



Climate Resilience in Agriculture: Addressing Risks Perspective in Food Crops Sector in Sri Lanka

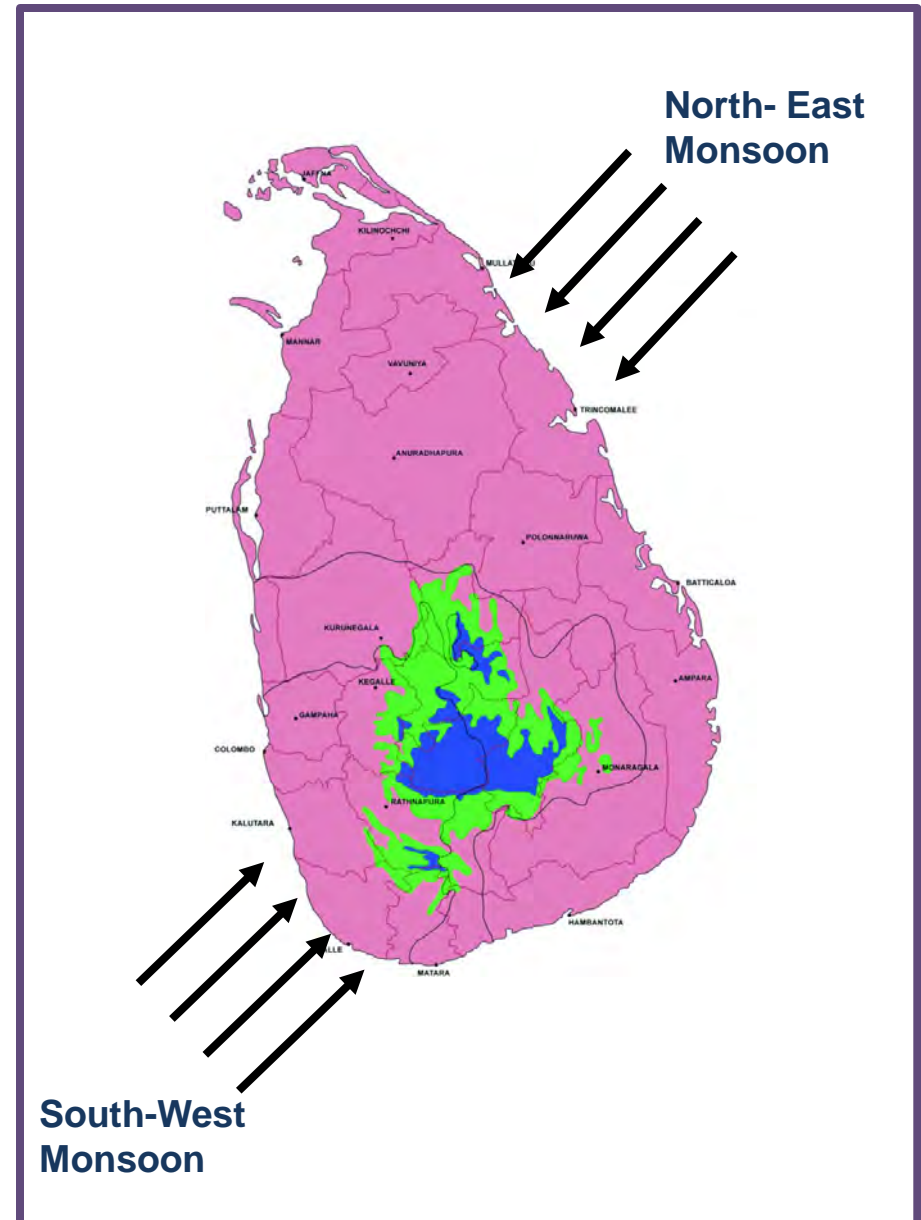


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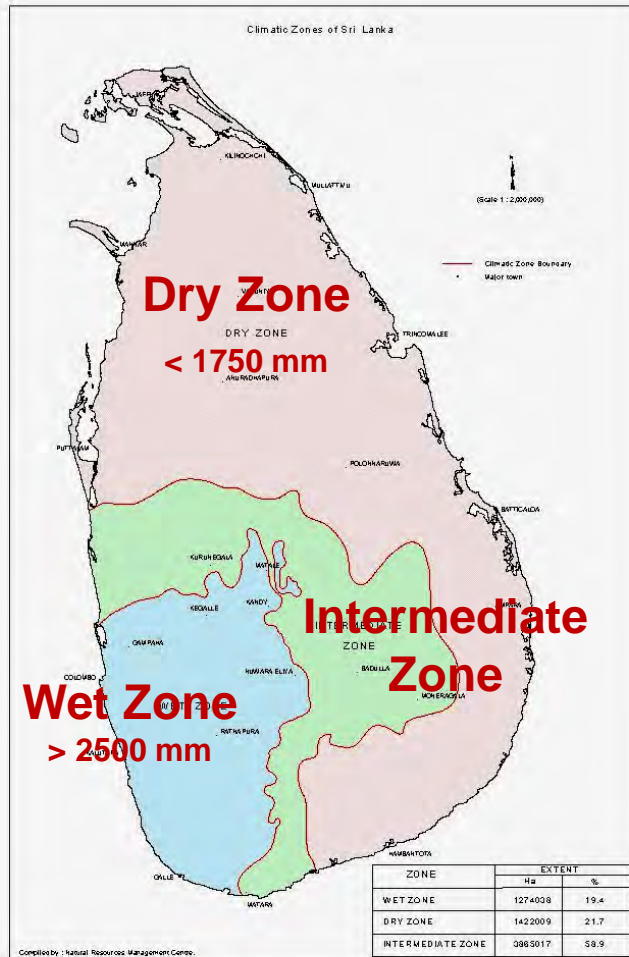


