Documentation of Sustainable Land Management Technologies and Approaches

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Presenter's Experiences in SLM, WOCAT and LADA

1. Workshop on Land Degradation Assessment and Monitoring for SLM and Climate Change Adaptation in South Asia. China. 2012.
2. Meeting on the use of WOCAT-LADA to address the Assessment of the Efficiency of Soil Conservation Measures. Bangladesh. 2013.
3. 95 research and review publications in SLM.
4. 32 research and development projects in SLM.

Information sources consulted in the development of this presentation

1. Book: where the land is greener

case studies and analysis of soil and water conservation initiatives worldwide, Hanspeter Liniger and William Critchley (Eds.), WOCAT – 2007

2. Web site: www.wocat.net

3. Web site: www.sricat.net

4. FAO/UN Sri Lanka Project on SLM:

Rehabilitation of Degraded Agricultural Lands in Kandy, Badulla and Nuwara Eliya Districts in the Central Highlands funded by FAO/GEF

(2016 - 2021).

1. The WOCAT is a global network of soil and water conservation specialists which was initiated in 1992.

2. The WOCAT is organized as a consortium of national and international institutions and operates in a decentralized manner, through initiatives at regional and national levels, with back-stopping from a management group.

VISION is to improve land resources and ecosystems (including soils, water, flora, and fauna) and people's livelihoods by sharing, enhancing, and using knowledge on SLM.

MISSION is to support adaptation, innovation, and decision-making around SLM.

This includes:

- enhancing land productivity and water use efficiency
- improving provisioning of ecosystem goods and services
- promoting sustainable use of biodiversity
- contributing to food security, and climate change adaptation/ mitigation
- reducing disaster risks and land and water conflicts.

Regional and National Initiatives

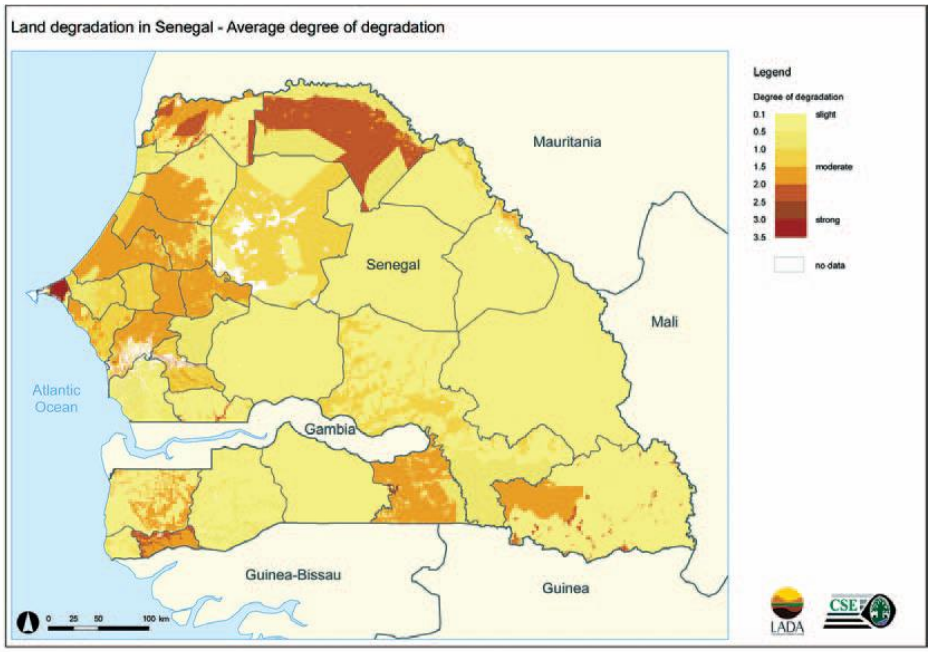
1. Philippines - PhilCAT
2. Thailand – ThaiCAT
3. Himalaya - HimCAT
4. Niger - NigCAT/GREAD
5. Ethiopia - EthioCAT
6. South Africa - SLM Information Framework
7. Nepal - NepCAT
8. Bangladesh - BanCAT
9. Bhutan - BhuCAT
10. Laos PDR - LaoCAT
11. Uganda - UgaCAT

LADA
Land Degradation Assessment in Drylands

Land Degradation Assessment in Dry Lands

The LADA is a science based approach for assessing and mapping land degradation at different spatial scales.

