

Ministry of Mahaweli,
Agriculture, Irrigation and
Rural Development



TRAINING MANUAL ON CLIMATE SMART AGRICULTURE

Ministry of Mahaweli, Agriculture, Irrigation
and Rural Development

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National Guidelines for Climate Smart Agricultural Technologies and Practices for the Dry and Intermediate Zones of Sri Lanka and Training Manual on Climate Smart Agriculture

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FOREWORD

I am delighted to record the generous response extended by the United Nations Development Programme in Sri Lanka, through the Climate Resilient Integrated Water Management Project and the Green Climate Fund, for the assistance provided to develop the National Guidelines for Climate Smart Agricultural Technologies and Practices for the Dry and Intermediate Zones of Sri Lanka.

This Training Manual is designed to educate farming communities and other stakeholders representing the governmental and non-governmental organisations working in these areas, on Climate Smart Agriculture interventions. These efforts are aimed at remodelling the cascade ecosystems to mitigate the negative impacts of climatic aberrations affecting the sustainability of the forest and agro-ecosystems, and the livelihoods of the communities in this context. I hope that well-planned partnerships of all sectors would help achieve these goals.

I am grateful to the Panel of Experts, the

**The Secretary
Ministry of Mahaweli, Agriculture, Irrigation
and Rural Development**

National Technical Advisory Committee and the officials in government institutions, members of farmer organisations, and other partners in the communities, for contributing to develop the National Guidelines for Climate Smart Agriculture interventions and the corresponding Training Manual.

My wish is that the training programme, scheduled to begin in due course, would help remodel the ecosystems of the Dry and Intermediate zones in Sri Lanka to new heights, while enhancing the livelihoods of the farming communities and the work environments of the respective service providers in those areas.

ACRONYMS

AI

Agriculture Instructor

ASC

Agrarian Service Centre

CC

Climate Change

CSA

Climate Smart Agriculture

DAD

Department of Agrarian Development

DoA

Department of Agriculture

DoM

Department of Meteorology

GCF

Green Climate Fund

MASL

Mahaweli Authority of Sri Lanka

NRMC

Natural Resources Management Centre

ARPA

Agrarian Research and Production Assistant

AWS

Automated Weather Station

CRIWMP

Climate Resilient Integrated Water Management Project

CF

Conservation Farming

DOFC

Department of Forest Conservation

Dol

Department of Irrigation

DS

District Secretary

GHG

Greenhouse Gas

NTAC

National Technical Advisory Committee

OFC

Other Field Crops

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TRAINING MANUAL FOR CLIMATE SMART AGRICULTURE IN SRI LANKA

1

Introduction

It is appropriate to introduce the training activity with the definition of Climate Smart Agriculture (CSA), presented by the Food and Agriculture Organization (FAO) of the United Nations. According to this, CSA is based on three principles: **Mitigation** of GHG emissions from agriculture, **adaptation** of agricultural practices to Climate Change, and sustainable maintenance or increase of **agricultural productivity** to achieve national food security and development goals.

It is envisioned that the CSA practices recommended in this manual should deliver at least one or more benefits based on these three principles of the CSA, to Sri Lanka's agricultural system, particularly to the Dry and Intermediate zones in Sri Lanka.

The National Guidelines on CSA and the respective Training Manual are the combined outcome of detailed studies on three river basins: namely, Malwathu Oya, Mi Oya, and Yan Oya. This selection was mainly due to the high dependency of the respective river basin communities on the climatic factors for agriculture. The study consisted of several components such as field visits to the three river basins and numerous fact-finding missions. Previous exposure of the Expert Group (EG) members in other countries on replicable CSA practices also became useful in the preparation of the National Guidelines.

The EG and the 26-member National Technical Advisory Committee (NTAC) were appointed by the Ministry of Agriculture to technically guide the National Consultant to design the National

Guidelines consisting of five chapters, and the Training Manual to be adopted in the Dry and Intermediate zones of the country. The NTAC members represent the relevant national and provincial agencies in the given areas.

The National Guidelines on CSA comprises the following five chapters:

- I. Introduction: Key challenges faced by Sri Lanka's agriculture sector with special reference to Malwathu Oya, Mi Oya, and Yan Oya river basins
- II. Existing practices in agricultural production systems and recommendations for the future
- III. Climate Smart Agriculture (CSA) applications in other countries
- IV. CSA adoption in Sri Lanka specifically for the river basins of Malwathu Oya, Mi Oya, and Yan Oya: Enablers and challenges
- V. Recommended Technologies and Practices on Climate Smart Agriculture interventions

The CSA Technologies and Practices that are recommended for Sri Lanka's Dry and Intermediate zones are categorised under six Thematic Areas, which are further divided into 15 Thrust Areas. Approximately 110 Technologies and Practices have been identified under these Thrust Areas.

Thematic area 1: **Tank Cascade Management**

Thrust Area:

1. Tank Cascade Management

Thematic area 2: **Soil and Water Management**

Thrust Areas:

2. Soil and Land Management
3. Nutrient Management
4. Water Management

Thematic area 3: **Agronomy: Research and Development**

Thrust Areas:

5. Crop Management
6. Conservation and Management of Genetic Resources

Thematic area 4: **Climate Information and Forecasting: Research and Development**

Thrust Area:

7. Climate Information

Thematic area 5: **Institutional and Social Development**

Thrust Areas:

8. Management Integration
9. Agrarian Services
10. Agriculture Marketing and Value Chain Development
11. Social Development Measures
12. Risk Transferring Mechanism

Thematic area 6: **Energy and Mitigations**

Thrust Areas:

13. Energy Management
14. Mechanisation
15. Post-harvest Operations

1.1 Guidelines for Training Managers on the Implementation of the Training Programmes

1. Conduct awareness programmes on CSA for District Agriculture Committee members/and the relevant staff of Divisional Secretariats, and Departments of Irrigation, Agrarian Services, Forestry, Wildlife and Agriculture.
2. Identify the required number of trainers (Extension Staff/AIs) to represent the target geographical areas for training of farmers and other stakeholders (ideally, two trainers per farmer group).
3. Provide necessary guidance to the trainers to function as coordinators of the CSA programme of the respective area.
4. Conduct a two-day interactive workshop per target geographical area to train the trainers.
5. Provide trainers with the essential documents, other tools (some of them to be initially in draft format and finalised after the workshop) and opportunities, such as:
 - A. *The National Guidelines and the Training Manual on CSA*
 - B. *Training Aids: maps, charts, audiovisual equipment, record books for trainers and farmers*
 - C. *Attendance registers*
 - D. *Visuals: The trainers are expected to design their own visuals to suit their target areas (to be discussed in detail at respective TOT sessions)*
 - E. *Views obtained from trainers to improve/update/revise the Training Manual and Visual Aids*
 - F. *Adequate practice opportunities provided for the trainers in order to maintain uniformity in training*

1.2 Guidelines for Trainers

Resource persons and invitees as appropriate, for instance:

- A. Clergy – Monk/Priest from the area
 - B. UNDP and Project Staff
 - C. Locally based officials representing relevant public sector institutions, such as:
 - *Provincial Director/District Director – Agriculture, Agriculture Officers/Agriculture Instructors*
 - *Divisional Secretary/Grama Niladhari (GN)*
 - *Representatives from Animal Production and Health Sector, Coconut Cultivation Board, Irrigation Department, and Land Use Policy Planning Department (LUPPD), and Public Health Inspectors (PHIs)*
 - *Agrarian Development Officer/AI/ARPA*
 - D. Representatives from the relevant corporates, for instance:
 - *Agriculture machinery suppliers, i.e. drip irrigation equipment*
 - *Service providers who carry out repairs and maintenance of machinery*
 - *Dealers of seeds, planting materials, pesticides and other products*
 - *Storage facility providers*
 - *Financial service providers, such as banks*
 - *Agricultural insurance companies*
 - E. Staff/members of civil society organisations, community-based organisations and Non-Governmental Organisations working in respective areas
- Trainees:** Farmers, landowners, school leavers, representatives of civil society organisations (male

and female representation, preferably equal, is an important factor), and members of various service provider institutions.

Steps:

1. Select an appropriate location with training facilities.
2. Open and maintain a register with lists of trainees/resource persons making sure that the number of trainees per session would not exceed 25.
3. Prepare six sets of brochures covering the Thematic Areas for distribution among interested parties.
4. Arrange meeting(s) of the trainers and resource persons prior to the training programme to agree on the training objectives and the contents; the above-mentioned brochures should be available at this meeting.
5. Appoint a Coordinator (preferably an office bearer of a farmer organisation in the respective area) as the point of contact for regular interaction with the farmers in the area, the trainer and the project staff.
6. Prepare budget(s) for the training programme (including estimated cost of refreshments, and printing of documents, handouts, brochures, and stationery, required for the training activities).
7. Ensure that all decisions made at the training sessions are endorsed by the farmers and other

trainee participants by placing their signature on a document. This action would ensure a shared responsibility to adhere to the decisions made at the training sessions. The signed document should be circulated among the trainees.