Climatic Seasons of Sri Lanka

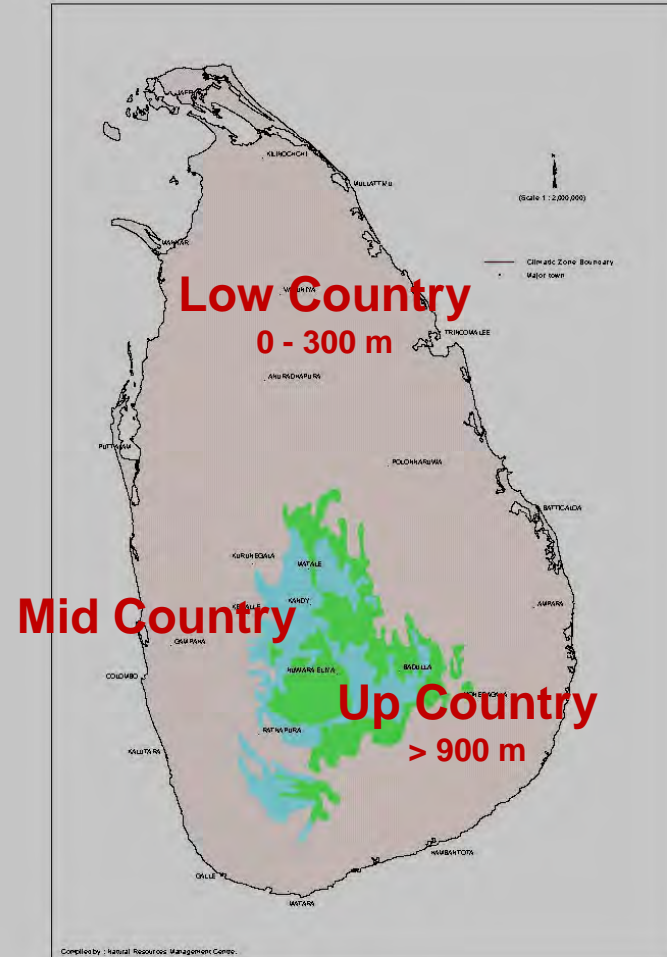
- **First Inter-Monsoon (FIM)**
March and April
- **South-West Monsoon (SWM)**
May – September
- **Second Inter-Monsoon (SIM)**
October and November
- **North-East Monsoon (NEM)**
December - February



Climatic and Topographical Regions of Sri Lanka



Climatic Regions



Topographical Regions

Agro-ecological Regions of Sri Lanka

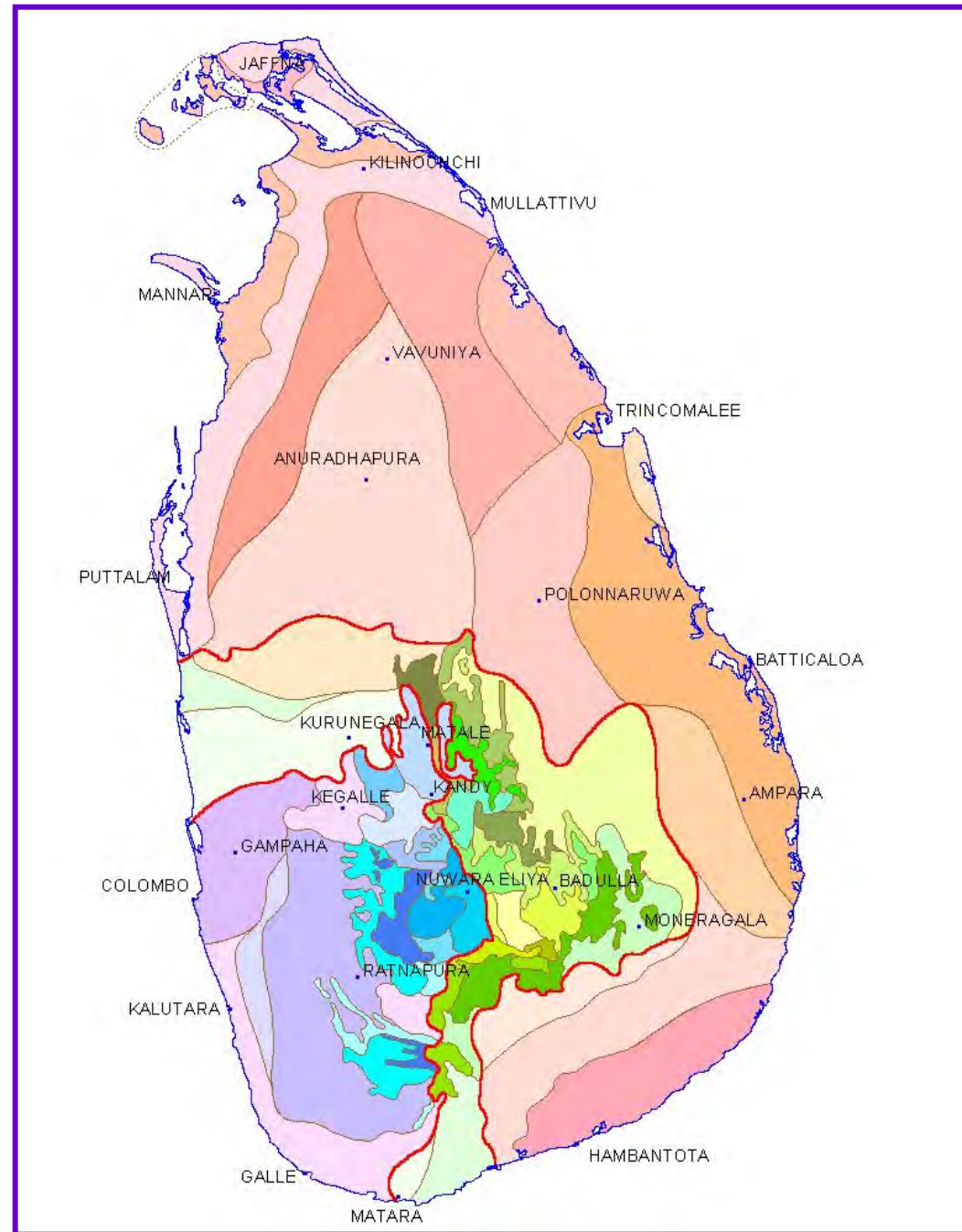
(Based on RF distribution, Soil type)