1. **Global**
2. **Regional**
3. **National**
4. **Local**
5. **Village**



Source: FAO (TCP/RAS/3312) Inception Workshop in China, 2012

The objectives of this presentation

1. **Create awareness among the RDAL Project stakeholders on documentation of SLM technologies and approaches to promote experience sharing and knowledge management through SriCAT website.**

2. **Provide awareness on the WOCAT and LADA for the project stakeholders.**

Controlling Land Degradation
Enhancing Land Productivity

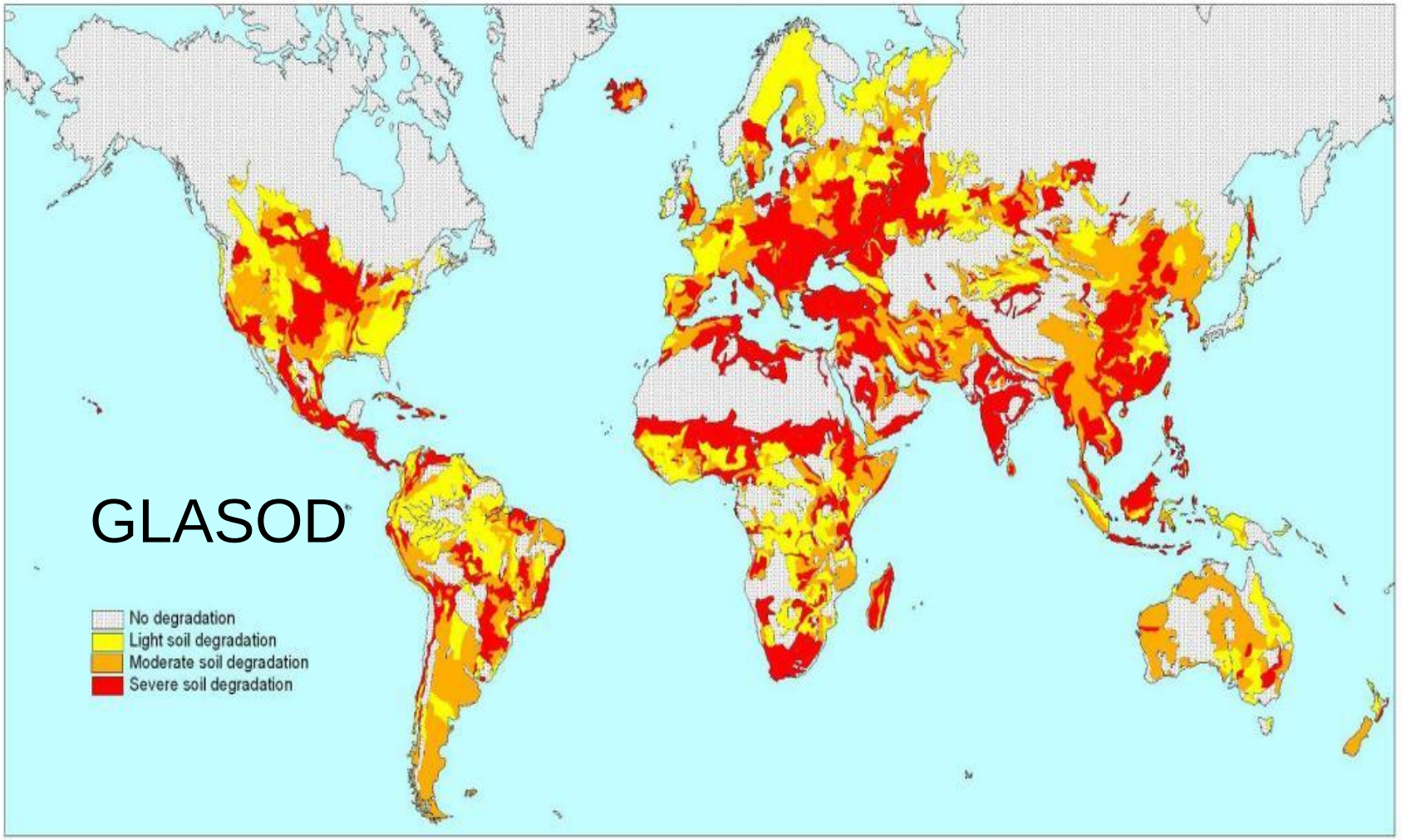
Global Status in Land Degradation

Degradation Type	Total Land Extent (Million ha.)	Percent Extent (%)
Water Erosion	**1093.7**	**55.6**
Wind Erosion	548.3	27.9
Chemical Deterioration	239.1	12.2
Physical Deterioration	83.3	4.2
Total	1964.4	100.0

