved fertilizer management practices, nutrient management, and judicious combination of organic and inorganic fertilizers, among others.

Adoption of CSA practices requires institutional support, especially for smallholder farmers. In particular, medium- and long-range seasonal climate forecasts, better intra- and inter-institutional coordination, and improved market access by smallholders are prerequisites for increased CSA adoption in Sri Lankan agricultural systems.

Additionally, innovative knowledge management systems should be developed to promote adoption of knowledge-intensive CSA technologies aimed at strengthening farmers' knowledge of CSA practices, facilitating sharing the techniques, and providing support to local and indigenous knowledge systems.

Compliance and voluntary markets are important instruments for enhancing climate resilience, reducing greenhouse emissions, and generating carbon credits, while contributing to the social, economic and environmental development of Sri Lanka.

The development of governance and institutional framework supported by legal and regulatory frameworks is critical for maximizing the opportunities for climate finance mobilisation and emissions trading in the various sectors of the economy.

A Adaptation · M Mitigation · P Productivity · Institutions · $ Finance

The climate-smart agriculture (CSA) concept reflects the ambition to improve the integration of agriculture development and climate responsiveness. CSA aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase agriculture productivity, enhance resilience of agro-systems, and reduce/remove greenhouse gases (GHGs) from agriculture production, and require planning to address tradeoffs and synergies between these three pillars: **productivity, adaptation, and mitigation** [1]. While the concept is new, and still evolving, many of the practices that constitute CSA already exist worldwide and are used by farmers to different degrees to cope with various production risks [2]. Mainstreaming CSA requires a critical stocktaking of existing and promising agricultural production practices for the future, and of institutional and financial enablers for CSA adoption. This country profile provides a snapshot of a developing baseline created to initiate the discussion about entry points for investing in and scaling up CSA in Sri Lanka.

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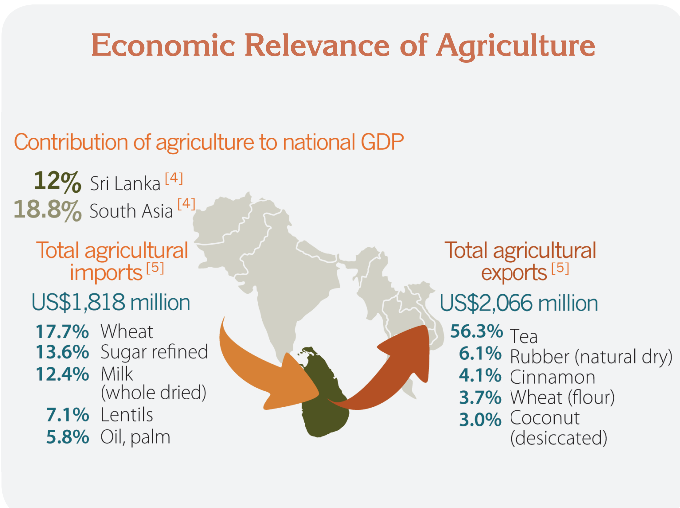
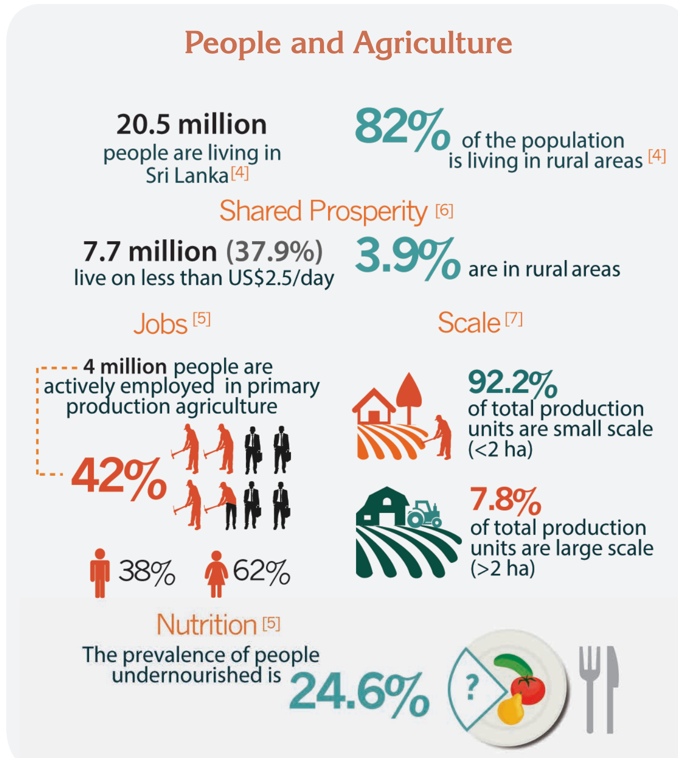
National context:
Key facts on agriculture and climate change

Economic relevance of agriculture

Agriculture has historically been the mainstay of the Sri Lankan economy and remains central to the country's modern rural economy. A member of the South Asian Association for Regional Cooperation (SAARC), Sri Lanka is considered an emerging economy with a per capita gross domestic product (GDP) of US$3,280 in 2013 [3]. The agricultural sector represents a significant 12% of the national GDP and has demonstrated consistent growth in recent years, increasing by 3.7% annually from 2010 to 2014 [4]. Moreover, the agricultural sector is an important source of employment; approximately 42% of the total economically active population is engaged in primary agricultural production.





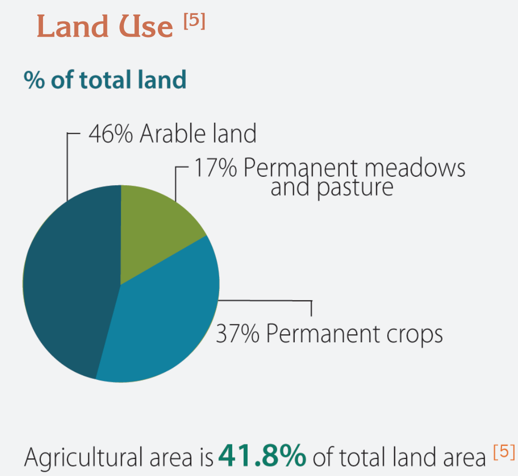
Land use

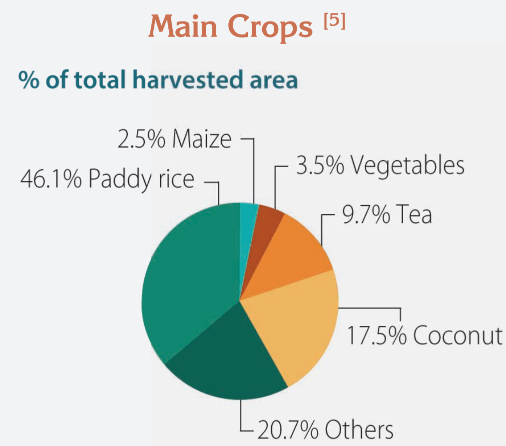
Agricultural land covers approximately 2.6 million hectares, or roughly 42% of Sri Lanka's total land area [5]. The great majority of the land used for food production is owned by some 1.65 million smallholder farmers [7]. With average landholdings totaling less than 2 hectares, smallholder farmers are in charge of almost 80% of Sri Lanka's total annual crop production [7].