46 Agro-ecological regions

WZ - 15

IZ - 20

DZ - 11

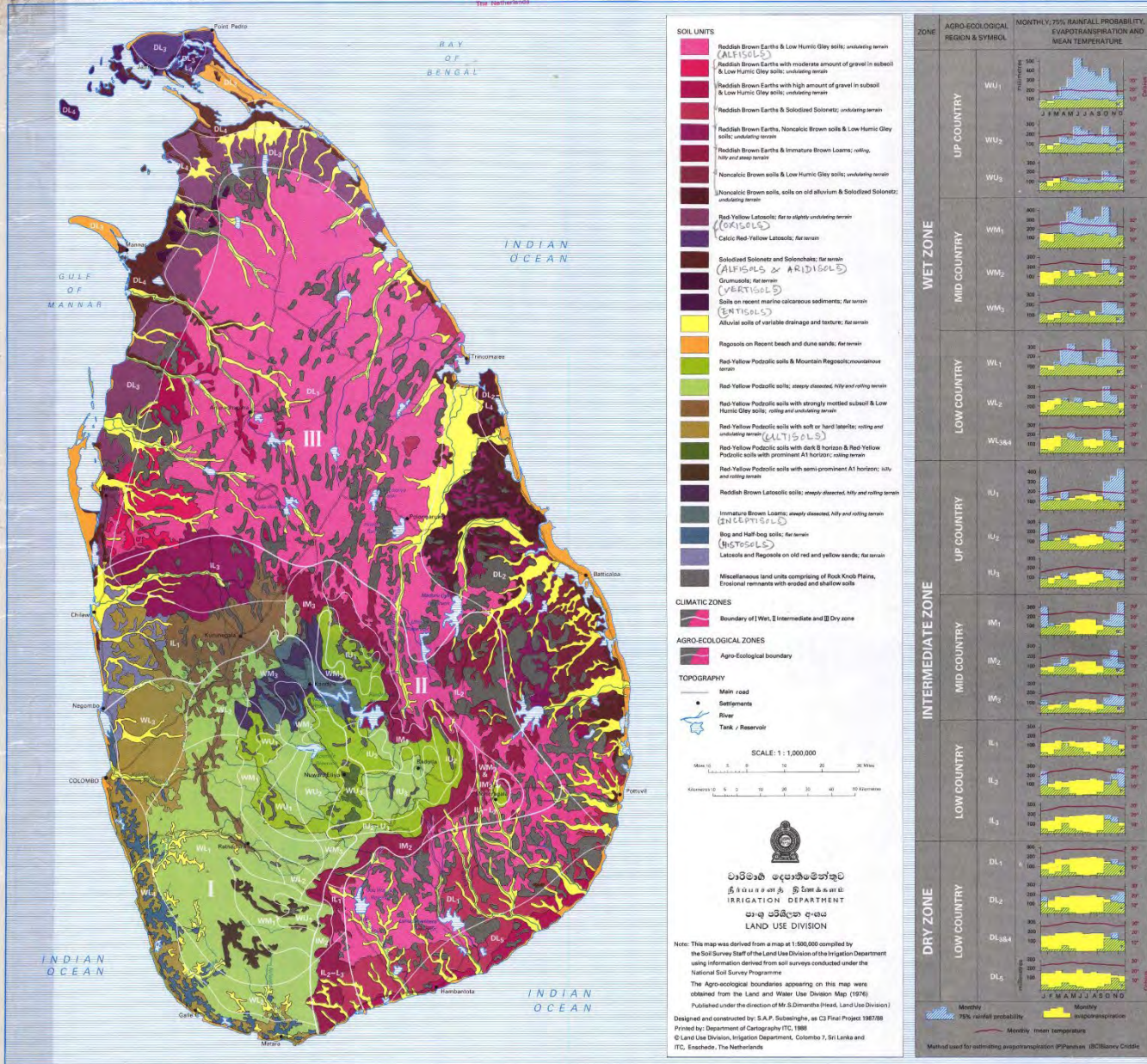


Soil Types of Sri Lanka

SOIL MAP OF SRI LANKA

ISRIC
P.O. Box 353
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The Netherlands

C. D. GANESODAMILA



Major Soil Types of Sri Lanka

	Soil Type	USDA Classification	Extent ('000 ha)	% Distribution
1	Reddish Brown Earth (RBE)	ALFISOLS	1,610	24.6
2	Low Humic Gley (LHG)	ALFISOLS & ENTISOLS	950	14.5
3	Non Calcic Brown (NCB)	ALFISOLS	163	2.5
4	Red and Yellow Latasols (RYL)	OXISOLS	320	4.9
5	Immature Brown Loams (IBL)	INCEPTISOLS	205	3.1
6	Solodized Solonetz	ARIDISOLS	210	3.2
7	Grumusols	VERTISOLS	15	0.2
8	Red Yellow Podzolic	ULTISOLS	1,490	22.8
9	Reddish Brown Latasol (RBL)	ALFISOLS	60	0.9
10	Alluvials	ENTISOLS	450	6.9
11	Regosols	ENTISOLS	190	2.9
12	Bog and Half Bog	HISTOSOLS	60	0.9
13	Lithosols	INCEPTISOLS	210	3.2

Being a tropical island in the Indian Ocean, Sri Lanka has consistently been placed among the top ten countries at risk of extreme weather events by the Global Climate Risk Index (UN Sri Lanka)

Natural resources -

Sri Lanka's economy and employment depend on natural resources, so climate change will have significant consequences on lives and livelihoods.

Water sector -

Sri Lanka ranks highly on the Global Climate Risk Index for climate change risks to water. The country's water infrastructure and security are vulnerable to quality, quantity and salinity intrusion.

Droughts, floods and landslides -

Sri Lanka experiences prolonged droughts. Flash floods and landslides occur due to intensive rainfall.

Forest cover -

Sri Lanka's forest cover has declined over time and now only makes up 29.7% of its total land area.