8. Be prepared with required stationery to record the decisions taken and agreements to be made, and for farmers' and other stakeholders' corresponding signatures.
9. Schedule the training programmes in such a way that they do not exceed two days and are phased out with a seven-day gap, thereby assuring maximum productivity.
10. Update the Project Office regularly through a Training Summary document, which should also include the decisions taken at the training sessions.
11. Maintain the continuity of the actions through regular checks (at least once in every season), to discuss progress and issues encountered.

1.3 General Format of Training Modules (Lesson Plan)

The trainers should follow the General Guidelines given below for all training sessions.

At the initial training session, the training group should collectively decide on a name for the group. For example: Name of the village/ASC/District.

The trainers would decide the listing order of resource persons and the appropriate manner of introduction.

	Topic	Mode of Communication	Audio visual aids and other	Time
1	Icebreaker: Introduction of resource persons and participants.	Verbal	Visuals: YouTube presentations as appropriate	20 min
2	Introduce training objectives. Familiarise participants with Technologies and Practices.	Lecture	Presentation	60 min
3	Participants' views and feedback. Farmers to fill feedback questionnaires.	Discussion		30 min
4	Break for refreshments.			30 min
5	Farmers, landowners, and other stakeholders to propose modifications to improve the work plan.	Discussion	Revised work plan to be circulated for signatures	30 min
6	Recap: Restate the final agreed points and make necessary endorsements by participants.			10 min
	Total time allocated			180 min

Table 1.1 General Format for Training Sessions

Notes:

1.4 Training Module for Day 1

From 09:00 to 12:00

Thematic area 1:

Tank Cascade Management

Thrust Area:

- Tank Cascade Management

Thematic area 2:

Soil and Water Management

Thrust Areas:

- Soil and Land Management
- Nutrient Management
- Water Management

Number of Technologies and Practices to be addressed under each Thrust Area:

1. Tank Cascade Management (4)
2. Soil Management (2)
3. Nutrient Management (2)
4. Water Management (4)

Technologies and Practices to be discussed:

1. Tank Cascade Management

1.1 Rehabilitation and maintenance of the entire cascade system in a cohesive manner, as opposed to individual tank focused rehabilitation.

1.2 Demarcation of catchment area boundaries, to help prevent unauthorised cultivation in catchments.

1.3 Reforestation/afforestation to help maximise water availability and expand crop area; establishing of suitable perennial trees in Gasgommana, and wev thavulla to enable smooth run-off of water and prevent the formation of sediment; planting suitable trees in Kattakaduwa to minimise salinisation and also on wind breaks with timber trees. These steps collectively contribute to eco-system management.

1.4 Tank bund renovation and the construction of an access road for the sustainability of the cascade system.

2. Soil Management

2.1 Laser technology-assisted levelling, contour soil bunds, mulching with crop residues and the adequate demarcation of drainage (kunu ela).

2.2 Switching to land preparation with incidental rain.

3. Nutrient Management

3.1 Adapting to Integrated Plant Nutrition System (IPNS).

3.2 Switching to site-specific fertilisers; recycling of straw; production of compost for field applications; application of foliar nutrient to minimise wastage; and the use of non-conventional fertilisers to minimise cultivation cost.

4. Water Management

4.1 Use of rainwater harvesting; pitcher irrigation, roof rainwater harvesting, and micro-irrigation;

4.2 Appropriate use of agro-wells, tube wells, and bucket drip kits.

4.3 Improvements to irrigation infrastructure, such as groundwater recharging through percolation.

4.4 Use of traditional varieties and farming practices.

Target group: Farmers, landowners, school leavers, representatives of civil society organisations (male and female representation, preferably equal, is an important factor); and members of various service provider institutions.

Resource persons: Senior Agriculture Extension Officers in the area.

Objectives:

Farmers and landowners in tank cascade systems agree to follow the recommended CSA Technologies and Practices to ensure sustainability of the cascade system; also learn to conserve water, manage soil fertility and nutrients, thereby achieving higher productivity and profitability of farming.

	Topic	Mode of Communication	Audio visual aids and other	Time
1	Icebreaker: Introduction of resource persons and participants.	Verbal	Visuals/PPP/flip charts/YouTube presentations	20 min
2	Introduce training objectives. Familiarise participants with Technologies and Practices.	Lecture	YouTube presentations	60 min
3	Participants' views and feedback. Farmers to fill feedback questionnaires.	Discussion		30 min
4	Break for refreshments			30 min
5	Farmers, landowners, and other stakeholders to propose improvements to the work plan; endorse their decisions and responsibilities with signatures.	Discussion	Circulate revised draft for signatures.	30 min
6	Recap: Restate the final agreed points and make necessary endorsements by participants.			10 min
	Total time allocated			180 min

Table 1.2 Training Session: Day 1 – From 09:00 to 12:00

1.5 Training Module for Day 1

From 13:00 to 16:00

Thematic area 3:

Agronomy: Research and Development

Thrust Areas:

- Crop Management
- Conservation and Management of Genetic Resources

Thematic area 4:

Climate Information and Forecasting: Research and Development

Thrust Area:

- Climate Information

Number of technologies and practices to be addressed under each Thrust Area:

1. Crop Management (22)
2. Conservation and Management of Genetic Resources (3)
3. Climate information (4)¹

Technologies and Practices to be discussed:

1. Crop Management

1.1 Different cultivation practices aimed at increased productivity, such as crop diversification, crop rotation, systematic home gardening, and cultivation of climate resilient fruit varieties – like guava, papaya, tamarind, wood apple – and grafted fruit varieties and traditional yams, and pot farming of crops.

1.2 Innovative crop establishment methods: e.g. the parachute system.

1.3 Alternative cultivation techniques such as bund cultivation with vegetable crops in paddy fields, food forest systems, inter cropping with leguminous crops with nitrogen fixing ability, shared cultivation methods (Bethma), and cultivation under controlled environments such as net houses and rain shelters.

1.4 Cost-effective and labour-efficient practices like Biochar preparation and usage, silage making, self-seed production to ensure steady seed supply, use of deep ploughing at specific times, and alternative income-generation activities such as beekeeping.

1.5 Importance of biotic stress management with the help of approaches such as IPNS and crop protection from wild animals.

2. Conservation and Management of Genetic Resources

Guaranteed food security through improved land productivity and minimised input cost by instilling in the trainees on:

2.1 Use of farmer experience and insights to identify and collect genetically diverse crop varieties.

2.2 Conservation of wild and traditional crops suitable for cultivation under adverse climate conditions, as well as those that display resistance to pests and disease.

2.3 Introduction of drought-resistant herbs of Ayurvedic value; highlight importance of Forward Contract Agreements that are vital in marketing respective herbs.

3. Climate Information

3.1 Adherence to seasonal climate forecasting and to the agro-met advisory service by all parties engaged in farming, due to the largely important role they play in crop management, given the challenges posed by climate change.

3.2 Crucial role played by training of farmers and other FO members on measures to mitigate effects of climate change.

3.3 Farmer collaboration to establish a surveillance and forecasting system to manage pests and disease.

Target group and resource persons: Same as described under 1.5 Training Module for Day 1

¹However, only three out of these four Technologies and Practices are relevant for the given audience; hence only three of them would be discussed herein.

Objectives:

Trainees would be informed and knowledgeable enough on:

- a. The importance of using officially issued climate information to plan cultivations.
- b. The use of IPNS options in pest and disease management.
- c. Identifying the most fitting irrigation system to their context, thereby achieving water use efficiency and high land productivity.
- d. The assurance of high crop productivity, thereby enhancing income and food security in areas under their tank cascade systems that are usually faced with the adverse effects of Climate Change.

	Topic	Mode of Communication	Audio visual aids and other	Time
1	Introduction to Session 2: Objectives to be explained	Verbal	Visuals/PP/flip charts as appropriate.	
2	Lecture/discussion	Lecture, accompanied by documentary.	YouTube clips	90 min
3	Participants' feedback Evaluation/questionnaire	Interactive discussion		30 min
4	Break for refreshments			30 min
5	Farmers, landowners, and other stakeholders to propose improvements to the work plan; endorse their decisions and responsibilities with signatures.	Discussion	Circulate revised draft for signatures.	20 min
6	Recap: Restate the final agreed points and make necessary endorsements by participants	Endorsements		10 min
	Total time allocated			180 min

Table 1.3 Training Session: Day 1 – From 13:00 to 16:00

1.6 Training Module for Day 2

From 09:00 to 12:00

Thematic area 5: **Institutional and Social Development**

Number of Technologies and Practices to be addressed under each Thrust Area:

1. Management Integration (5)
2. Agrarian Services (8)
3. Agriculture Marketing and Value Chain Development (12)
4. Social Development Measures (12)
5. Risk Transferring Mechanism (7)

Technologies and Practices to be discussed:

1. Management Integration

- 1.1 Need for farmers to engage in crop/livestock integration practices, obtain and upgrade knowledge and competence on livestock management.
- 1.2 Importance of crop insurance schemes for all farmers.
- 1.3 Scope in converting Chena lands into more productive perennial crop cultivation.
- 1.4 Farmers' role in agro-tourism and the required infrastructure development for those ventures.