The agricultural area in Sri Lanka has increased gradually in the past decade. With the end of internal conflict, previously inaccessible territories have been converted into productive cropland. From 2003 to 2013, rice-harvested areas increased by 30.4% (911,440 to 1,188,230 hectares), while maize-harvested areas more than doubled (27,060 to 67,720 hectares) [5]. During the same timeframe, pastureland did not increase significantly [8], and shifting cultivation[1] actually declined, due in part to limited land availability. Homegardens,[2] which contribute to household-level food security in rural Sri Lanka, cover a substantial 14.8% of the total land area [10]. These changing patterns of land use, coupled with the strict enforcement of anti-deforestation laws, have resulted in a decreasing rate of deforestation over the past decade.

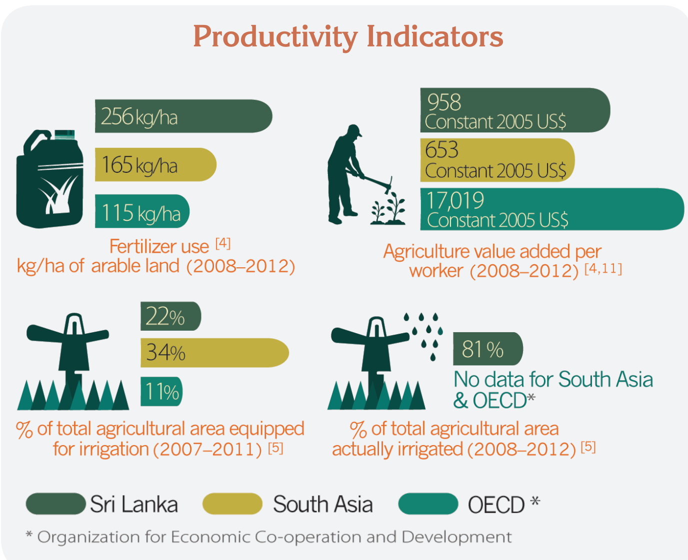
1 Shifting cultivation, or *Chena*, is an agricultural system in which plots of land are cultivated temporarily, then abandoned and allowed to revert to their natural vegetation. Common shifting cultivation practices include land clearing, migratory resettlement, and slash-and-burn techniques.

2 Homegardens represent complex land-use systems that combine multiple farming components, such as annual and perennial crops, livestock, and occasionally fish, providing environmental services, household needs, and employment and income generation opportunities to farmers [9].





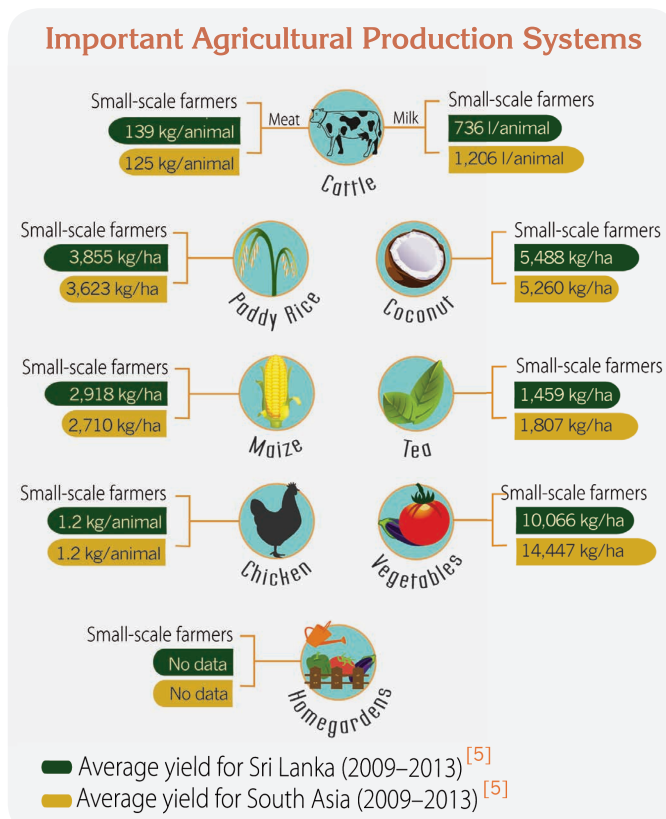
* Calculation based on sum of FAO estimates of areas under (a) arable land, (b) permanent crops, and (c) permanent meadows and pastures, not taking into account bodies of water.



Agricultural production systems

Sri Lanka encompasses three major agricultural production systems: food crops, plantation crops,[3] and dairy cattle. The most important food product systems in Sri Lanka are rice, maize, pulses, and vegetables, which are produced at varying scales and intensities. Sri Lanka's staple food crop – rice – is produced both by small-scale farmers (using intensive and extensive practices), and by large-scale farmers (using intensive, irrigation, and input-dependent practices). Mono-cropping is common in paddy rice production, and more than 98% of Sri Lanka's rice areas are cultivated with improved, high-yielding, self-pollinating varieties. Small-scale farmers typically produce maize and pulses (e.g., mung bean, cowpea, etc.), using extensive practices, while small- and large-scale farmers produce vegetables and high-value crops, both extensively and intensively.