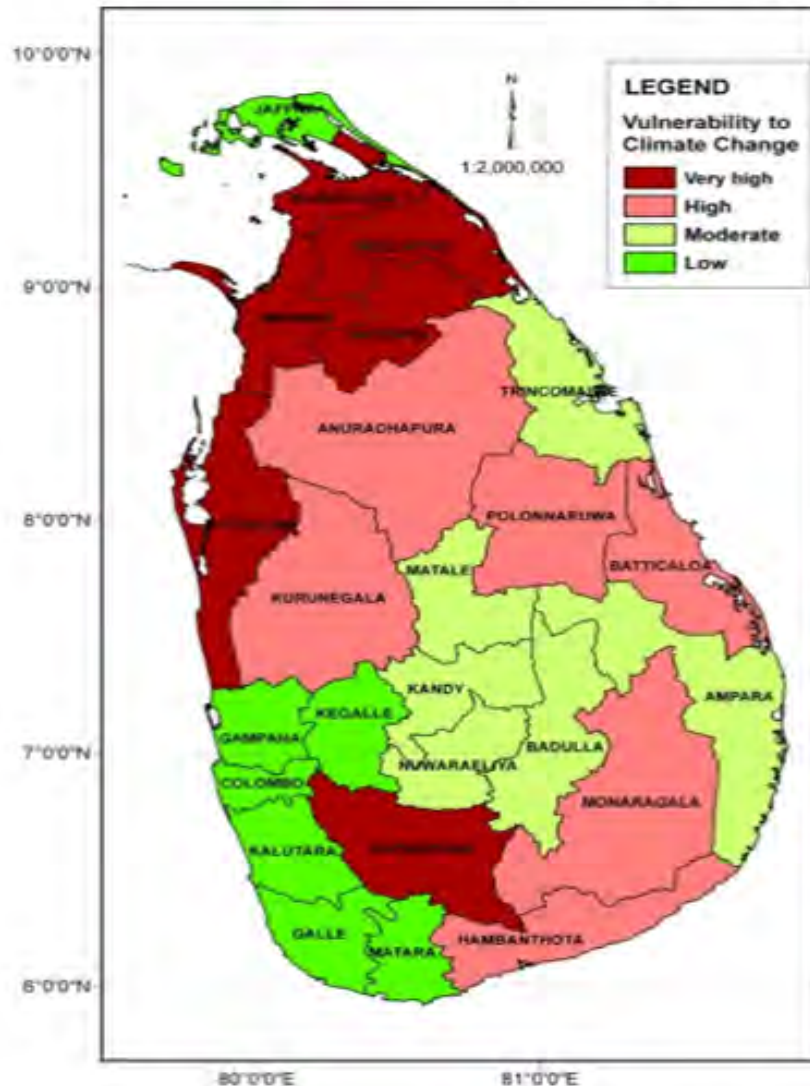
Sea level rise -

Sri Lanka is experiencing sea level rise.

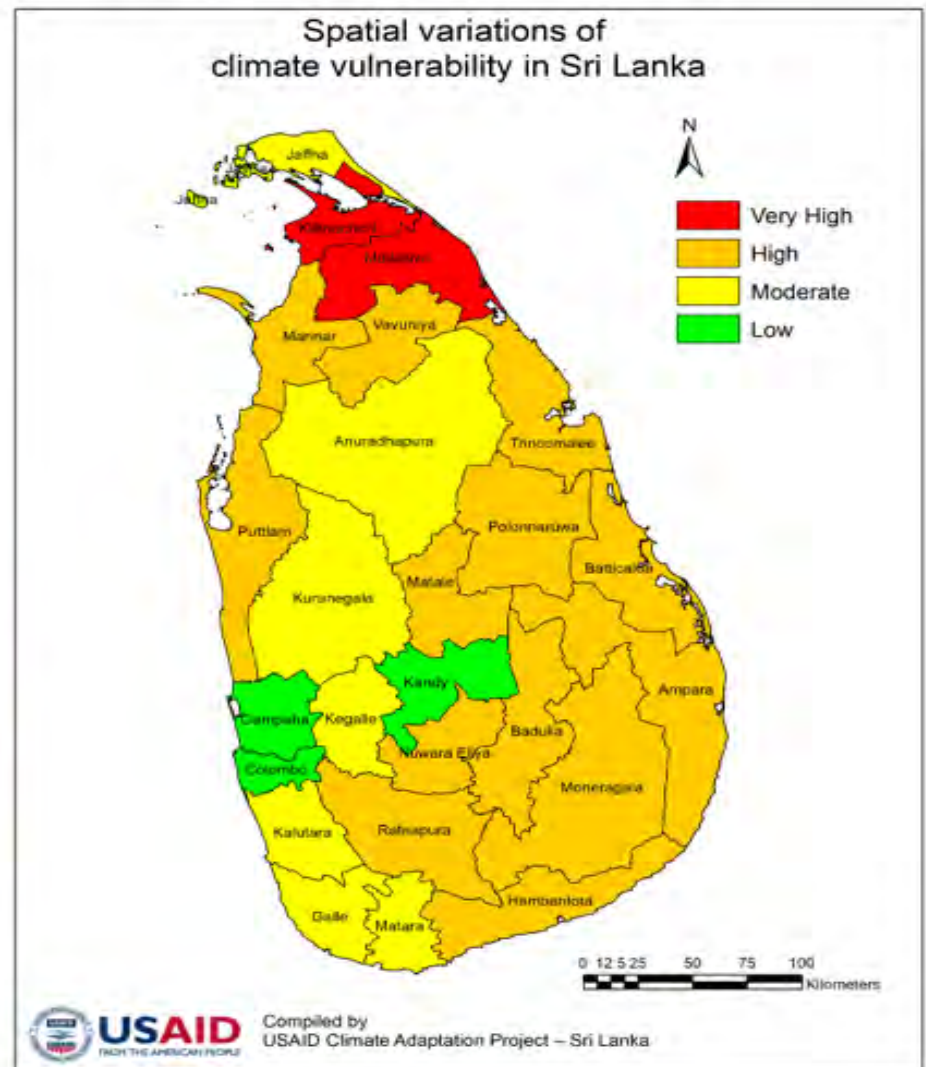


Climate vulnerability in Sri Lanka

Punyawardena, et al (2013)



Punyawardena, et al (2024)



Spatial variations of climate vulnerability in Sri Lanka

Climate Change in Sri Lanka

2022 Average temperature: 27 - 28°C

1-1.5 °C temperature rise
estimated by 2050



Food Insecurity

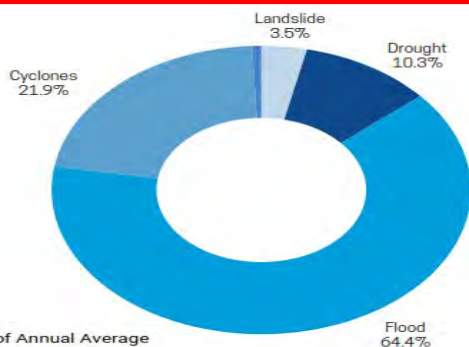
Food insecurity is a serious challenge for Sri Lanka, with an estimated 17 percent of the population experiencing moderate acute food insecurity in March 2023.

Climate change threatens to worsen this situation by affecting food and water availability and reducing agricultural output, including essential staples like rice.



Threatened Biodiversity

Sri Lanka is one of 36 **biodiversity hotspots** in the world, with a wealth of endemic species. The country continues to face serious environmental challenges, such as deforestation of its lowland rainforests and degradation of its urban and coastal wetlands. These threats pose a risk to the ecological balance and the well-being of the people and wildlife of Sri Lanka.



Cause of Annual Average Disaster Losses (2020)

750,000

Sri Lankans on average affected by natural disasters per year, between 2011-2020

\$313 million

average annual **disaster losses** related to housing, infrastructure, agriculture and relief

19 million

Sri Lankans live in locations set to become moderate or severe **climate hotspots** by 2050

104 / 185

Climate Vulnerability Ranking

81.2%

of population lack adaptive capacity to disasters



6 in 10 Sri Lankans are multi-dimensionally vulnerable



Extreme Weather Events

In the past 30 years, floods have affected more than **10 million people** in Sri Lanka.