2. Agrarian Services

- 2.1 Importance of farmers' following seasonal advisory services.
- 2.2 Vital role played by information on tank storage for crop cultivation.
- 2.3 Importance of disaster preparedness.
- 2.4 Role of farmer organisations, and the need to give recognition to Agriculture Extension Officers in Kanna meetings.
- 2.5 Improve knowledge on rehabilitation of tanks and on CSA, among the farming community.
- 2.6 Knowledge on land-use policies.
- 2.7 Vital role of an online information network system, which includes all agricultural inputs, outputs and other relevant resources.

3. Agriculture Marketing and Value Chain Development

- 3.1 Commodity groups for farmers to link with respective market chains.
- 3.2 Organising and linking village-based sale points for wholesale marketing.
- 3.3 Value chains to process farmers' produce and development of high-quality products using systems such as GAP certification.
- 3.4 Farmers' knowledge on Forward Contract Agreements for their products.
- 3.5 Development of appropriate procedures/tools to minimise post-harvest losses during storage and transport.
- 3.6 Warehouses for safe storage of excess produce.
- 3.7 Regional and community-level collection centres with cold storage facilities.

4. Social Development Measures

- 4.1 Strengthened extension service to meet increasing farmer demand for scientific agriculture.
- 4.2 Introduction of effective and reliable e-agriculture information systems.
- 4.3 Knowledge on organic farming due to growing demand for such products.
- 4.4 CSA Farmer Field Schools to enhance capacities of the farmers through experiential learning.
- 4.5 Revolving funds system to strengthen farmers' livelihoods.

5. Risk Transferring Mechanism

- 5.1 Climate Smart Village concept with the involvement of wider groups of stakeholders.
- 5.2 Reinforcement of Acts/Laws/Policy documents pertaining to the country's agriculture sector.
- 5.3 Artisanal handicraft and other cottage industries as additional income generating sources.
- 5.4 Inclusion of CSA in school education, and in curricular of higher education institutions.

Target group and resource persons: Same as described under 1.5 Training Module for Day 1

Objectives:

Participants would be adequately familiar on avenues of improving livelihoods of their farming communities, enhancing productivity of their cultivation practices, and learning about ways of minimising the adverse effects of climate change on ecosystems.

	Topic	Mode of Communication	Audio visual aids and other	Time
1	Introduction to Session 2: Objectives to be explained.	Verbal		20 min
2	Lecture/discussion	Lecture	PowerPoint presentation	60 min
3	Participants' feedback Evaluation/questionnaire	Interactive discussion		30 min
4	Break for refreshments			30 min
5	Farmers, landowners, and other stakeholders to propose improvements to the work plan; endorse their decisions and responsibilities with signatures.	Discussion	Circulate revised draft for signatures.	30 min
6	Recap: Restate the final agreed points and make necessary endorsements by participants.	Endorsements		10 min
	Total time allocated			180 min

Table 1.4 Training Session: Day 2 – From 09:00 to 12:00

1.7

Training Module for Day 2

From 13:00 to 16:00

Thematic area 6:

Energy Management and Mitigation

Number of Technologies and Practices to be addressed under each Thrust Area:

1. Energy Management (3)
2. Mechanisation (4)
3. Post-harvest Operations (3)

As appropriate, some Technologies and Practices will be jointly addressed under one or more Thrust Area/s.

Technologies and Practices to be discussed:

1. Energy Management

All three Technologies and Practices under the Thrust Area – Energy Management are consolidated herein. Hence, it is not numbered.

As an effort to minimise the dependence on fossil fuel-based power, CSA recommendations include community-level solar power generation, windmill and bio-energy usage.

2. Mechanisation

- 2.1 Gradual shift by farmers to mechanisation.
- 2.2 Well explained deep ploughing – the pros and cons.
- 2.3 Encouraged land and plot consolidation due to its capability of facilitating the use of farm machinery.

Target group and resource persons: Same as described under 1.5 Training Module for Day 1

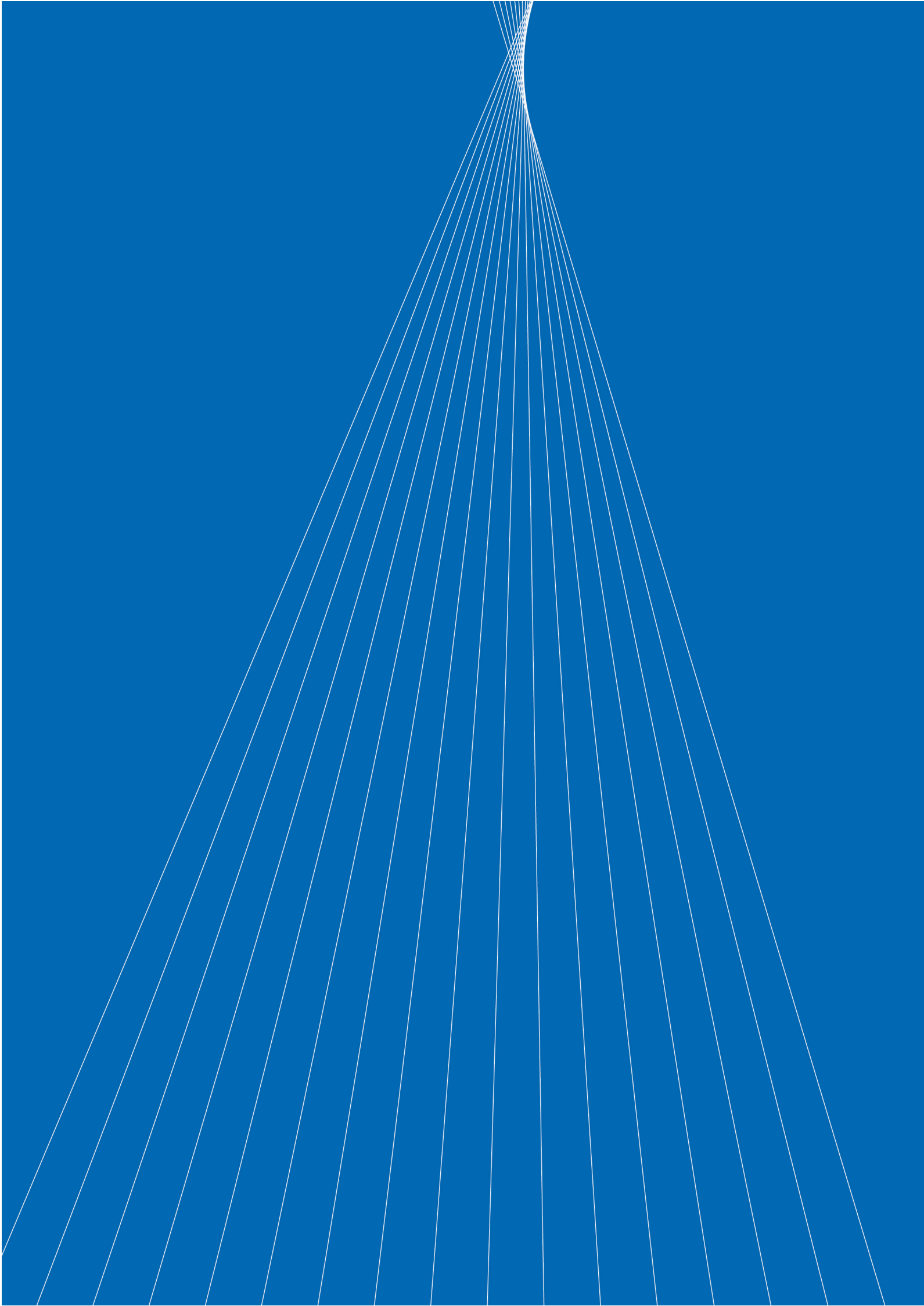
Objectives:

Farmers learn the importance of using energy efficiently. They become aware of alternate energy sources that can be used for domestic and village levels.

They also become aware of ways of maximising productivity, increased profitability and of the additional income that can be generated by the village youth, by bringing in mechanised agriculture and servicing the machinery.

	Topic	Mode of Communication	Audio visual aids and other	Time
1	Introduction to the main theme of the session: Energy Management and Mitigation.	Verbal	Visuals/ YouTube clips	20 min
2	Lecture/discussion	Lecture, accompanied by documentary	YouTube	60 min
3	Participants' feedback Evaluation/questionnaire	Interactive discussion		30 min
4	Break for refreshments			30 min
5	Farmers, landowners, and other stakeholders to propose improvements to the work plan; endorse their decisions and responsibilities with signatures.	Interactive discussions and endorsements	Draft the revisions collectively.	30 min
6	Recap: Restate the final agreed points and make necessary endorsements by participants.		Circulate revised draft for signatures.	10 min
	Total time allocated			180 min

Table 1.5 Training Session: Day 2 – From 13:00 to 16:00



VISUAL AIDS

1. FOR TRAINING MODULE 1: DAY 1 MORNING – SLIDES (60 MINUTES)

INTRODUCTION (15 minutes)

- Welcome the resource persons, trainee participants
- Introduce yourself and your friend/partner
- Request trainees to introduce themselves
- Explain the objective of the training programme (UNDP/GCF/MOA/DOA)

The Tree – YouTube

- Trainer asks questions from the farmers about their knowledge on global warming

• Trainer explains the terms

What is global warming/climate change? How does it happen?