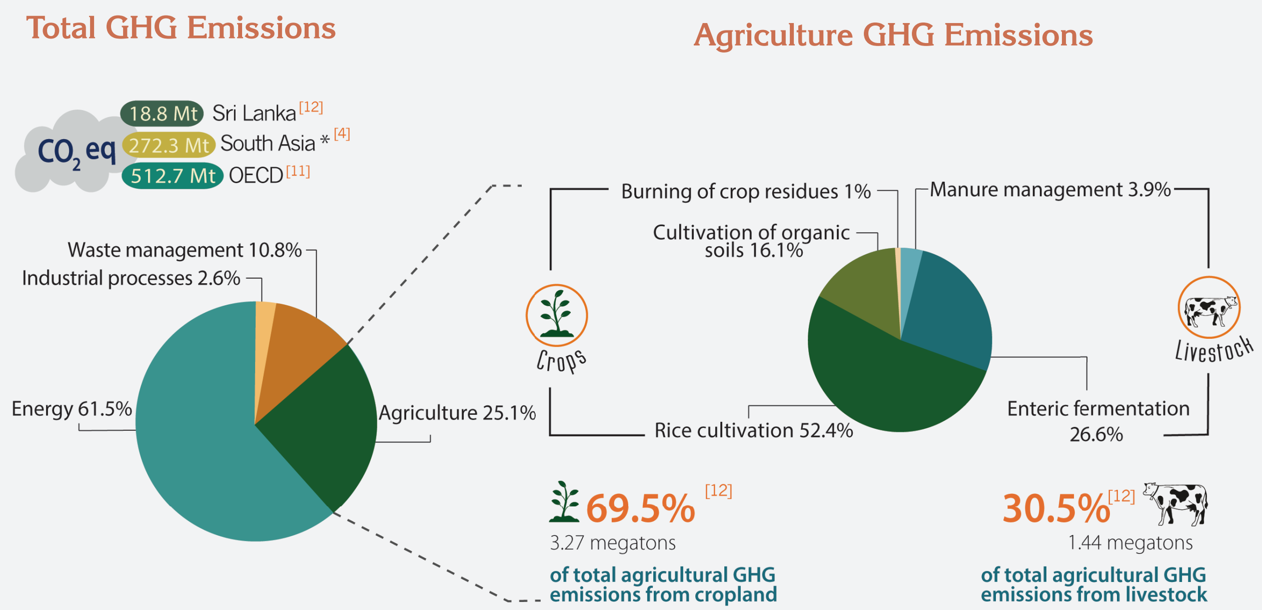
The cattle production system is almost exclusively focused on dairy production. Indigenous cattle are reared extensively in certain Northern provinces for manure collection, while cross-breeds are raised intensively and extensively for milk production across the Dry Zone.



3 These include tea, rubber, and coconut for domestic and export purposes. Intensive, mono-cropping techniques are common for plantation crops. Relative importance of production systems is based on the product's share of crop area, production value, and contribution to daily kilocalorie consumption per capita per day.

Agricultural greenhouse gas emissions

Agriculture accounts for 25.1% (4.71 megatons CO_2 equivalent) of the country's total greenhouse gas (GHG) emissions, almost three times less than the energy sector (61.5%), but more than the waste management (10.8%) and industrial sectors (2.6%). GHG emissions from cropland (mostly rice cultivation and cultivation of organic soils) account for 69.5% of total emissions, while the livestock sector (especially enteric fermentation)[4] accounts for 30.5% [11].



* Refers to Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepan, Pakistan, and Sri Lanka.).

Challenges for the agricultural sector

Sri Lanka's agricultural sector is performing below its potential, as evidenced by low levels of productivity and a lack of diversification. Strengthening the agricultural sector will require overcoming major social, economic, environmental, and policy-related challenges.

The country's staple crop, irrigated paddy rice, requires 1,500 mm of water annually. Irrigation systems and drought-resistant varieties are widely used in Sri Lanka; however, accessibility and affordability are limiting factors for smallholder farmers. Water salinity poses another major threat, as more than 45,000 hectares of agricultural land are affected by salinity due to improper irrigation techniques and poor drainage [13]. Added to this, soil degradation resulting from soil erosion challenges crop productivity and food security.[5]

The overuse of inorganic fertilizers and chemicals endangers soil quality and compromises public health. In 2014, Sri Lanka imported 765,000 tons of inorganic fertilizer [16] and approximately 8,200 of formulated pesticide products to support the agricultural system. More than 70% of imported fertilizers are used for paddy rice cultivation, owing in part to generous state subsidies for rice cultivation. This indicates that policies curtailing excessive use of synthetic fertilizer are required, providing farmers with recommendations of improved fertilizer management practices, promoting the use of judicious combination of organic and inorganic fertilizers, training farmers on nutrient management, and raising public awareness of environment protection.

Sri Lanka faces challenges in meeting its sustainability and productivity goals, particularly with respect to the livestock and chicken production systems. Practices such as silage

4 Methane gas produced in digestive systems of ruminants and, to a lesser extent, non-ruminants.

5 In areas where tea is vegetatively propagated, annual soil losses total up to 15 tons per hectare. In areas where tea is propagated with seedlings, and more exposed, annual losses can exceed 20 tons per hectare [14]. This is particularly true for areas of potato production, where 58% of farmland is susceptible to soil erosion [15].

preparation, biogas and compost production, total mixed ration (TMR) feeding, and the cultivation of fodder grasses are often not capitalized on. Adaptive breeds of chicken and cattle (such as CPRS chickens and Kottukachchiya goats) are not widely adopted and, as a result, these sectors face productivity lags [17]. This complicates Sri Lanka's sustainability efforts, such as the goal of achieving 50% self-sufficiency in milk production by 2015 [18].

At present, variable and ad-hoc trade policies fluctuate between delivering benefits to consumers or producers, resulting in great uncertainty and variability in the agricultural sector. In an effort to ensure domestic food security, guaranteed price schemes and import tariffs heavily protect rice, tea, liquid milk, and, to a lesser extent, other crop and livestock sub-sectors. In spite of this, most small-scale farmers lack market access and are unable to compete with large-scale commercial enterprises. Limited market access and the absence of insurance and credit programmes make investment in productivity and sustainable practices especially difficult for smallholders.

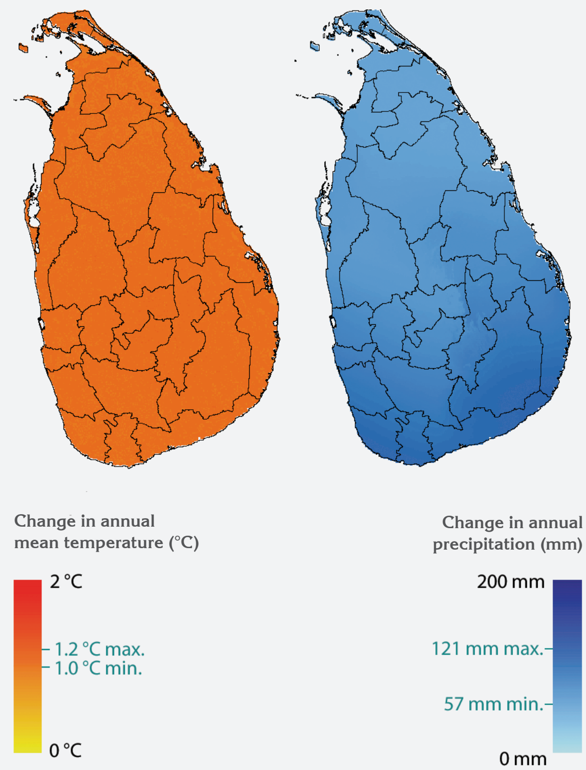
Agriculture and climate change

Sri Lanka's climate is considered tropical monsoonal with great rainfall variation seasonally and across the three principle climatic zones: the Wet Zone (WZ) in the southwestern region; the Dry Zone (DZ), covering the northern and eastern parts of the country; and the Intermediate Zone (IZ), skirting the central hills (see Annex I). The DZ and IZ, where the majority of Sri Lanka's agro-ecological regions (AERs) are concentrated[6] [10], are particularly vulnerable to rainfall seasonality and variability.