Drought is a major challenge for livelihoods and food security affecting nearly 8 million people between 2008-2018.

Sea level rise and average temperature changes have increased the frequency of storm surges causing saline intrusion and inundating lands along Sri Lanka's coastal belt.

Without adaptive action, the projected increase in the frequency and intensity of extreme precipitation events may put lives, livelihoods, and infrastructure at risk through their link with riverine flooding, flash floods, and landslides.

Impact of climate change to Sri Lanka

- Slow and continuous rise of ambient temperature
 - ✓ (0.01 – 0.03 °C per year)
- Frequent occurrence of extreme weather events
 - ✓ Drought & floods: increased
 - ✓ High intensity rains- Land slides: increased
 - ✓ Tornado type winds: increased
 - ✓ Intense lightening strikes: increased
 - ✓ Total number of dry days: increased
 - ✓ Number of warm days: increased
 - ✓ Number of cold nights/ comfort nights: decreased

Source: Marambe et al. (2012, 2013, 2015), Punyawardena et al. (2010, 2013), Punyawardena and Premalal (2013)



11.10.2024

**Flood Warning Issued
as Heavy Rains Persist**



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03-01-2024

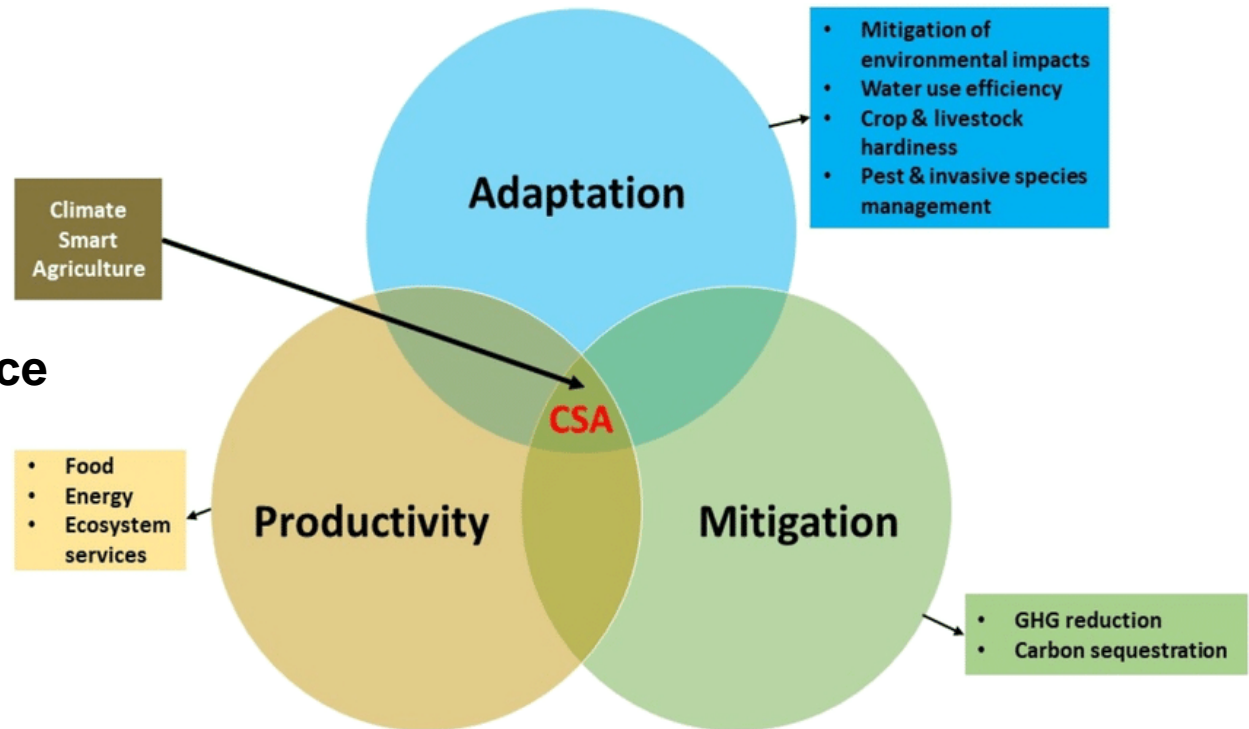


Climate Smart Agriculture (CSA) :

Is an integrated approach to managing croplands, livestock, forests and fisheries that addresses the interlinked challenges of food security and accelerating climate change

Three pillars of CSA

1. Adaptation/ Resilience
2. Mitigation
3. Productivity



CSA technologies or practices available in Sri Lanka

Thematic area - Crop management

- 1. Crop diversification**
- 2. Crop rotation with short-age legume crops**
- 3. Cultivation of stress-tolerant crop varieties**
(Short age varieties/ Pest tolerant varieties/ Paddy - Salinity tolerant varieties)
- 4. Protected agriculture for high-value crops/ Rain shelters**
- 5. Seasonal-adapted planting times/ Planting with onset of rains**
- 6. 'Parachute' method of paddy seedling broadcasting**
- 7. Dry sowing of paddy**
- 8. Technology package for OFC seed production**
- 9. Cover crops**
- 10. Home gardening**
- 11. 'Sorjan' cultivation - Wet zone**
- 12. Introduction of new crop combinations**





Third season mung bean cultivation



'Paratute' technique in paddy broadcasting



Screening of rice varieties for droughts



Dry sowing of paddy



Big onion true seed production in rain shelters



Protected agriculture for high value crops

Introduced crop diversification strategies

- Introduction of “Third Season Cultivation “ concept
 - Suitable crops / Varieties
 - Water management practices
 - Establishment methods
 - Harvesting techniques



	Green gram cultivation	
	Maha season	Third season
Total cost (Rs/ha)	218,881	191,502
Net profit (Rs/ha)	597,119	648,298



- 12.5% cost reduction in third season cultivation compared to conventional *Maha* season cultivation
- Short aged legume cultivation increases land productivity

Technology package for OFC seed production



Big onion

- seed production under rain shelters
- Pollination techniques
- Soil rejuvenation package
- Techniques for shoot emergence
- Seed processing techniques

Chilli

- New hybrid seed production technique
- Low cost



Maize

- F1 maize hybrid seed production technology

Introduced high yielding 5 *Dioscorea* accessions suitable for cultivation under dry zone conditions after evaluating 42 accessions