Explain the effects of climate change on the planet

And on agriculture and livelihoods of people

Explain the worst effects of climate change in Sri Lanka
Floods (riverine floods, urban floods, reservoir induced floods)

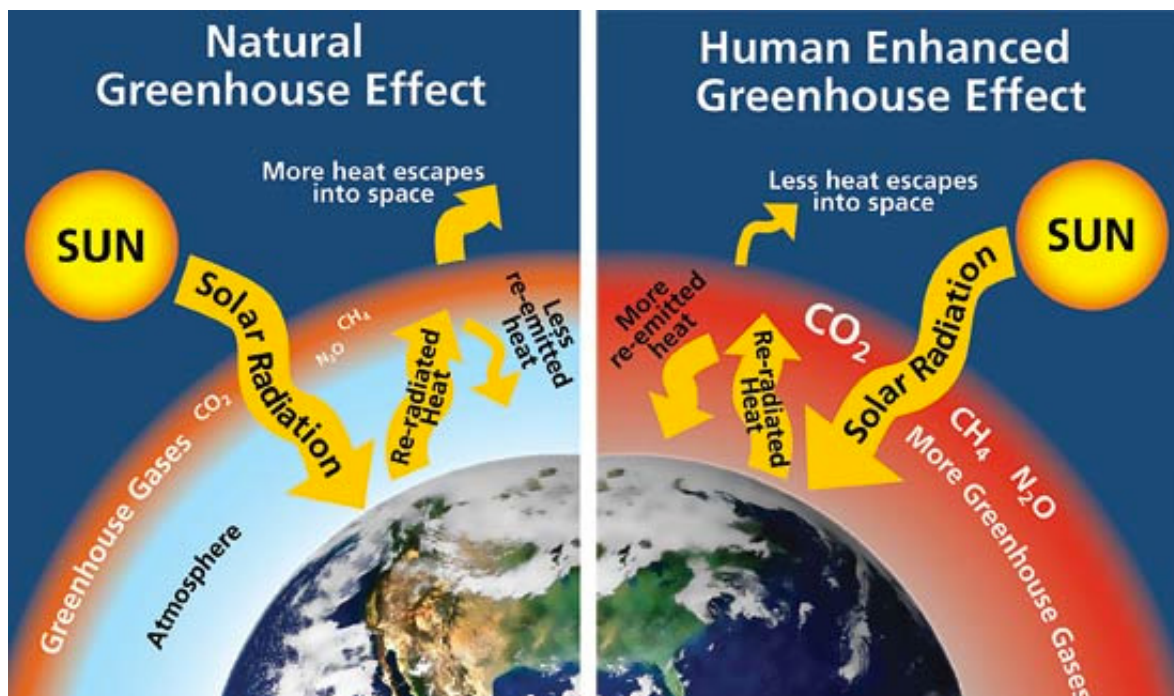
What are Greenhouse Gases?

They are man-made.

We need to concentrate on Climate Change; why?

Losses suffered

What is Climate Smart Agriculture?

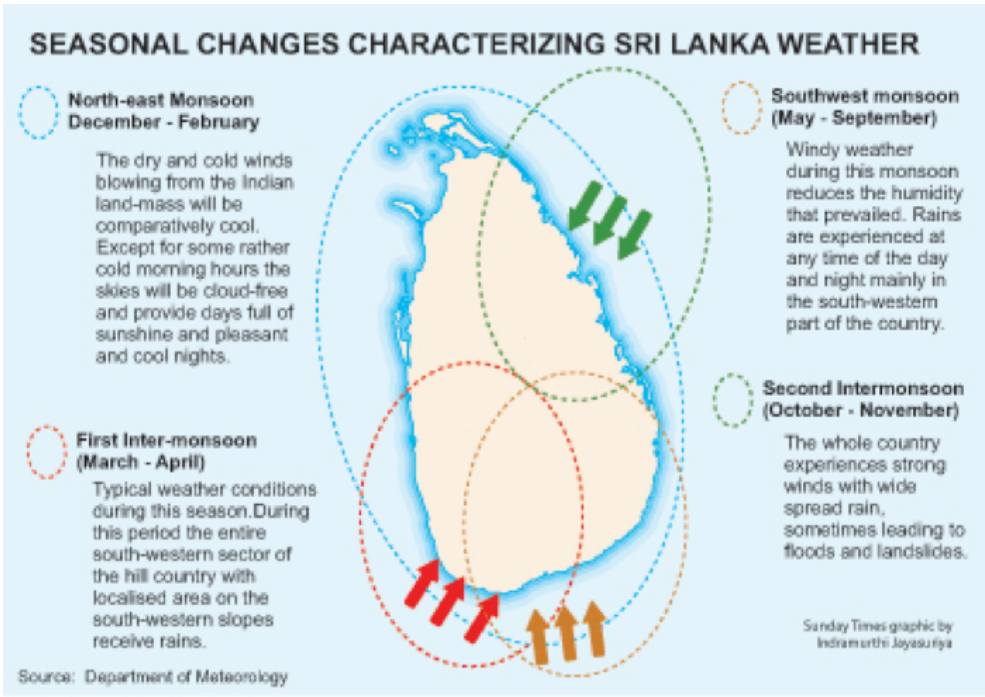


https://www.google.com/url?sa=i&source=images&cd=&ved=0ahUKEwj4n_yW-

2. SIGNIFICANT CLIMATE RELATED DISASTERS IN SRI LANKA

Damages to housing, infrastructure and agriculture	USD 327 million
Annual losses: Floods Cyclones/high winds Landslides Droughts	USD 2.1 billion USD 2.5 billion USD 1.1.billion USD 0.9 billion
This is equivalent to 0.4 percent of GDP or 2.1 percent of government expenditure	
Floods and landslides in recent history: In May 2016, caused damages amounting to USD 572 million.	

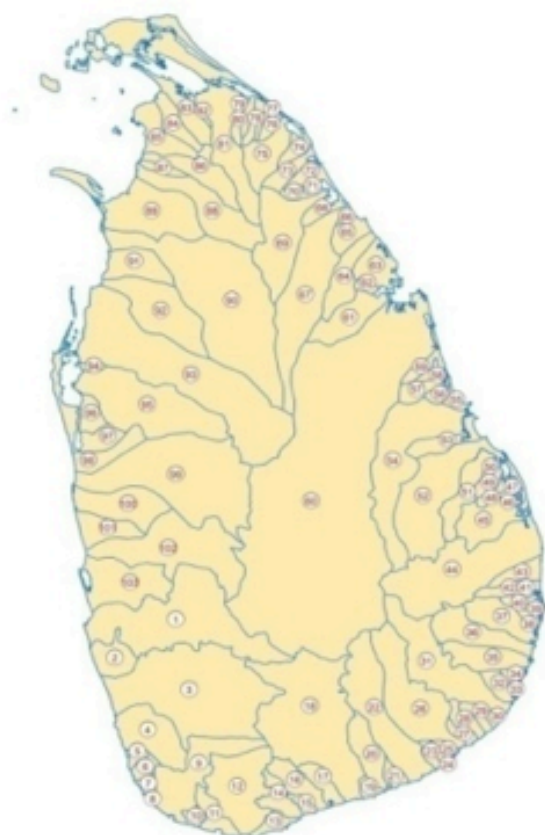
3. RAINFALL IN SRI LANKA



4. RIVER BASINS

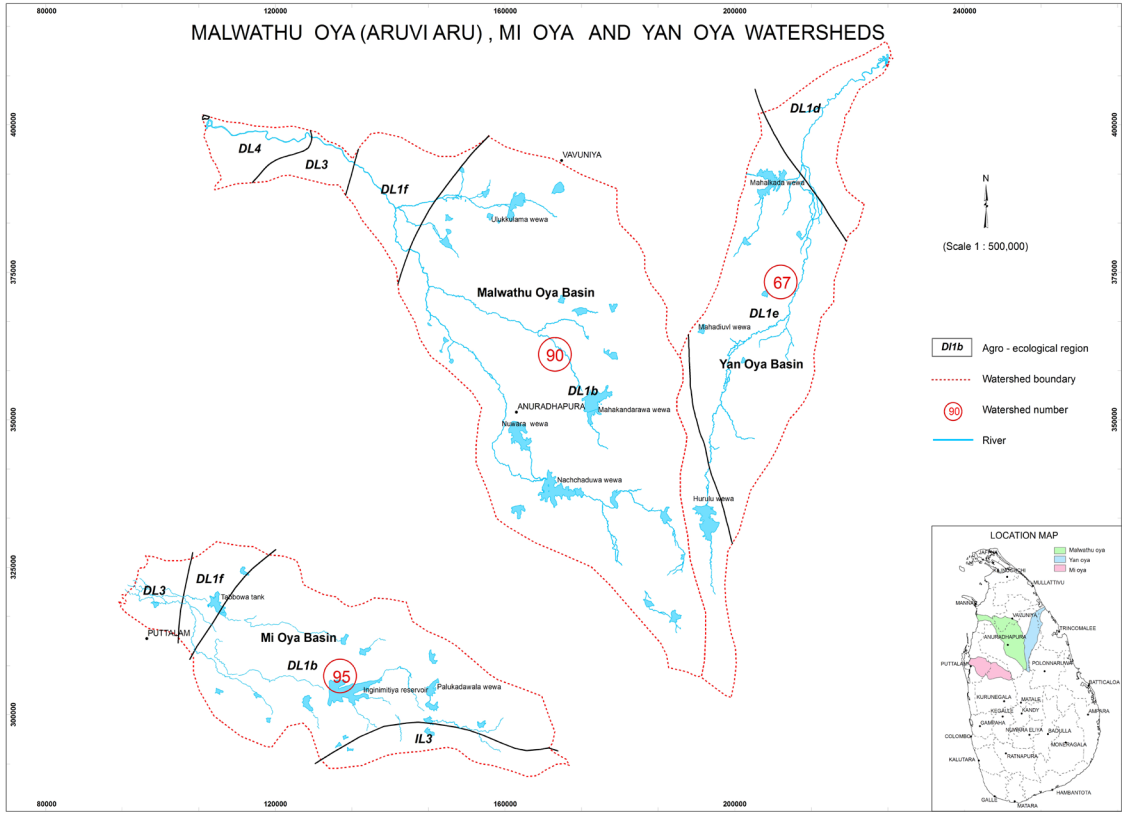
River basins of Sri Lanka and seasonal changes (2 minutes)