According to climate predictions, Sri Lanka's wet areas are becoming wetter, while the dry areas are becoming drier, directly affecting the agriculture activities in the WZ and DZ [18].[7] Annual rainfall is expected to increase by a minimum of +57 mm, with up to +121 mm in the WZ, while droughts will be magnified, particularly in the IZ. Temperature increases will range between +1 and +1.2 °C, with greater impact in the DZ and IZ.

Sri Lankan agriculture has already felt the effect of extreme weather events and climate changes, including: a slow but steady rise of ambient temperature (0.01–0.03 °C per year); high-intensity rainfall resulting in landslides and soil and coastal erosion;[8] salinity intrusion into soils and aquifers; tornado-type winds; and increasingly extreme droughts and floods. Future climate change will continue to impact the agricultural sector in general, but will be especially acute for Sri Lanka's smallholder farmers, due to several factors:

Projected Change in Temperature and Precipitation in Sri Lanka by 2030



- Lack of access to irrigation systems increases susceptibility to drought (e.g., in the Kurunegala district [IZ], drought has reduced rice yields by 44%) [21].
- Reliance on rainfed systems threatens staple crop productivity. A reduction of monthly rainfall by 100 mm could reduce tea yields by 30–80 kilos per year [22].
- Rice dependency and undiversified production, which, given anticipated higher temperatures, may make agricultural production more risky. For instance, minimal exposure to temperatures of over 33 °C during the flowering stage significantly reduces productivity [23].
- Root and tuber production is typically smallholder, and a reduced diurnal temperature range in the highlands will likely negatively impact these crops' productivity [14].

6 These agro-ecological regions (AERs) take into account the annual rainfall, monthly rainfall amount (at 75% probability), and distribution, contribution of southwest monsoon rains, soil type, land use, and vegetation (Annex II).

7 Projections based on RCP 4.5 emissions scenario [24] and downscaled using the Delta Method [25].

8 Approximately 30 cm of soil has already been eroded from upland tea plantations [20].

- Limited access to technology (e.g., watering and silage production techniques), which impedes small-scale livestock farmers to cope with climate-related challenges (e.g., limited adoption of watering and silage production techniques for extensive livestock farmers).

CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges, as well as for promoting economic growth and development of the agriculture sector. For the purpose of this profile, technologies and practices are considered CSA if they maintain or increase agriculture productivity and contribute to at least one of the other objectives, that is, adaptation and/or mitigation. Hundreds of technologies and approaches around the world fall under the heading of CSA [2].

In Sri Lanka, traditional and modern climate adaptation strategies co-exist. For example, as a response to climate variability, the country's ancient rulers built reservoirs for collecting and saving rainwater for irrigation and human and animal consumption during the dry season. These reservoirs continue to support modern agriculture alongside more recently introduced CSA practices, such as conservation of genetic diversity and indigenous crop and livestock varieties, introduction of high-quality, genetically improved varieties of rice, tea, and maize, adapted planting times, water and soil conservation techniques, intercropping and agroforestry, shade management, mulching, manure production and organic fertilization, crop diversification, and home gardening for increased food security, etc.

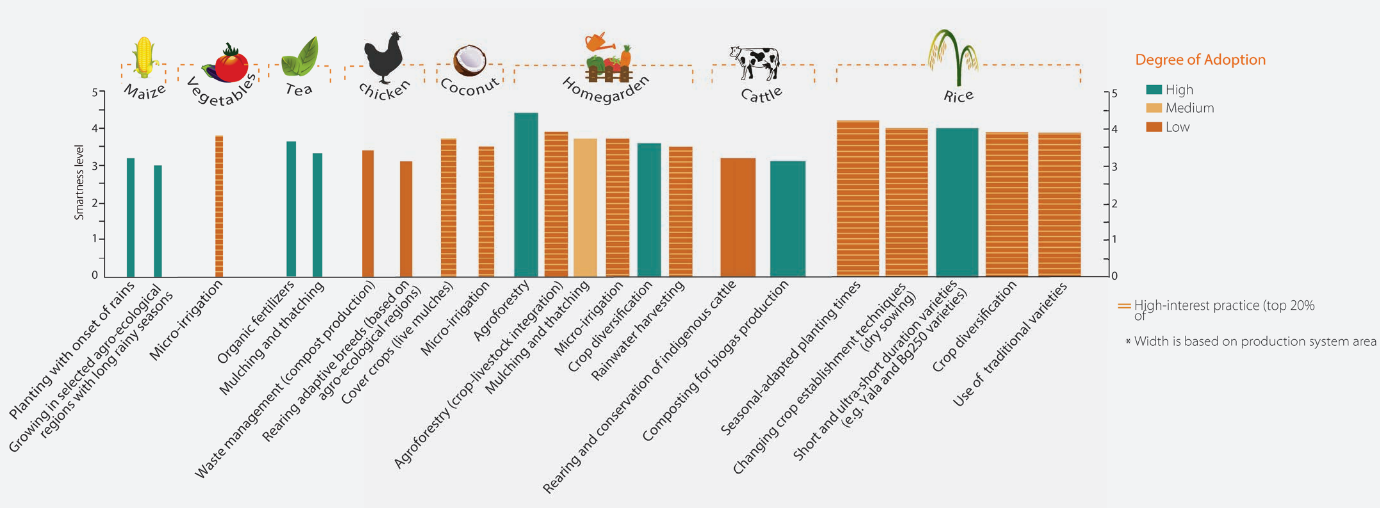
The practices presented below are an indication of the broad range of CSA practices that have been adopted in different production systems, and at different scales and intensities, in Sri Lanka. Despite the great variety of productivity and adaptation strategies, significantly fewer strategies focus on mitigation.