Situation in 1991

Source: Oldeman et. al., 1991

Global Assessment of Soil Degradation



Source: WOCAT, 2007

Land Use Status in Sri Lanka

Land use	Land extent			
	1956		2007	
	000' ha	%	000' ha	%
Homesteads	586.3	9.0	1,028.6	15.7
Tea	257.5	4.0	189.8	2.9
Rubber	227.4	3.5	183.2	2.8
Coconut	250.5	3.8	313.7	4.8
Mixed perennial crops	90.0	1.4	164.3	2.5
Paddy	510.7	7.8	844.0	12.9
Sugarcane	0.3	0.0	13.8	0.2
Sparsely used crop lands	1,008.1	15.4	1,439.5	22.0
Other crop lands	4.3	0.1	76.8	1.2
Forest	3,360.6	51	2,278.8	28.8
Other (Urban and barren lands)	267.3	4.1	420.0	6.4
Total (Agric + Forest + Other)	6,561.0	100.0	6,561.0	100.0

Source: Ministry of Environment and Renewable Energy, Government of Sri Lanka, 2014

Definition of Land

Physical environment of the earth surface Including:

- Climate
- Hydrology
- Relief
- Soils
- Flora (Crops, domestic and wild plants)
- Fauna (Man, domestic and wild animals)

Land Degradation

A process of reducing the qualities of a land to a lower rank.

Sustainable Land Management (SLM)

The United Nations defines SLM as

"the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions".

Technologies and Approaches

SLM Technology

- An SLM Technology is a physical practice in the field that controls land degradation and/ or enhances productivity.
- A Technology consists of one or several measures, such as agronomic, vegetative, structural, and management measures.

Source: www.sricat.net

SLM Approach

- An SLM Approach defines the ways and means used to implement one or several SLM Technologies.
- It includes technical and material support, involvement and roles of different stakeholders, etc.
- An Approach can refer to a project/ program or to activities initiated by land users themselves.

Source: www.sricat.net

WOCAT Technologies

Required Information on SLM Technologies for WOCAT

1. General information
2. Description of an SLM technology
3. Classification of the SLM technology
4. Technical specifications
5. Implementation activities, inputs and costs.
6. Natural and human environment
7. Impacts and concluding statements
8. References and links
9. Annex
10. Editors
11. Cartoons and figures
12. Proofreading
13. Layouts
14. Coordination
15. Consortium partners
16. Contact address

Individual Platform

General Information

1. Name of the technology.
2. Contact details of resource persons.
3. Conditions regarding the data use.
4. Declaration on the sustainability.
5. Reference to the questionnaire.

Double Hedgerows

Description of an SLM Technology

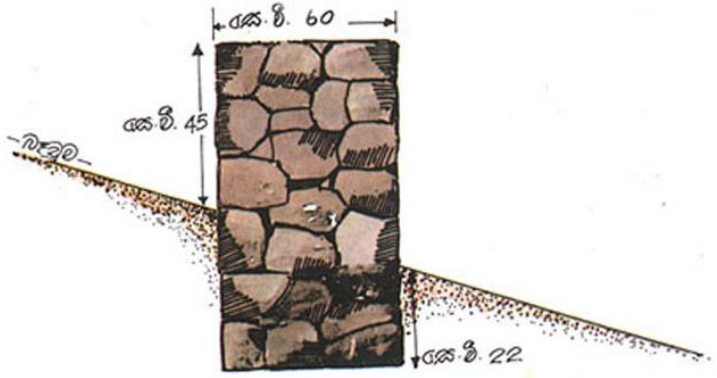
1. Short description.
2. Detailed description.
3. Photos.
4. Videos.
5. Country, Region and Locations.
6. Date of implementation.
7. Introduction of the technology.