Our livelihoods depend on the rivers/streams below:



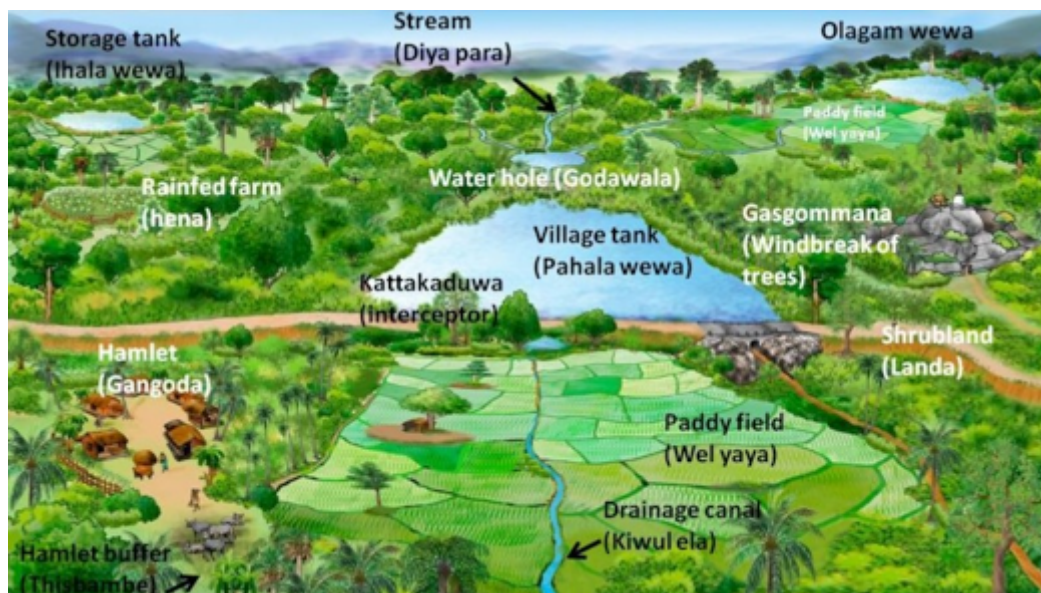
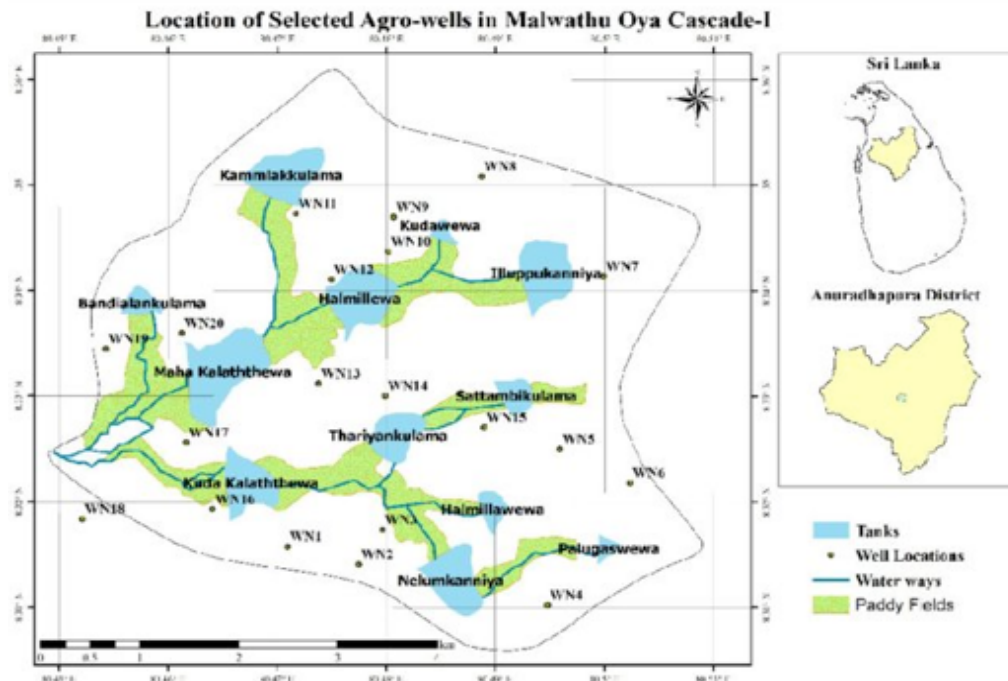
1	Kelani Ganga Basin	36	Heda Oya Basin	71	Chavar Aru Basin
2	Bolgoda Ganga Basin	37	Karanda Oya Basin	72	Palladi Aru Basin
3	Kalu Ganga Basin	38	Semana Aru Basin	73	Manoli Aru Basin
4	Bentara Ganga Basin	39	Tandiadi Aru Basin	74	Kodalikattu Aru Basin
5	Madu Ganga Basin	40	Kangkadichi Aru Basin	75	Per Aru Basin
6	Madampe lake Basin	41	Rufus Kulam Basin	76	Pali Aru Basin
7	Telelwatta ganga Basin	42	Pannel Oya Basin	77	Maruthapillay Aru Basin
8	Ratgama Lake Basin	43	Ambalan Oya Basin	78	Theravil Aru Basin
9	Gin Ganga Basin	44	Gal Oya Basin	79	Piramenthal Aru Basin
10	Koggala Lake Basin	45	Andella Oya Basin	80	METHALI Aru Basin
11	Polhwatta Ganga Basin	46	Tumpen Keni Basin	81	Kanakarayan Aru Basin
12	Nilwala Ganga Basin	47	Namakada aru Basin	82	Kahelappu Aru Basin
13	Sinmodara Oya Basin	48	Mandipattu Aru Basin	83	Akkarayan Aru Basin
14	Kirama Oya Basin	49	Pathatoppu Aru Basin	84	Mandakal Aru Basin
15	Rekawa Oya Basin	50	Vett Aru Basin	85	Pallavarayan Kaddu Basin
16	Urubokka Oya Basin	51	Unnichai Basin	86	Pali Aru Basin
17	Kachchigala Basin	52	Mundeni Aru Basin	87	Chappi Aru Basin
18	Walawe Ganga Basin	53	Miyangolla Ela Basin	88	Parangi Aru Basin
19	Karagan Oya Basin	54	Maduru Oya Basin	89	Nay Aru Basin
20	Malala Oya Basin	55	Puliyampota Aru Basin	90	Aruvi Aru Basin
21	Embilikala Oya Basin	56	Kirimechchi Odai Basin	91	Kal Aru Basin
22	Kirindi Oya Basin	57	Bodigolla Aru Basin	92	Moderagam Aru Basin
23	Bamdawe Ara Basin	58	Mandan Aru Basin	93	Kala Oya Basin
24	Mahasiliwa Oya Basin	59	Makarachchi Aru Basin	94	Moongil Aru Basin
25	Butawa Oya Basin	60	Mahaweli Ganga Basin	95	Mi Oya Basin
26	Menik Ganga Basin	61	Kantalai Aru Basin	96	Madurankuli Aru Basin
27	Katupila Ara Basin	62	Palamputta Aru Basin	97	Kalagamuna Oya Basin
28	Kurundu Ara Basin	63	Panna Oya Basin	98	Rathambala Oya Basin
29	Nabadagas Ara Basin	64	Pankulam Aru Basin	99	Deduru Oya Basin
30	Karambe Ara Basin	65	Kunchikumban Aru Basin	100	Karambala Oya Basin
31	Kumbukkan Oya Basin	66	Palakutta Aru Basin	101	Ratmal Oya Basin
32	Bagura Oya Basin	67	Yan Oya Basin	102	Maha Oya Basin
33	Girikula Oya Basin	68	Mee Oya Basin	103	Attanagalla Oya Basin
34	Helawa Ara Basin	69	Ma Oya Basin		
35	Wila Oya Basin	70	Churiyan Aru Basin		