Adaptation to extreme weather events, especially flooding and droughts, is of utmost importance in Sri Lanka. As a result, farmers have adopted many CSA practices aimed at water conservation, such as the use of short-duration and drought-resistant varieties, shared cultivation, zero tillage, rainwater harvesting and micro-irrigation. Soil conservation practices include the introduction of salt-tolerant varieties, construction of ditches, contour planting, mulching, manure harvesting, and use of cover crops. For centuries, resource-poor farmers have used intelligently genetic diversity and, as a result, have developed crop and livestock varieties adapted to their unique environmental stresses. This provides a strong foundation for the sustainable development of new varieties capable of responding to increasingly variable climate conditions, one of the most promising CSA practices for rice, maize, vegetables, and cattle.

CSA practices are not uniformly adopted across production systems. Insufficient resources and limited marketing options are important barriers to CSA adoption. For example, smallholder farmers have largely adopted government-subsidized improved varieties for staple crops. However, few of them have changed planting cycles and strategies, possibly due to the costs associated with more input- or labor-intensive cultivation techniques. This is also true for large-scale cattle and chicken farmers and small-scale food crop producers who face resource-related constraints in their attempt to use manure and compost in their agricultural activities.

Programmatic state interventions have had a significant impact on CSA implementation in Sri Lanka. The Department of Agriculture's (DA) complementary programmes "*crop germplasm collection*" and "*systematic crop comparison*" are carried out with farmers in different agro-ecological regions, with the aim of improving access to new climate-adapted genetic material. State protection and guaranteed price schemes, particularly in paddy rice, tea, milk, and chicken, have the potential to encourage the adoption of particular mitigation and adaptation practices, such as livestock integration and crop diversification.

Selected Practices for Each Production System with High Climate Smartness



This graph displays the smartest CSA practices for each of the key production systems in Sri Lanka. Both ongoing and potentially applicable practices are displayed, and practices of high interest for further investigation or scaling out are visualized. Climate smartness is ranked from 1 (very low positive impact) to 5 (very high positive impact).

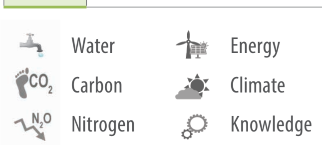
Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in Sri Lanka

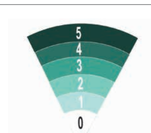
The assessment of a practice's climate smartness uses the average of the rankings for each of six smartness categories: water, carbon, nitrogen, energy, weather, and knowledge. Categories emphasize the integrated components related to achieving increased adaptation, mitigation, and productivity. For more information, see Annex V.

	CSA Practice	Climate Smartness	Adaptation	Mitigation	Productivity
Rice (paddy rice: 46% of total harvested area)	Seasonal-adapted planting times ■ Low adoption (<30%)		Efficient use of rainwater and efficient management of rainwater harvested in village tanks.	Reduces GHG emissions such as methane by minimizing periods of flooding. However, supplementary irrigation would be required to ensure water availability but can also possibly lead to higher energy consumption.	Increases productivity and income.
	Changing crop establishment techniques (dry sowing) ■ Low adoption (<30%)		Minimizes water use and conserves soil moisture, when combined with minimum or zero tillage.	Promotes carbon storage in soil. Water retention increases, which in turn reduces energy needs for irrigation, reduces inundation, thus reducing GHG emissions.	Productivity may be maintained/reduced depending on rainfall availability.

	CSA Practice	Climate Smartness	Adaptation	Mitigation	Productivity
Maize (2.5% of total harvested area)	Planting with onset of rains ■ High adoption (>60%)		Adjusting the cropping calendar by planting with the onset of rains reduces losses due to changing water patterns.	Rainwater supply can reduce energy needs for irrigation.	Increased land and crop productivity per unit of water.
	Growing in selected agro-ecological regions with long rainy seasons ■ High adoption (>60%)		Suitable planting areas can reduce crop vulnerability to changing water and climate patterns.	Rainwater supply can reduce energy needs for irrigation.	Increased land and crop productivity per unit of water.
Tea (9.7% of total harvested area)	Organic fertilizers ■ High adoption (>60%)		Enhances soil quality, water retention and soil functions, increasing the system's potential to overcome climate shocks.	Reduces use of nitrogen fertilizer, thus reducing nitrous oxide emissions.	Enhanced product quality and increased income.
	Mulching and thatching ■ High adoption (>60%)		Improves soil's retention of nutrients and combats erosion. Conserves soil moisture and promotes maximum use of soil residual moisture. Controls weed.	Reduces use of synthetic fertilizer and related GHG emissions. Increases carbon storage in soils.	Increased productivity per unit of water consumed.
Coconut (17.5% of total harvested area)	Cover crops (live mulches) ■ Low adoption (<30%)		Leguminous cover crops reduce the requirement for nitrogen fertilizer of the crop and enriches soil fertility.	Ploughing in cover crops promotes carbon storage in soil.	Increased productivity per unit of nutrients supplied.
	Micro-irrigation ■ Low adoption (<30%)		Ensures water availability.	No significant benefits. Inefficient use of fuel pumps may increase the system's contribution to GHG emissions.	Increased land and crop productivity per unit of water.

	CSA Practice	Climate Smartness	Adaptation	Mitigation	Productivity
Cattle (dairy)	Rearing and conservation of indigenous cattle Low adoption (<30%)		Local breeds can present greater resistance to diseases and heat stress.	Contributes to reductions in GHG emissions and energy when integrating the practice with techniques related to feeding and manure management.	Reduces production costs by reducing external inputs.
	Composting and biogas production High adoption (<30%)		Increases system's resilience to climate shocks.	Reduces the use of nitrogen fertilizer, thus reducing nitrous oxide emissions.	Increased land productivity, product quality and income.
Chicken	Waste management (compost production) Low adoption (<30%)		Improves organic matter usage in crop production (integrated crop-animal systems) and minimizes use of chemical fertilizers.	Reduces the use of nitrogen fertilizer, thus reducing nitrous oxide emissions.	Increased land productivity, product quality, and income.
	Rearing adaptive breeds (based on agro-ecological zones) Low adoption (<30%)		Increases system's resilience to climate shocks.	Contributes to reductions in GHG emissions and energy when integrating the practice with techniques related to feeding and manure management.	Increased stability in productivity given increased resilience to climate shocks.
Homegardens (15% of total harvested area)	Agroforestry High adoption (>60%)		The inclusion of tree crops for shade reduces heat stress on the soil.	Increases in carbon sequestration and storage.	Crop diversification can improve yields, with potential benefits for food and nutrition security and income diversification.
	Agroforestry (crop–livestock integration) Low adoption (<30%)		Improves use of organic matter in crop production (integrated crop-animal systems), minimizes use of chemical fertilizers, and improves energy use efficiency.	Reduces burning of fossil fuel, contributing to minimizing GHG emissions.	Increased land productivity and income.
Vegetables	Micro-irrigation Low adoption (<30%)		Ensures water availability.	Use of efficient fuel pumps may be required to avoid increases in energy consumption.	Increased land and crop productivity per unit of water.