Classification of the SLM Technology

1. Main purpose.
2. Current land use.
3. Previous land use.
4. Water use.
5. SLM group.
6. SLM measures.
7. Land degradation type addressed.
8. Prevention, Reduction, Restoration or Management

Multipurpose bunds

Technical Specifications, Implementation Activities, Inputs and Costs



1. Technical drawings.
2. Input and cost calculations.
3. Establishment of activities.
4. Cost of inputs needed for establishment.
5. Maintenance and recurrent activities.
6. Cost of maintenance (Materials and recurrent activities per year).
7. Most important factors affecting the cost.

WOCAT

Natural and Human Environment

1. Climate.
2. Topography.
3. Soils.
4. Water availability and quality.
5. Biodiversity.
6. Characteristics of the technology users.
7. Holding size and ownership.
8. Water use rights.
9. Access to services and infrastructure.

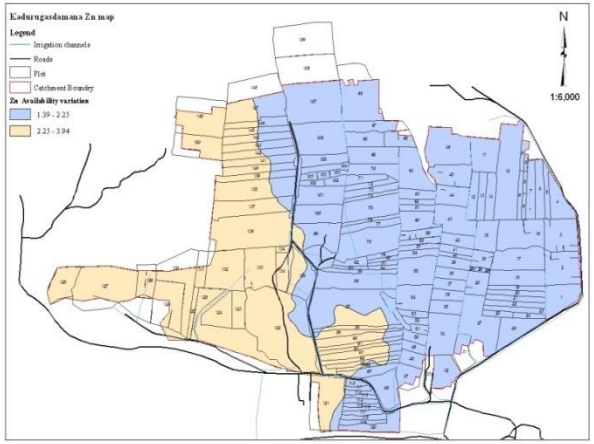
Impacts and Concluding Statements

1. On site impacts.
2. Off site impacts.
3. Exposure and sensitivity environmental changes . (Eg. Climate change)

1. Cost benefit analysis.
2. Technology adoption.
3. Adaptation.
4. Strengths, advantages and opportunities.
5. Weaknesses, disadvantages and risks and the ways of overcoming them.

WOCAT
Approaches

Requested Information on SLM Approaches for WOCAT



1. General information.
2. Specification of the SLM approach.
3. Participation and roles of the stakeholders involved.
4. Technical support, capacity building and knowledge management.
5. Financing and external material support.
6. Impact analysis and concluding statements.
7. References and links.

WOCAT

Participation and Roles of the Stakeholders Involved

1. Stakeholders involved and their roles.
2. Involvement of local land users and local communities.
3. Flow chart (If available).
4. Decision making in the selection of SLM technologies.

Technical Support, Capacity Building and Knowledge Management

1. Capacity building and training.
2. Advisory service.
3. Institutions strengthening.
4. Monitoring and Evaluation.
5. Research.

WOCAT

Financing and External Material Support

1. Annual budget for the SLM component of the approach.
2. Financial and material support provided to land users.
3. Credit provided.
4. Other incentives and instruments provided.

Directions in Approaches

- Financial incentives
- Material approaches
- Credit facilities
- Formulation of regulations
- Policy support
- Market support
- Providing rental services
- Creation of awareness
- Providing training
- Formation of affinity groups
- Formation of producer groups

Selected Case Studies from the WOCAT Database - 2007

Conservation Agriculture

1. No-till technology (Morocco)
2. Conservation agriculture (United Kingdom)
3. Small-scale conservation tillage (Kenya)
4. No-till with controlled traffic (Australia)
5. Green cane trash blanket (Australia)

Chena farming with sesame

Alley Cropping

Manure Application and Compost Making

1. Vermiculture (Nicaragua)
2. Compost making associated with planting pits (Burkina Faso)
3. Improved trash lines (Uganda)