5. THE THREE RIVER BASINS OF THE STUDY

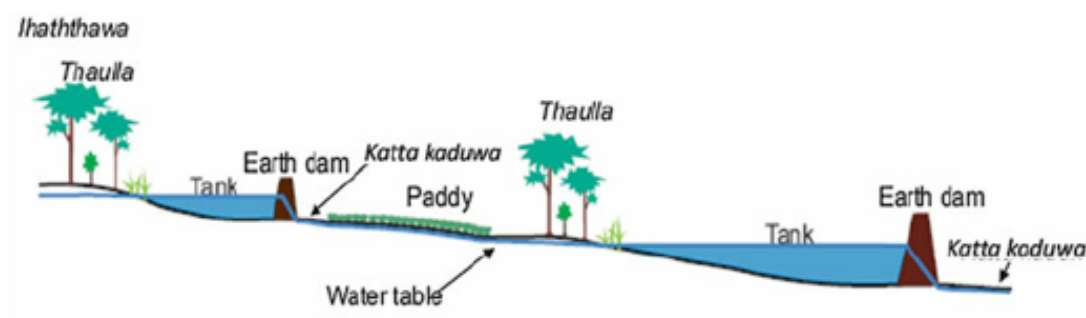


Basin No.	Name of the river basin and length	Catchment area (km ²) and length	Mean annual rainfall volume (MCM)	Average annual discharge volume to the sea (MCM)	% discharge from the catchment rainfall
90	Malwathu Oya (164 km)	3,284	4,573	566	12.4
95	Mi Oya (109 km)	1,533	1,925	199	10.3
67	Yan Oya (142 km)	1,598	2,476	482	19.5

6. INTRODUCTION TO A CASCADE SYSTEM

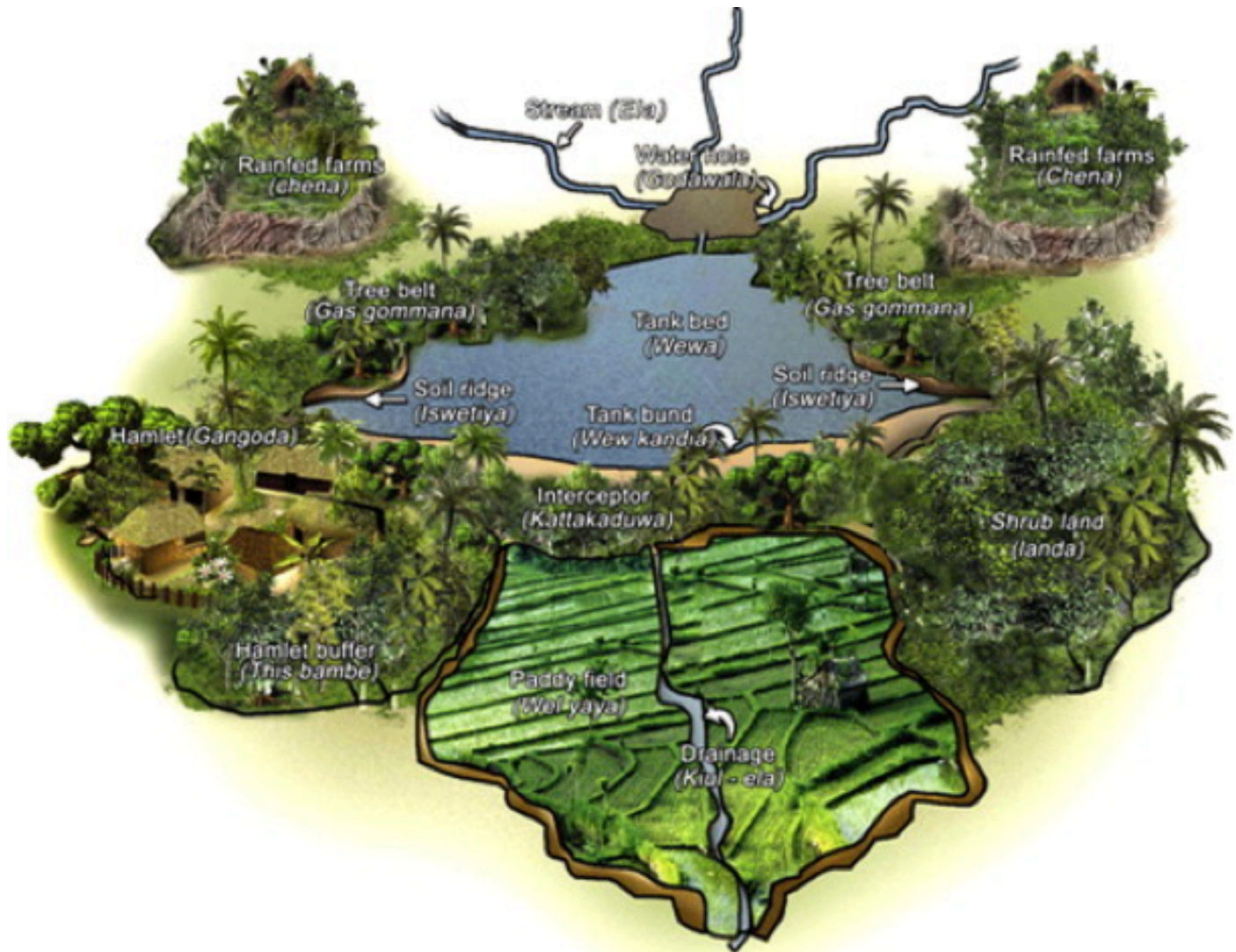


Source: P B Dharmasena



7. COMPONENTS OF A CASCADE

The trainees get a chance to study the local cascade systems.



Source: P B Dharmasena

8. CASCADE MANAGEMENT

ACTIVITY:

Using the detailed map, the participant farmers get involved in demarcating the catchment areas.

1. Reforestation: Participatory discussion with farmers (5 minutes)

Initiating a reforestation programme for the village:

- a. Explain the advantages and individual responsibility of replanting
- b. Collectively identify species of plants for reforestation

- c. Identify the source of plant material, identify growers

2. Tank bund renovation and development of access road as a collective responsibility (5 minutes)

- a. Identify responsible partners/organisations for planning stages
- b. Start planning voluntary programmes/campaigns



Source: UNDP Sri Lanka



Web: Tzachquiel02/ Nursery plantation for re-forestation project

9. LAND LEVELLING AND CONSOLIDATION

1. Participants become aware of the benefits of land levelling (with the help of laser technology) and the importance of land preparation with incidental rains (10 minutes)



Water Management – laser levelling

Source: A S K Abeysekera



Land consolidation – Bund reconstruction for easy crop management

Source: A S K Abeysekera

10. LAND LEVELLING AND CONSOLIDATION (CONT'D)

Preparation of lands with incidental rains to save water



Source: Shantha Emitiyagoda

11. NUTRIENT MANAGEMENT TO ENHANCE PRODUCTIVITY

1. Participants become aware of the role of nutrient management as an important measure to enhance productivity (10 minutes)

- a. Significance of IPNS
- b. Recycling of straw/paddy husk/foliar nutrient; available opportunities for commercial production of plant-based nutrients from organic waste for local use
- c. Production of bio-gas from organic waste

The 'Four Rs' in integrated nutrient management:

Right amount – Proper application rate and the exact quantity

Right source – Proper type of application

Right placement – Appropriate method of application

Right timing – Correct time of application in the lifecycle of the system



Well-maintained solid waste composting systems
Source: Ministry of Agriculture

12. WATER CONSERVATION AND MANAGEMENT

1. Participants become aware of all aspects of water conservation and water management (10 minutes)

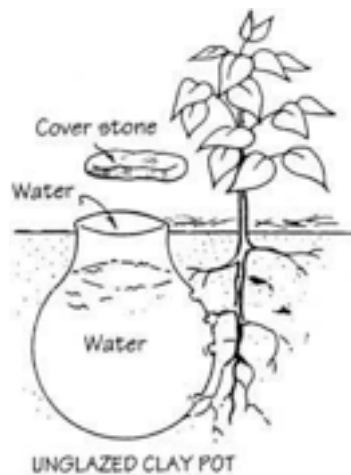
- a. Rainwater harvesting: Options and opportunities
- b. Pitcher irrigation, micro irrigation, bucket drip kits

- c. Roof rainwater harvesting
- d. Agro-wells, tube wells, groundwater recharging systems
- e. Cultivation of traditional varieties
- f. Water conservation farming



Rainwater harvesting and agro wells
Source: Shantha Emitiyagoda

Credit: Pitcher Irrigation: Advances in Environmental Research – Volume 22: 2012/ Drought-tolerant Maize Crops