Dam Ala 1
Dioscorea alata



Maha Kukulala
Dioscorea esculenta



Jafna Ini Ala
Dioscorea alata



Dam Ala 2
Dioscorea alata



Angili Ala
Dioscorea alata

Average yield : 20- 30 t/ha

Life time : 8 months

Farmers adoption : Distributed to 800+ farmers, Universities and Schools

Planting materials : Available at SPMDC

Thematic area - Soil management

- 1. Multi-purpose soil conservation bunds and terraces**
- 2. Contour planting**
- 3. Organic manure**
- 4. Biochar application**
- 5. Mulching**
- 6. Developed new protocols for site specific fertilizer recommendation**



Mulching



Contour planting in uplands



Multi-purpose soil conservation bunds

Thematic area - Water management

- 1. Rainwater harvesting**
- 2. Drip and sprinkler irrigation systems**
- 3. Plot consolidation of paddy fields/ Laser levelling**
- 4. Alternate wetting and drying (AWD) in rice cultivation**
- 5. Recharging of groundwater through percolation pits**
- 6. Rehabilitation and maintenance of Cascade systems in the dry zone**



Sprinkler irrigation

Drip irrigation



AWD technique in rice

Thematic area - Energy

1. Photovoltaic lights for agro-farms, protected houses and storage houses
2. Solar-powered water pumping
3. Biogas technology



Bio-gas
production



Solar water pumping coupled sprinkler irrigation

Thematic area - Agro-forestry/ Perennial crop production



Paddy based agro-forestry

1. Agroforestry (agriculture-forest integration)
2. Crop-livestock integration
3. Boundary trees and hedgerows
4. Fruit orchards
5. Cultivation of multi-purpose nitrogen-fixing trees





Fruit orchards

N-fixing tree cultivation Crop - livestock integration

Thematic area - Weather forecasting

Agro-met advisories and alert systems

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Department of Agriculture
Natural Resources Management Centre

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Director General of Agriculture,
Department of Agriculture, Peradeniya

Through:
Director (Natural Resources Management Centre),
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Recommended & forwarded
Dr. H. K. Kadupitiya
 Director
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Agro-met Advisory: February 2022
 (For the months of February, March and April)

Department of Meteorology (DoM) forecasts a near normal rainfall for February to April (FMA), over most parts of the country. For February, near or slightly above normal rainfall forecast has been issued over most parts of the country. The seasonal weather outlook of DoM further stated that, near normal rainfalls over Eastern and Uva provinces during March and a forecast has not been issued for the other areas. No weather prediction has been issued for April too. With the available weather information, it is advisable to consider general climatological rainfall values for agriculture planning. Agro-ecological region-wise expected average rainfall values are attached in Table 1 - 3.

According to the Irrigation Department (ID), the average effective storage of major reservoirs is about 66%. Recently updated summary of daily water levels & storage of major reservoirs are attached in Table 4. ID further assured that the available water in major and medium reservoirs is sufficient to continue the rest of 2021/22 Maha Season and for the inter-season cultivation, for potential areas.

Considering the weather forecast of DoM and irrigation water availability information of ID, the following agronomic interventions are recommended to ensure optimum productivity under existing situation,

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- Since the weather forecast of DoM predicted a near normal rainfall for February to April, lesser amount rainfall can be expected to the entire island. Therefore, when irrigation scheduling, more attention should be paid for rice to ensure water supply during reproductive stage.
- It is advisable to plan harvesting of paddy under prevailing dry period, considering short-term weather forecasts issued by DoM to avoid any sudden short-interval rains.
- Paddy farmers who are planning cultivation activities for the coming 2022 Yala season, advisable to start the cultivation on time with the onset of First Inter-monsoon (FIM) rains. The dates of the onset of FIM will be informed in near future by DoM.
- For paddy fields with the potential for 4th season cultivation (ie. after completion of the Maha season and before the cultivation activities of Yala season), short age legume crops such as Mung bean can be cultivated. Farmers in potential areas (Hambantota, Amuradhapura, Kurunegala, Puttalam and Moneragala), can start Mung Bean cultivation for 4th season in mid-February. Seed and Plant Material Development Center (SPMDC) assured availability of seeds to fulfill the farmer requirements.
- Farmers who are willing to cultivate short age legumes such as Mung bean, cowpea, soy bean etc. instead of paddy for 2022 Yala season, advisable to start cultivation in mid-April.
- Vegetable and Potato farmers in the up-country areas (altitude is above 1,500 m) are advised to pay attention to the daily weather forecast of DoM for possible occurrence unfavorable conditions with ground-frost during February with a significant drop of temperature (below 6 °C), under the predicted dry weather condition.
- Please consider that this advisory was prepared based the on national level forecasted information and therefore, it is advisable to consider localized detailed information, as a supplementary to this advisory.

dated Agro-met Advisory will be issued in early March for the rest of 2021/22 Maha season and Yala season in consultation with the Department of Meteorology and other relevant resource s and stakeholders.

Technical Advisory Team Members

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- Eng. D. Abeysiriwardena (Director – Water Management) Department of Irrigation
- Ms. D.K.W.R. Seneviratna (Director – Agriculture) Mahaweli Authority of Sri Lanka
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ector, Plant Protection Service)
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–Ministry of Agriculture (f. y. i. pls.)
 and Development) (f. y. i. pls.)

**Approaches taken to increase
the adoption of CSA technologies**

Development and adoption of micro irrigation based high productivity crop management packages

Smartness in agriculture	Micro irrigation based crop management packages
Water smart	✓
Energy smart	✓
Carbon smart	✓
Nitrogen/ Nutrient smart	✓
Weather smart	✓
Knowledge smart	✓

Agronomic management package for chilli under drip irrigation



Package

- Drip irrigation
- Cattle manure - 15 t/ ha
- Straw mulching - 5 t/ ha
- Split application of fertilizer through fertigation

- **Yields** - Around 45 t/ ha of green chilli from hybrids
- **Water productivity** - 50 % increase compared to surface irrig.
- **Labour saving** - Irrigation and Weeding
- **Energy saving in irrigation**



Case study -
Drip irrigation based chilli cultivation package
Area: Anuradhapura



Yields and the income/ 0.25 ac.