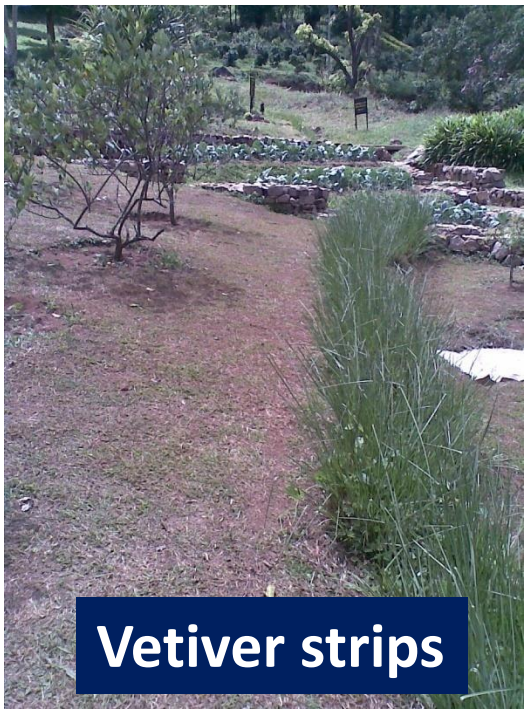
Cow Dung Pellets

Household Compost

Farm Yard Manure

Vegetative Strips and Covers

1. Natural vegetative strips (Philippines)
2. Green cover in vineyards (Switzerland)
3. Vetiver grass lines (South Africa)



Agro-forestry

1. Shelterbelts for farm land in sandy areas (PR China)
2. Grevillea agro-forestry system (Kenya)
3. Poplar trees for bio-drainage (Kyrgyzstan)
4. Multi story cropping (Philippines)
5. Intensive agro-forestry system (Colombia)
6. Shade-grown coffee (Costa Rica)
7. Conversion of grazing land for fruit and fodder plots (Tajikistan)
8. Orchards based agro-forestry (Tajikistan)

Kandyan Forest Gardens

Water Harvesting

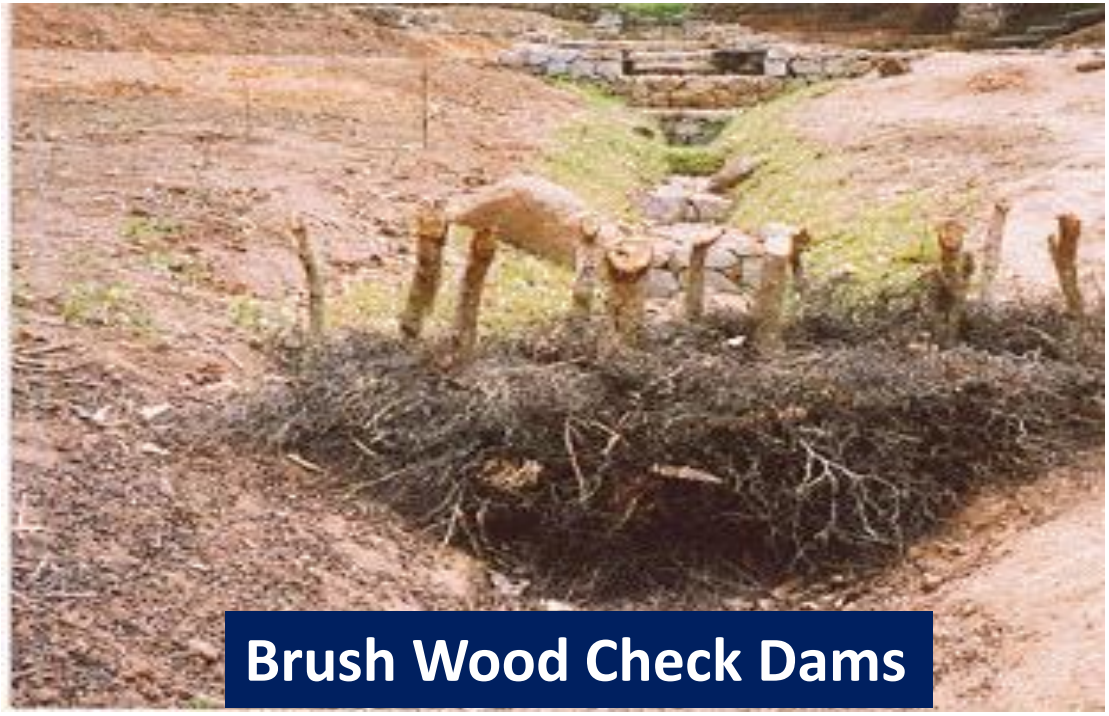
1. Sunken streambed structure (India)
2. Planting pits and stone lines (Niger)
3. Furrow-enhanced runoff harvesting for olives (Syria)