Calculations based on qualitative ranking, where positive change was noted as 5=very high; 4=high; 3=moderate; 2=low; 1=very low; 0=no change; N/A=not applicable, and N/D=No data.

Case Study: Homegardens

Homegardens are dynamic multi-functional agro-ecosystems in Sri Lanka covering 14.8% of the total land area. Homegardens combine multiple production systems, from timber and crops to livestock and fish, with considerable contributions to household food security and income, especially amongst the rural poor [9]. Found throughout all 25 districts (nine provinces), homegardens extend over 2.4% of the total land area of the Manner district in the Northern Province and over 36.2% of the Matara district in the Southern Province. The total number of homegardens has grown by 1.6% annually, as a result of the establishment of new settlements and fragmentation of existing home gardens [26]. Around 52% of homegardeners are small-scale farmers conducting semi-subsistence farming activities on less than 0.5 hectares of land. However, the size of a homegarden varies considerably throughout the country, from 0.05 ha to over 2.5 ha.

Studies carried out in the Kandyan homegardens of the Central province suggest the importance of acknowledging women's role in promoting and scaling out CSA, given their role as decision-makers and managers of homegardens. While men grow mainly tree crops and are engaged in marketing the products, women are usually in charge of growing secondary crops that aim to diversify production and provide for a healthy household diet, contributing to ensuring household resilience and food security [27].

CSA strategies used by homegardeners vary significantly across the country, mainly depending on household head educational attainment, farming experience, garden size, and perception of climate change impacts. Homegardeners choose these strategies to improve household food security and income and for mitigating the adverse effects of climate change on agricultural production. Specific activities in use amongst homegardeners include the introduction of new technologies, such as use of new varieties and irrigation equipment (55%); soil and water conservation measures (41%); agronomic practices (39%); and new planting cycles (37%). Livestock are increasingly included to improve food and nutrition security, and may contribute to increasing biodiversity [9]. Furthermore, focusing on homegardens relieves pressure exerted on natural forests and contributes to conservation by providing a variety of habitat niches, contributing to decreased deforestation and a diverse landscape mosaic [28].

Challenges faced by homegardening in Sri Lanka include considerable degradation due to fragmentation and urbanization, especially in the highly populated Wet zone. In the past three decades, people have begun clearing homegardens to grow more cash crops such as vegetables and eucalyptus trees, with homegarden species receding to the hedges. This transformation from forest utility trees to monocrop vegetable and cash crops has disturbed the mixed and multi-storied nature of homegardens and reduced their environmental and other social benefits [28].

Furthermore, a considerable knowledge gap in research exists and must be addressed in order to reach a more comprehensive understanding of challenges faced by homegardens nationwide, as well as variations in usage, purpose, and garden composition regionally and within socioeconomic classes. Having realized the importance of homegardens, the national development policy framework of the government of Sri Lanka now includes strategies to expand and improve food and timber productions in such landscapes of the country. The impact of these programmes, which include fertilizer subsidy for food crops and national agriculture development programmes like "Divineguma," have yet to be assessed [28].

Ample evidence exists indicating that by working with homegardens as entry points for CSA, there are enormous opportunities for agricultural production under a changing and variable climate, through expansion, replacement, substitution, and management of plant and domestic animal species [28]. Development programmes that promote the adoption or scaling-up of homegardens should consider the factors that influence homegardeners' adaptation strategies.

Photography: Prof. DKNG Pushpakumara

Institutions and policies for CSA

Sri Lanka was amongst the first 50 countries to ratify the United Nations Framework Convention on Climate Change (UNFCCC) in 1993. It became a signatory to the Montreal Protocol and the Kyoto Protocol in 2002. Domestically, Sri Lanka's two National Communications on Climate Change under the UNFCCC in 2000 and 2011 discuss the effect of climate change on food security with special emphasis on vulnerable groups. Sri Lanka will continue to support these commitments with a more comprehensive National Adaptation Plan (NAP), currently in the development phase.

As a cross-cutting phenomenon, climate change issues are anchored in different sectoral policies in Sri Lanka. These policies address the adaptive and mitigation capacities of the country, though at different priority levels. The main national strategies concerning CSA include:

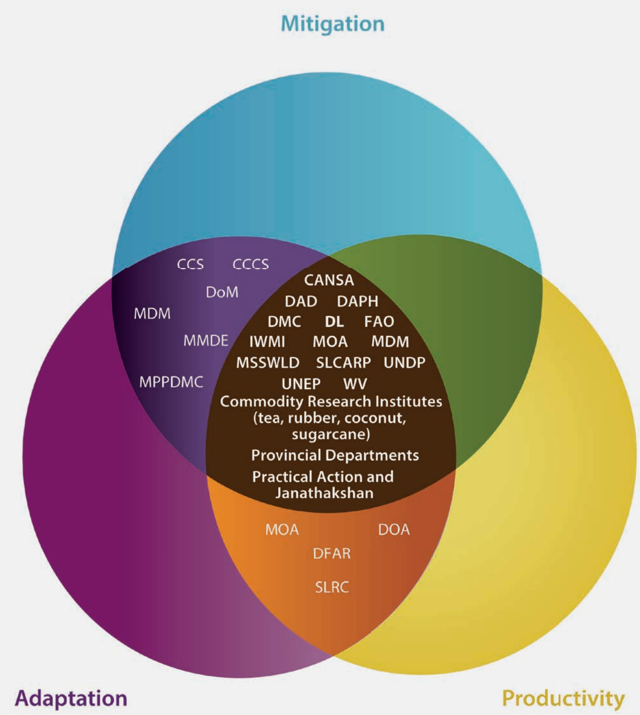
- The National Environmental Policy (NEP), 2003.
- The National Climate Change Policy (NCCP), 2012.
- The National Climate Change Adaptation Strategy (NCCAS), 2011–2016.
- The Action Plan for *Haritha Lanka* Programme, 2009.
- The Roadmap for Disaster Risk Management, 2005.