Pick number	Yield (kg)	Price (LKR/ Kg)	Income (LKR)
1 st	248	360	89,280
2 nd	621	380	235,980
3 rd	583	450	262,350
4 th	256	280	71,680
5 th	378	400	151,200
6 th	540	320	172,800
7 th	320	260	83,200
8 th	380	550	209,000
9 th	365	500	182,500
10 th	450	460	207,000
11 th	320	550	176,000
12 th	300	850	255,000
13 th	270	830	224,100
14 th	210	760	159,600
15 th	180	700	126,000
16 th	90	800	72,000
Total	5,511	-	2,677,690

**National average
green chilli yield:
Around 5 t/ ha**

USD 1 = LKR 300

Costs - Benefits

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Component	LKR/ 0.25 ac.
Total cost	665,500.00
Total income	2,677,690.00
Profit	2,012,190.00
Profit with the depreciated cost for the drip system*	2,282,190.00

* The drip system will be used for 10 seasons and thus, the cost of the drip system per season is LKR 30,000.00



USD 1 = LKR 300

Agriculture Sector Modernization Project - ASMP



**Yield (t/ ha) - 11 months
(35 - 40 picks)**

Max.

Min.

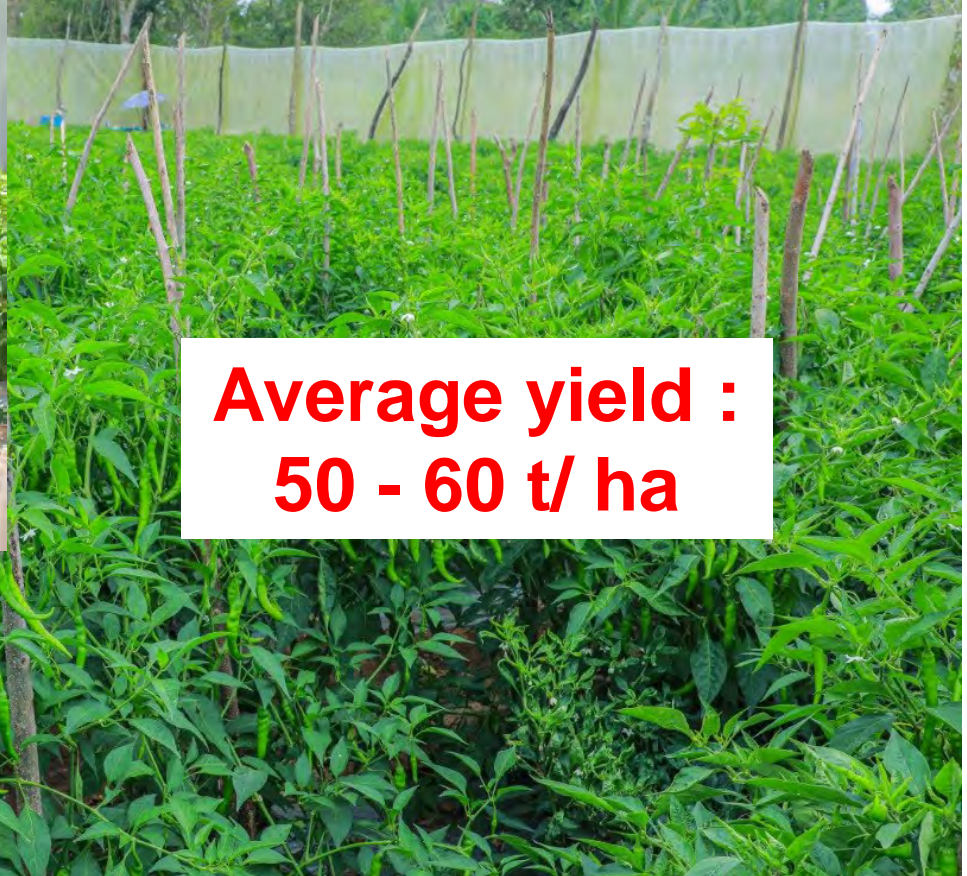
Average

65

30

45

Smallholder Agribusiness Partnership Programme - SAPP



**Average yield :
50 - 60 t/ ha**

Agronomic management packages for chilli under sprinkler irrigation

Package

- Sprinkler irrigation
- Cattle manure - 15 t/ ha
- Straw mulching - 5 t/ ha
- Manual application of fertilizer including micro nutrients



- **Yields** - Around 45 t/ ha of green chilli from hybrids
- **Water productivity** - 30 % increase compared to surface irriga.
- **Labour saving** - Irrigation and Weeding

Agronomic management packages for onion under drip irrigation

Package

- Drip irrigation
- Cattle manure - 15 t/ ha
- Straw mulching - 5 t/ ha
- Split application of fertilizer through fertigation



- **Yields** - Around 40 t/ ha
- **Water productivity** - 50 % increase compared to surface irrig.
- **Labour saving** - Irrigation and Weeding
- **Energy saving in irrigation**



Drip based onion cultivation package in farmers' fields -

- Interprovincial Agriculture Extension Service
- Provincial Department of Agriculture - Central Province
- Mahaweli Authority of Sri Lanka
- Agriculture Sector Modernization Project



Yala 2021 season - Yala 2024 season

Programme	Unit area (ac.)	Number
Demonstrations (2021)	0.25	28
Agriculture Sector Modernization Project	0.25	50
Sayubhagya programme	0.25	259
Sayubhagya programme	0.50	38
Total		375

- Majority of farmers obtained - > 35 t/ ha yields
- Some have achieved - 40 t/ ha
(National average onion yield - Around 17 t/ha)
- Average profits (including family labour cost) - > LKR 300 000/ 0.25 ac.
- Some have obtained - > LKR 500 000/ 0.25 ac.

USD 1 = LKR 300

Big onion true seed production under drip irrigation





Other crops grown -

- Cabbage
- Radish
- Capsicum
- Tomato
- Beet
- Knol khol
- Chilli



Agronomic management packages for onion under sprinkler irrigation

Package

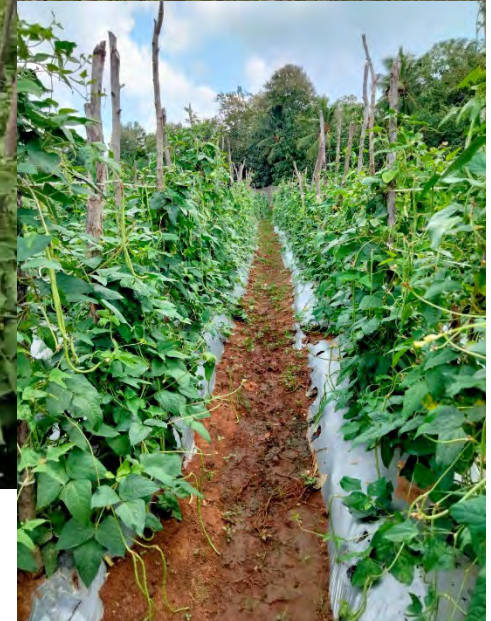
- **Sprinkler irrigation**
- **Cattle manure - 15 t/ ha**
- **Straw mulching - 5 t/ ha**
- **Manual application of fertilizer**