Agro-well Source: Shantha Emitiyagoda

13. WATER CONSERVATION AND MANAGEMENT (CONT'D)



**High-quality Agriculture Irrigation Drip
Tape for Micro Irrigation**
Source: alibaba.com

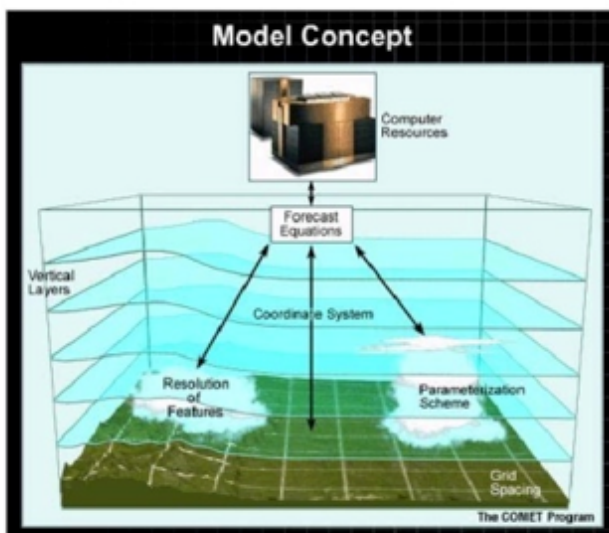


Simple Bucket Drip Irrigation System
Source: sowingshalom.wordpress.com

14. FOR TRAINING MODULE 2 DAY 1 AFTERNOON



CLIMATE INFORMATION



Sharing climate information to plan irrigation water use/crop calendar/cropping system, and improve land productivity and minimise waste

Forecasting pest/disease and weed infestations

Plan food availability under drought and flood conditions

Video_ crop forecast –Sri Lanka
www.data.gov.lk/dataset/crop-forecast

15. SURVEILLANCE SYSTEM

Govi wedaduru:

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16. INCREASING LAND AND WATER PRODUCTIVITY

1. Broadly discuss:

- Crop diversification, crop rotation
- Systemic home gardening
- Promoting fruit and other functional crop

cultivation

- Sandwich cropping and climate smart variety cultivation



2. Selection of crops:

- Farmers would list the selected crops and fruit trees for cultivation in different locations, and initiate discussion on plant nurseries



17. CONSERVATION AND MANAGEMENT OF GENETIC RESOURCES

1. Collectively discuss with participants the use of the following, as interventions:

- a. Genetically diverse crop varieties in rice, tomato, egg plant, banana, and root crops
- b. Medicinal plants and functional food plants
- c. Food crops that fetch high export revenue
- d. Types that have a high demand in the local market

2. Discuss ways of making available the respective seeds and other planting material



<https://www.google.com/url?sa=i&source=images&cd=&ved>



<https://www.google.com/url?sa=i&source=images&cd=&ved=>

18. CONSERVATION AND MANAGEMENT OF GENETIC RESOURCES (CONT'D)

3. Highlight the importance of conservation and management of crops with broad genetic diversity

- Crops known for their traditional use, and farmers' responsibility to conserve them
- Marketing issues and challenges faced by farmers



19. FOR TRAINING MODULE 3

DAY 2 MORNING



Integrated farming
Source: Shantha Emitiyagoda



MANAGEMENT INTEGRATION/CROP LIVESTOCK INTEGRATION

- a. Services provided by, and benefits of, ASC centres, and seasonal advisory services
- b. Significance of tank storage, safe storage systems for grains as safeguards against disaster situations
- c. Importance of timely switch to CSA practices; the benefits of sound knowledge on land policy use
- d. Understanding different aspects of marketing and value chain development; brainstorming on avenues of risk mitigation

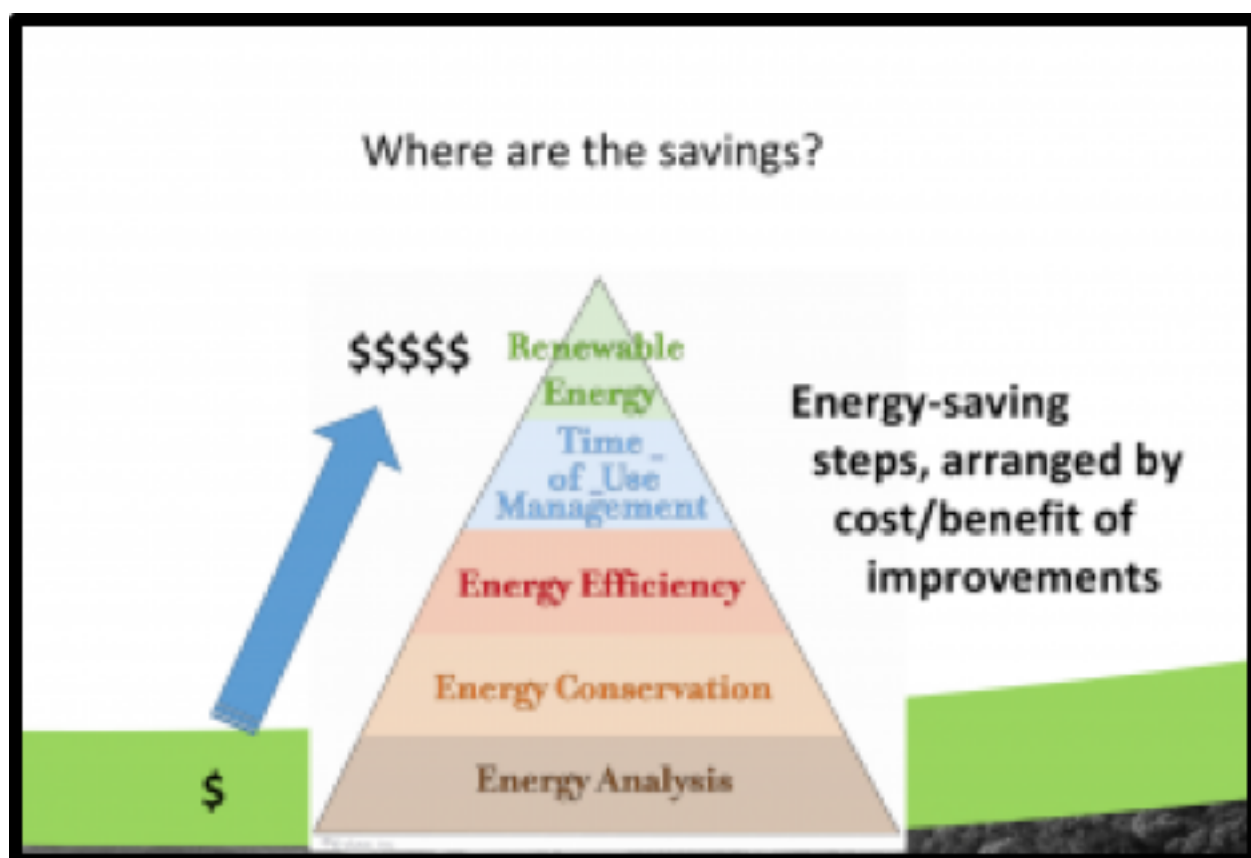
20. FOR TRAINING MODULE 4

DAY 2 AFTERNOON

ENERGY MANAGEMENT – SLIDES (60 MINUTES)

1. Make the farmers/participants understand the importance of clean energy

- Availability of rich sources in the river basin cascade systems to locally generate electricity, for community use and for other purposes
- Capability of this intervention to upgrade livelihoods of local communities
- Different potentials of energy sources such as solar power, wind and bio energy sources



21. CLEAN ENERGY



Windmills

Source: Renewable energy in Europe 2017 — Recent growth and knock-on effects: eea.europa.eu



Solar energy

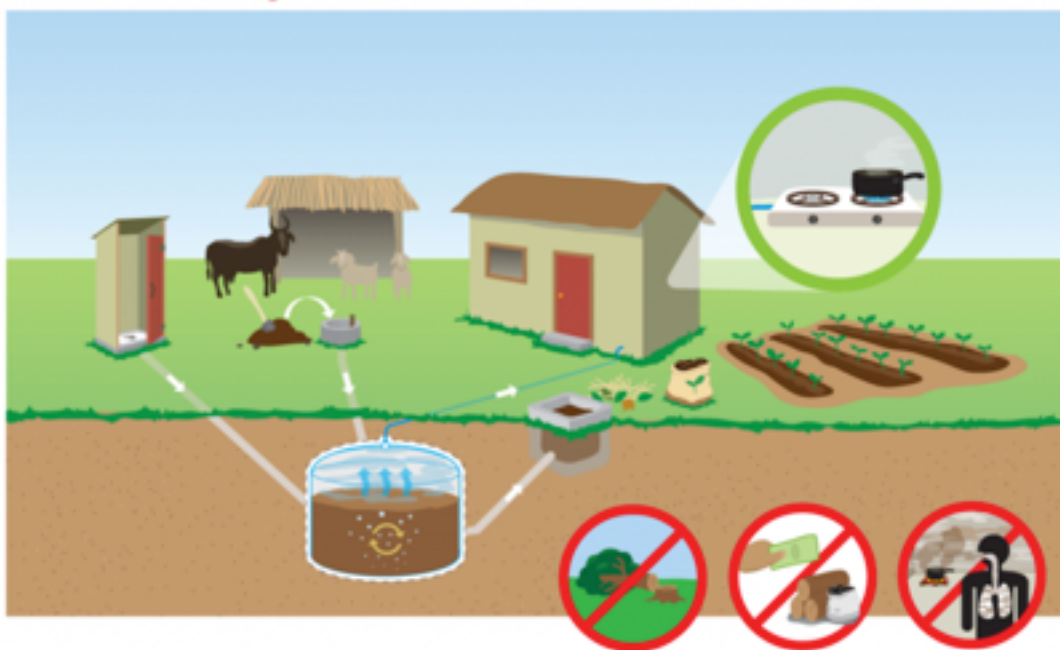
Source: <https://www.google.com/url?sa=i&source=images&cd=&ved>