The National Policy on Air Quality Management (NPAQM) and the Draft National Policy on Clean Development Mechanism (NPCDM) are two policy and planning instruments that directly address climate change in Sri Lanka, but have no direct reference to mitigation in the agriculture, livestock, and fisheries sectors [18].

In 2006, recognizing the potential impact of climate change on ecosystems and on the overall development of the country, the Cabinet of Ministers of the Sri Lankan government directed all government agencies to carry out Strategic Environmental Assessments (SEA) for all policies, plans, and programmes prior to implementation. Complementing SEA, several sectoral directives have been created to guide the adoption CSA action plans. These directives include the National Agriculture Policy (2007), National Agricultural Research Policy (2012), National Livestock Development Policy (2007), and the National Fisheries and Aquatic Resources Policy (2006).

Additionally, the Sri Lankan government created freestanding policy entities that consider adaptation and mitigation strategies. The Climate Change Secretariat (CCS) within the Ministry of Mahaweli Development and Environment (MMDE) is entrusted with facilitating, formulating, and implementing climate-related projects at the national level. Two expert committees on adaptation and mitigation have been established and an Inter-Ministerial Coordinating Committee was created under the Chairmanship of the Secretary to the Ministry of Environment, to ensure that information on climate change is efficiently disseminated across ministries.

Primary Focus of Institutions Engaged in CSA



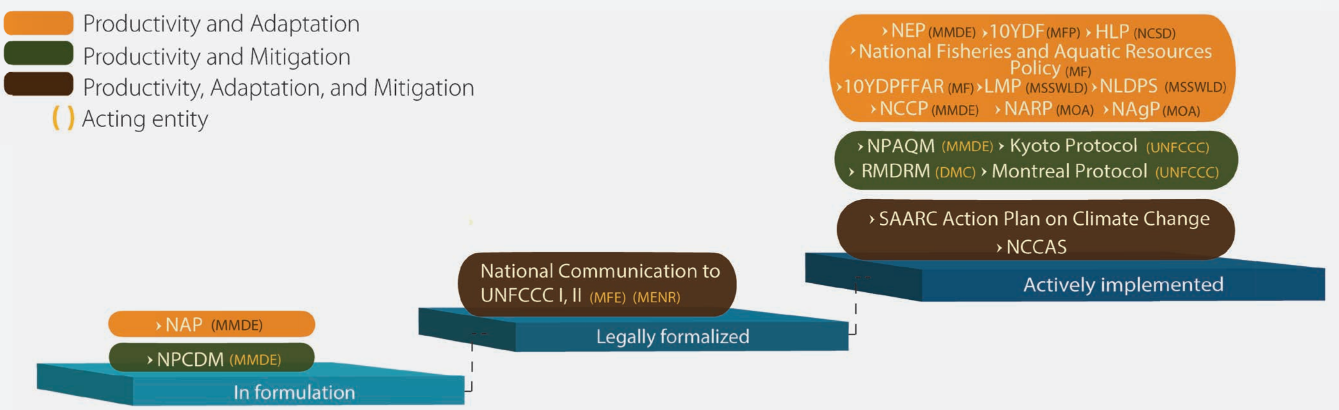
Several public entities contribute to climate change research that supports adaptation and mitigation practices. In 2000, a GHG inventory was prepared by MMDE, and an update is currently under preparation. In the same year, the Centre for Climate Change Studies (CCCS) was established under the Department of Meteorology (DOM) to conduct research, monitor climate change, and provide the general public with current information on climate change-related issues. In 2007, the Ministry of Environment identified the nation's main challenges to implementing the UNFCCC and tasked appropriate ministries with strengthening the capacities that fall within their respective sectors. The Disaster Management Centre (DMC) has been mandated to formulate national and local-level disaster risk management programmes and align them with sector development programmes, starting with the Sri Lanka Comprehensive Disaster Management Programme (SLCDMC), 2014–2018. The DOM is mandated to provide weather and climate forecasts and disseminate them to the general public, while the Department of Irrigation (DOI), under the Ministry of Irrigation and Water Resource Management (MIWRM), plays a crucial role in water management in all agriculture systems.

Synergies between mitigation and productivity are achieved through research, development, and extension programmes for Sri Lanka's main production systems. For the plantation crop sector, various institutes under the purview of the Ministry of Plantation Industries (MPI) focus on CSA for specific crops, including the Tea Research Institute (TRI), Coconut Research Institute (CRI), and Rubber Research Institute (RRI). All other export crops receive support from the Department of Export Agriculture (DEA) and extension services from the Department of Agrarian Development (DAD). The seasonal food crop sector is under the purview of the Department of Agriculture (DOA) of the Ministry of Agriculture (MOA), and the sugar sector research and development is coordinated by the Sugarcane Research Institute (SRI). The Department of Animal Production and Health (DAPH) and the Veterinary Research Institute (VRI) have research and development mandates and are responsible for the conservation of indigenous livestock germplasm for the purpose of future breeding that takes into account climate change. The faculties of agriculture of Sri Lankan universities are responsible for higher education, training, and research in CSA techniques.

At the regional level, nine provincial ministries represent agriculture, livestock, and fisheries; their relative significance is determined by the sectoral specificities of each province. The national Departments of Agriculture, Animal Production and Health, and Fisheries and Aquatic Resources Development are decentralized, and their responsibilities are shared with provincial-level departments. These provincial departments provide CSA information and training at the community and farm level.

Enabling Policy Environment for CSA

Policies listed are related to maintaining and/or enhancing **agricultural productivity** and at least one of the other CSA pillars:



NLP National Action Plan for Haritha Lanka Programme (2009) **LMP** Livestock Master Plan: A Strategy for Livestock Development for Self-sufficiency **NAgP** National Agriculture Policy **NAP** National Adaptation Plan **NARP** National Agricultural Research Policy **NCCAS** National Climate Change Adaptation Strategy for Sri Lanka (2011-2016) **NCCP** National Climate Change Policy **NEP** National Environmental Policy **NLDPS** National Livestock Development Policy and Strategies **NPAQM** National Policy on Air Quality Management **NPCDM** National Policy on Clean Development Mechanism **RMDRM** Road Map for Disaster Risk Management (2005) **SAARC** The South Asian Association for Regional Cooperation (2008) **10YDF** Ten-year Horizon Development Framework 2006–2016 **10YDPFFAR** Ten-year Development Policy Framework of the Fisheries and Aquatic Resources Sector (2007)

Financing CSA

National finance

A country's plans for investment in the agriculture and climate sectors are a proxy for assessing CSA financing, as they reflect the way national funds will be allocated across the institutional body. In Sri Lanka, this is particularly relevant because of programmatic and financial overlaps between these sectors at the national and provincial levels. The Central Treasury is the main source of CSA financing and channels funds to relevant ministries, typically the MMDE and other affiliated ministries. Likewise, several key departments are able to mobilize CSA financing, including the DOA, DAD, DOI, DAPH, DEA, TRI, CRI, RRI, and SRI. The Central Treasury also channels funds for CSA through the provincial governments, particularly the provincial Departments of Agriculture, Animal Production and Health, Irrigation and Environment, and research entities such as the Sri Lanka Council for Agricultural Research Policy (SLCARP), National Research Council (NRC), and the National Science Foundation (NSF).