- **Yields - Around 30 t/ ha**
- **Water productivity - 30 % increase compared to surface irrig.**
- **Labour saving - Irrigation and Weeding**

Private sector involvement

Keels Pvt. Ltd./ Cargills Pvt. Ltd.
20 different types of crops

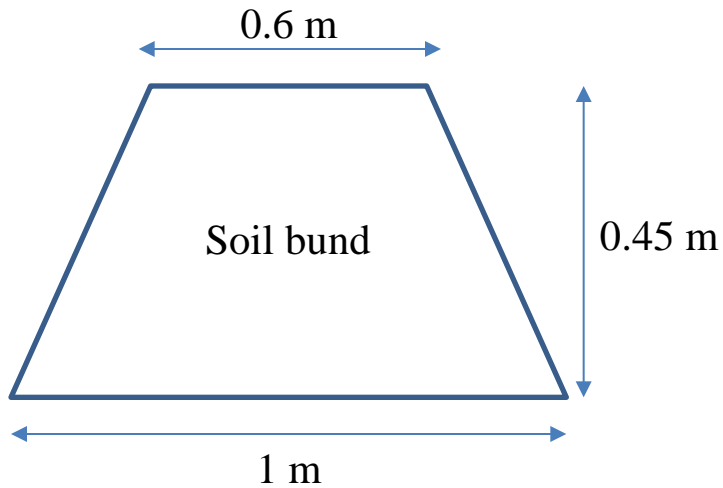


**Advancement of existing CSA
technologies/ practices**

Solar water pumping coupled micro irrigation based crop management packages



Multipurpose soil conservation bunds



Sufficient space (20 m) is kept between the bunds for machinery operation



Perennial trees on the bunds -

- Sesbania
- Moringa
- Pomegranate
- Lime
- Gliricidia





Moringa on the Soil Conservation Bunds



Gliricidia on the SCBs

- **Additional income**
- **Sustainability of the bunds**
- **Maximum utilization of the land**
- **Green manure**
- **Livestock feed**



Pomegranate on the SCBs

Compilation of available CSA technologies/ practices in Sri Lanka



**Consortium for Scaling-up Climate Smart Agriculture
in South Asia (C-SUCSeS) Project**

Project Steering Committee Meeting
27th October

Policy Roundtable Meeting
28th - 29th October

Kandy, Sri Lanka 2023

Natural Resources Management Centre &
Field Crops Research and Development Institute
Department of Agriculture

**Climate-Smart Agriculture Technologies
and Practices in Sri Lanka**

Consortium for Scaling-up Climate Smart Agriculture in South Asia (C-SUCSeS) Project
(IFAD Grant No. 2000001968)



SAARC Agriculture Centre
South Asian Association for Regional Cooperation (SAARC)

Investing in rural people

SAARC Development Fund

INTERNATIONAL
FOOD POLICY
RESEARCH
INSTITUTE

Inventory of CSA technologies with details of their targeted climate risks, spatial suitability, farmer acceptability ratings and targeted farming systems -

CSA technology dissemination strategies

- Field demonstrations
- Visits on successful farm fields
- Video/ Audio programmes (TV/ Radio/ You Tube)
- Social media (FB/ WhatsApp groups)
- Leaflets/ Booklets
- Street drama
- Individual meetings with farmers
- Hands on training



Main Policy documents/ plans related to CSA in Sri Lanka

National Agricultural Policy (NAP) (2021) - DRAFT

Related thematic areas :

- *Promote adoption of appropriate adaptation and mitigation measures to increase climate resilience of the agriculture systems*
- *Strengthen food systems by connecting urban and rural communities to tackle climate shocks and other disasters*

Nationally Determined Contributions (NDCs) in the Paris Agreement (updated in 2021)

NDC 1: *Reduce postharvest losses and value addition of fruits and vegetables*

NDC 2: *Increase crop productivity*

NDC 3: *Improve the adoption of renewable energy for crop farming/ value addition*

Sri Lanka Climate Prosperity Plan (2022)

- *SL government have started work on a Climate Prosperity Plan to fully commit to supporting the Paris goals of limiting global warming to 1.5 Centigrade.*
- *On climate resilience, it seeks to have the key economic sectors fully adapted, especially through the implementation of more sustainable land and water management practices.*

International collaborations in CSA related programmes/ projects

Atlas of Climate Adaptation in South Asian Agriculture (ACASA)

- *This comprehensive Atlas aims to provide granular-scale information for South Asian countries by integrating various spatially categorized data sets.*
- *It aims at improving access to climate risk and solution option analytics for South Asian countries.*

Development of the Soil Atlas of Asia and National Soil Information Systems (AFACI)

Objective

- *To develop soil information for Sri Lanka, make available to national/ global soil information system for sustainable soil management to better planning of food security*

Consortium for Upscaling Climate Smart Agriculture in South Asia (C-SUCSeS) Project

Goal

- *To promote sustainable and resilient agricultural intensification in South Asia through enhanced capacity (policy, institution and skill) to scale up CSA strategies and technologies*

Objectives

- *To accelerate the identification of and scaling up of viable CSA interventions through national policies and programmes in South Asia*
- *To set up effective and efficient mechanisms for knowledge-sharing, policy dialogue, and cooperation in research and development programmes among SAARC countries on CSA*



Main categories of the constraints in adoption in CSA technologies/ practices in Sri Lanka

- 1. Inherent risks associated with technology adoption**
- 2. Inadequate exposure and knowhow**
- 3. Unaffordable capital costs for smallholders**



Recommendations in scaling-up CSA technologies

- Site-specific selection and adoption of CSA technologies
(Ex. Based on cropping patterns, soil type, topography, etc.)
- Holistic approach in implementations
(Central Govt. - Provincial Govt. - MASL, etc.)
- Promote CSA through already implemented national programs and projects
(Ex. GAP, Soil Act, Cultivation planning programs, etc.)
- Establish resource sharing mechanism among the farmers through community organizations
(Ex. High capacity solar water pumping systems, High capacity water tanks)

Recommendations in scaling-up CSA technologies (Cont...)

- Enhance CSA knowledge availability to all stakeholders
- Encourage the involvement of the private sector, including agribusinesses and input suppliers, in the production and distribution of CSA technologies
- Government subsidy schemes for CSA infrastructure development
(Ex. Solar water pumps, Micro irrigation systems)
- Considering CSA in policy planning giving high priority



Thank You