Farm Ponds

Runoff Harvesting Structures

Gully Rehabilitation

1. Check dams from stem cuttings (Nicaragua)
2. Gully control and catchment protection (Bolivia)
3. Landslip and stream bank stabilization (Nepal)



Brush Wood Check Dams

Terraces

1. Stone wall bench terraces (Syria)
2. Rehabilitation of ancient terraces (Peru)
3. Traditional stone wall terraces (south Africa)
4. *Fanya Juu* terraces (Kenya)
5. Small level bench terraces (Thailand)
6. Orchard terraces with bahia grass cover (PR China)
7. Zhuanglang loess terraces (PR China)
8. Rain-fed paddy rice terraces (Philippines)
9. Traditional irrigated rice terraces (Nepal)

Grazing Land Management

1. Ecograze (Australia)
2. Restoration of degraded range land (South Africa)
3. Improved grazing land management (Ethiopia)
4. Area closure for rehabilitation (Ethiopia)

Grazing Lands in Tank Villages

Other Technologies

1. *Pepsee* micro irrigation system (India)
2. Sand dune stabilization (Niger)
3. Forest catchment treatment (India)
4. Strip mine rehabilitation (South Africa)


Sprinkler Irrigation


Water Percolation Pits

The WOCAT Categorization System

1. **Land use** (Croplands, Grazing lands, Forest/Woodlands Mixed lands and other lands)
2. **Degradation type addressed** (Water erosion, Wind erosion, Chemical deterioration, Physical deterioration, Vegetative degradation and Water degradation)
3. **Conservation measures**
4. **Agronomic and soil management** (Vegetation/soil cover, Organic matter/soil fertility, Soil surface treatment, Subsurface treatment)
5. **Vegetative** (tree and shrub cover, Grasses and perennial herbaceous plants)
6. **Structural** (Engineering structures)
7. **Combinations** (Bio-Engineering structures)

Contribution for the WOCAT Database - 2007

No	Country	Number of case studies
1	South Africa	4
2	Kenya	3
3	Australia	3
4	PR China	3
5	Philippines	3
6	India	3
7	Nicaragua	2
8	Tajikistan	2
9	Niger	2
10	Nepal	2
11	Ethiopia	2
12	Other countries	13

Selected WOCAT Examples on Standardized SLM Technologies and Approaches

Level bench Terraces - China

left: Aerial view over Zhuanlang county where 90% of the hillsides are covered with terraces. Reducing runoff and erosion, maintaining soil fertility and making farming operations easier are key for rainfed agriculture in this semi-arid environment. (He Yu)
right: A 4 m high terrace riser, where the lower part is vertical and bare – demonstrating the stability of the loess soil at this depth. The upper part is sloping, and stabilised with grasses, bushes and trees. (Hanspeter Liniger)

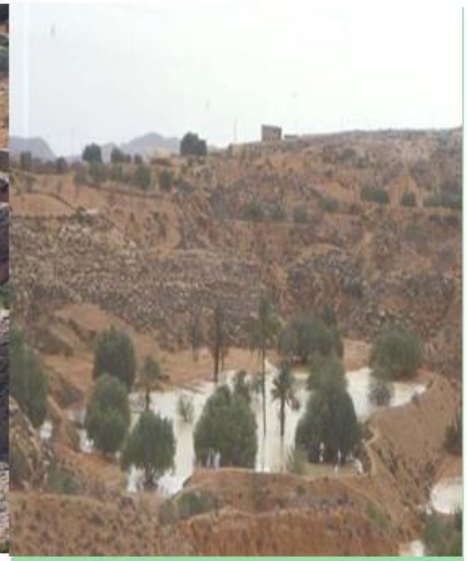
Zhuanglang loess terraces

China – 庄浪水平梯田

Level bench terraces on the Loess Plateau, converting eroded and degraded sloping land into a series of steps suitable for cultivation.