Private investment in CSA mainly comes from farmers' own resources and limited loan and insurance schemes. The Agricultural and Agrarian Insurance Board (AAIB) is the sole public sector entity offering farmer insurance services for paddy rice, maize, and livestock. In total, AAIB has provided LKR100 million (approximately US$740,000) in compensation to farming families affected by droughts and floods. However, AAIB funding has been limited since 2012, and future operations are uncertain. National subsidy programmes that include tariffs, guaranteed purchase and pricing, and subsidized inputs encourage savings and investment in select production systems. National NGOs, such as *Practical Action* and *Janathakshan*, assist government agencies in funding, training, and implementing CSA techniques in farming communities across agricultural systems. No systematic and comprehensive insurance and loan scheme exists for farmers.

International finance

International funding for CSA has been targeted towards different sectors, including environment, agriculture, and development. The United Nations Programme for Reducing Emissions from Deforestation and Forest Degradation (UNREDD+), Scaling Up Renewable Energy in Low-Income Countries (SRELIC), and the Global Environment Fund (GEF) are amongst the institutions that have provided targeted funding for Sri Lanka's environmental and climate programmes. The UN International Fund for Agricultural Development (IFAD) and Food and Agriculture Organization (FAO), Oxfam, and other institutions provide support for the agricultural sector. Several international and national institutions, such as the UN Development Programme (UNDP), USAID Development Grants Program (USAID GDP), Japan International Cooperation Agency (JICA), and the Nordic Development Fund (NDF), provide support for the agricultural sector in general.

Potential finance

Although Sri Lanka has accessed CSA finance through domestic and international institutions, the country has limited support from private and financial sector institutions. Particularly, investment and financing institutions, such as the Overseas Private Investment Corporation (OPIC), China Development Bank (CDB), and the Asian Development Bank (ADB), present interesting opportunities for expanding CSA-funding instruments in Sri Lanka. Other private entities, such as the Bill & Melinda Gates Foundation (BMGF) and Special Climate Change Fund (SCCF), may offer targeted funding for programmes that include CSA practices. Initiatives should be undertaken to attract climate finance and promote climate investment through financial and economic instruments.

Development of governance and institutional framework supported by legal and regulatory frameworks to maximize the opportunities for climate finance mobilisation and emissions trading is imperative in various sectors of the economy. There is great potential for developing mechanisms for payments for environmental services. Being a relatively new concept, this requires building awareness and institutional capacity, while identifying, assessing, and prioritizing ecosystem services.

Funds for Agriculture and Climate Change

AAP Australia's Aid Program **AF** Adaptation Fund **AFD** French Development Agency **BMGF** Bill & Melinda Gates Foundation **CARE** Cooperative for Assistance and Relief Everywhere **CDB** China Development Bank **CRI** Coconut Research Institute **DAD** Department of Agrarian Development **DAPH** Department of Animal Production and Health **DEA** Department of Export Agriculture **DOA** Department of Agriculture **DOI** Department of Irrigation **DOM** Department of Meteorology **ECF** Energy Conservation Fund **ENRTP** Environment and Sustainable Management of Natural Resources Thematic Programme **FAO** Food and Agriculture Organization of the United Nations **GEF** Global Environment Facility **GIZ** German Agency for International Cooperation **IFAD** International Fund for Agricultural Development **IFC** International Finance Corporation **JICA** Japan International Cooperation Agency **MOA** Ministry of Agriculture **MF** Ministry of Finance **MI** Ministry of Irrigation **MMDE** Ministry of Mahaweli Development and Environment **NDF** Nordic Development Fund **NRC** National Research Council **NORAD** Norwegian Agency for Development and Cooperation **NSF** National Science Foundation **OPIC** Overseas Private Investment Corporation **RRI** Rubber Research Institute **SCCF** Special Climate Change Fund **SIDA** Swedish International Development Cooperation Agency **SLCARP** Sri Lanka Council for Agriculture Research Policy **SLSEA** Sri Lanka Sustainable Energy Authority **SRELIC** Scaling Up Renewable Energy in Low-Income Countries **SRI** Sugarcane Research Institute **TCF** The Clinton Foundation **TRI** Tea Research Institute **UNDP** United Nations Development Programme **UNEP** United Nations Environmental Programme **UNREDD+** United Nations Programme for Reducing Emissions from Deforestation and Forest Degradation **USAID-DGP** United States Agency for International Development - Development Grants

Outlook

Increasingly frequent extreme weather events and rapidly changing climatic patterns pose serious threats to agriculture productivity and food security in Sri Lanka. The country has taken several important steps towards improving productivity and increasing resilience of primary production systems, such as rice, maize, and cattle. For example, Sri Lanka has simultaneously focused on improving adaptability with the adoption of improved plant varieties and livestock breeds, and on ensuring genetic diversity through the conservation of indigenous varieties. Adaptation strategies should be accompanied with more robust and extensive mitigation practices that support soil and water conservation and address emissions. Many of the beneficial practices identified for Sri Lanka's staple production systems are applicable for both small- and large-scale producers.

Scaling up of CSA will also require well-articulated knowledge management systems and improving smallholders' access to financial instruments, resources, and markets. Capacity building, supporting the sharing of knowledge and experience, creating incentives through social, legal, institutional, or economic and market mechanisms, long-term strategic investments in infrastructure, productive capacity, improved products and services, and public-private partnerships are essential to ensure that CSA objectives are achieved and longer term benefits delivered.

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For further information and online versions of the Annexes, visit:
http://dapa.ciat.cgiar.org/csa-profiles/

Annex I: Acronyms

Annex II: Agro-ecological map of Sri Lanka

Annex III: Land-use map of Sri Lanka

Annex IV: Selection of important production systems in Sri Lanka

Annex V: Climate-smart practices in Sri Lanka

This publication is a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT) – lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) – and the World Bank to identify country-specific baselines on CSA in Africa (Kenya and Rwanda), Asia (Sri Lanka), and Latin America and the Caribbean (Nicaragua and Uruguay).

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