22. CLEAN ENERGY (CONT'D)

Bio-gas production



The Bio-Gas Digester:



Source: <https://www.google.com/url?sa=i&source=images&cd=&ved=>

23. MECHANISATION

Participants become aware of the benefits of appropriate farm machinery use



Source: Shantha Emitiyagoda

Farm machinery hiring centres



24. MECHANISATION (CONT'D)

TRAINING MANUAL FOR CLIMATE SMART AGRICULTURE IN SRI LANKA



Mechanical Transplanter
Source: A S K Abeysekera



Safe pesticide application technique
Source: A S K Abeysekera

25. POST-HARVEST OPERATIONS

1. Trainees discuss the most challenging post-harvest issues and the need for addressing them before planting

Correct Post-Harvest Operations

Improve Agricultural Productivity by

- Preventing post-harvest losses
- Improving nutrition
- Adding value to agricultural products
- Opening new market opportunities
- Generating new job opportunities



Source: <https://www.google.com/url?sa=i&source=images&cd=&ved=>



26. POST-HARVEST OPERATIONS (CONT'D)

Packing

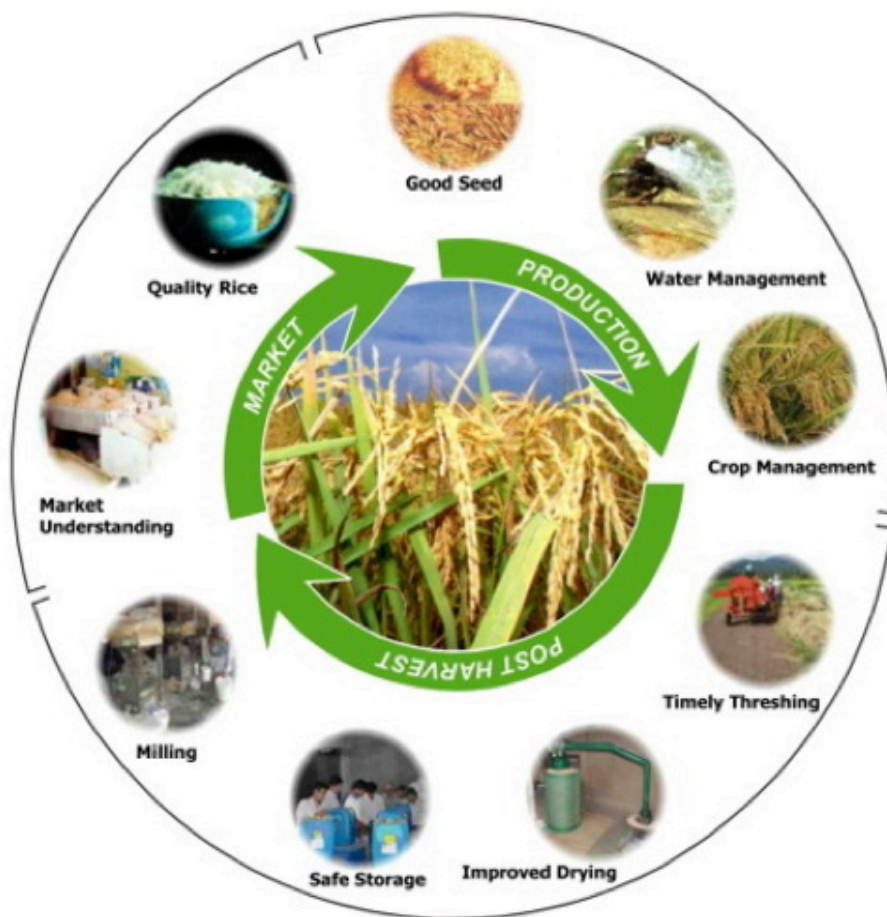
1. Importance of clean/uniform crop stages/pest-free crops

In general, minimising rough handling, sorting to remove damaged and decomposing produce, and effective temperature management, would contribute significantly to fresh produce of high quality and reduced post-harvest losses.



27. POST-HARVEST OPERATIONS (CONT'D)

Order of post-harvest operations



28. POST-HARVEST OPERATIONS (CONT'D)

Introduce practices such as GAP

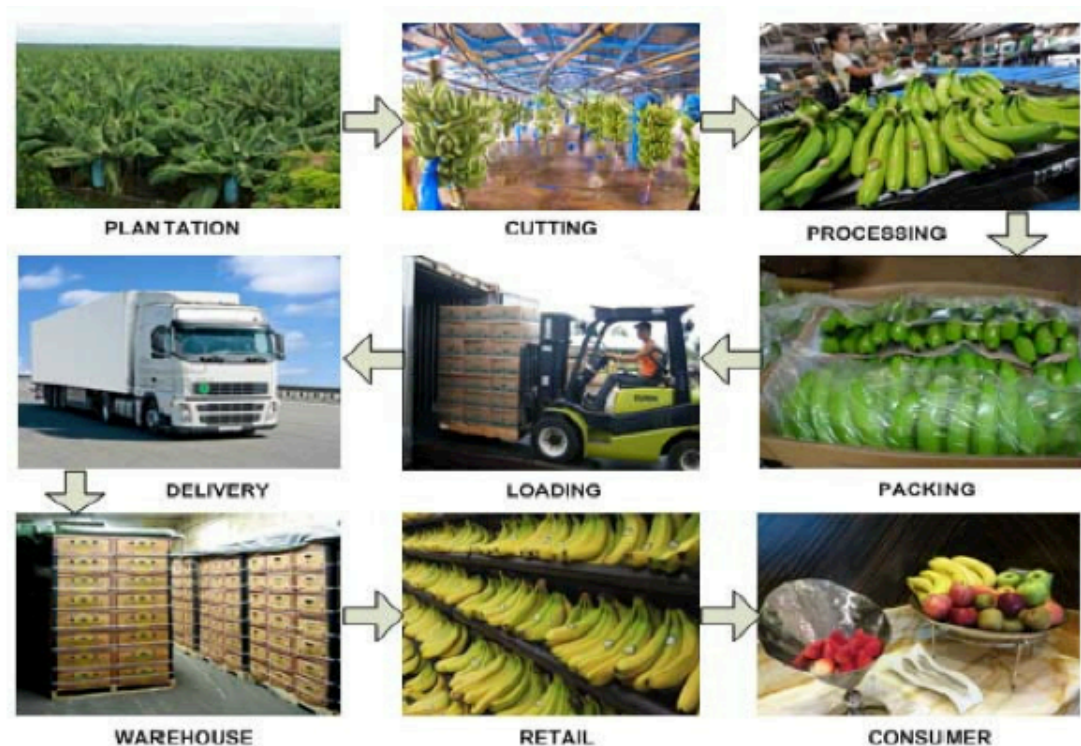
Participants become familiar with terms such as: GAP certificate holding/GAP Farmer



Source: Financial Times 2 Jan 2019

29. POST-HARVEST OPERATIONS (CONT'D)

1. Importance of preparing for the potential negative impacts of Climate Change



Important facts to be instilled in the participants:

- Be a professional farmer
- Understand the threats of global warming
- Prepare risk-mitigation measures
- Help make changes to the farming systems in river basins
- Help overcome the food crisis
- Preserve the ecosystem for health of future generations

**Farms operated by women are common
in Sri Lanka's Dry zone
Source: Shantha Emitiyagoda**





ANNEXURES

ANNEXURE 1:

Attendance Register Format

Trainers are requested to keep a tentative list of participants ready in order to save time.

Farmer Training on Climate Smart Agriculture in Sri Lanka
UNDP, Ministry of Agriculture, Natural Resources and Management Centre,
and Department of Agriculture Sri Lanka

Name of the village:

Venue:

Date:

Trainers:

	Name	Address/Position/Phone	Signature

ANNEXURE 2:

Farmer feedback on the training held: Blank sheets
should be attached to write comments

Farmer Training on Climate Smart Agriculture in Sri Lanka
UNDP, Ministry of Agriculture, Natural Resources and Management Centre,
and Department of Agriculture Sri Lanka

Name of the village:

Venue:

Date:

Trainers:

Is the training useful/I agree with the proposed changes			
	Good	No idea	No use

ANNEXURE 3:

Record of decisions taken and agreements made after each session/topic

Farmer Training on Climate Smart Agriculture in Sri Lanka:
UNDP, Ministry of Agriculture, Natural Resources and Management Centre,
and Department of Agriculture Sri Lanka

Name of the village:

Venue:

Date:

Trainers:

Decisions Taken: Subject: i.e. species of trees planted as wind break

- 1.
- 2.
- 3.

	Name	Agree	Do not agree	Signature