The Loess Plateau in north-central China is characterised by very deep loess parent material (up to 200 m), that is highly erodible and the source of most of the sedi

Runoff Water Harvesting Technique - Tunisia



left: Jessour is the plural of a Jessr which is the hydraulic unit made of the dyke, the spillway, the terrace (cropping area: fruit trees and annuals), and the impluvium (runoff catchment area). (Photo: Ben Zaied M.)
right: Jessour is an ancient runoff water harvesting technique widely practiced in the arid highlands of southern Tunisia. After each rainfall event, important volumes of runoff water accumulate in the terrace and infiltrate in the soil to sustain trees and crops (Photo: Ouessar M.)

Jessour

Tunisia - Jessr, Katra, Tabias (Arabic)

Jessour is an ancient runoff water harvesting technique widely practiced in the arid highlands

Jessour technology is generally practiced in mountain dry regions (less than 200 mm annually) with medium to high slopes. This technology was behind the installation of very old olive orchards based on rainfed agriculture in rugged landscapes which allowed the local population not only to ensure self-sufficiency but also to provide neighbouring areas with many agricultural produces (olive oil, dried figs, palm dates, etc.).

Jessour is the plural of jessr, which is a hydraulic unit made of three components: the impluvium, the terrace and the dyke. The impluvium or the catchment is the area which collects and conveys runoff water. It is bordered by a natural water divide line (a line that demarcates the boundary of a natural area or catchment, so that all the rain that falls on this area is concentrated and drained towards the same outlet). Each unit has

Self Help Groups - Kenya

left: Farmer explaining the difference between conventional tillage (left of picture) and conservation tillage (right of picture). (Hanspeter Liniger)
right: Contractor demonstrating the plough extension for deep ripping to members of the self-help group. (Hanspeter Liniger)

Self-help groups

Kenya

Small-scale farmers forming self-help groups to provide mutual support for adopting and promoting conservation agriculture.

The self-help group approach described here is an initiative which grew from the local land users themselves. Farmers with common interests and goals came together, formed and registered groups and developed constitutions. Conservation

Participatory Catchment Rehabilitation - Peru

left: Initial labour input for rehabilitation activities is high. Incentives were provided and equipment was partly subsidised to motivate the participation of land users. (DESCO)
right: Women participating in the rehabilitation of ancient terraces. The community was involved in planning, implementation and evaluation of the SWC activities. (DESCO)

Participatory catchment rehabilitation

Peru – *Participación comunitaria para la rehabilitación de cuencas*

Promoting the rehabilitation of ancient terrace systems based on a systematic watershed management approach.

The Center for Studies and Promotion of Development – DESCO, a Peruvian NGO, started the Terrace Rehabilitation Project in 1993 to re-establish ancient terracing and irrigation practices that had largely been lost. The project is part of a general integrated development programme. Its overall purpose is to restore the productive capacity of terraced cropland, and to generate better living standards in the Colca valley. The project has the following specific objectives: (1) to increase the productive infrastructure through soil conservation and better use and management of existing water resources; (2) to increase levels of production; (3) to stimulate people in soil conservation and land management; and (4) to encourage/promote relevant local institutions.

For implementation, a systematic watershed management approach was introduced. The catchment was considered the basic unit for development planning. Physical and socio-economic baseline studies were carried out. A strong community-based organisation, the catchment committee, was then founded. This consisted of representatives of major local grassroots organisations (irrigation committee, farmers' community, mothers' club etc). Responsibilities, commitments and rules were defined. Committee meetings and land user assemblies were the entities for planning, organisation and execution of project activities. DESCO initiated a process of 'concerted planning' in collaboration with other private and

Location: Río Colca, Arequipa, Peru
Approach area: 8,250 km²
Land use: cropland
Climate: semi-arid
WOCAT database reference: QA PER01
Related technology: Rehabilitation of ancient terraces, QT PER01
Compiled by: Aquilino P Mejia Marcacuzco, DESCO, Arequipa, Peru

WOCAT and LADA Collaboration

WOCAT

LADA

Land Degradation Assessment in Drylands

Potential Technologies and Approaches from Sri Lanka

Soil Conservation Structures for SLM
(15 Measures Recommended)

Source: Department of Agriculture, Sri Lanka

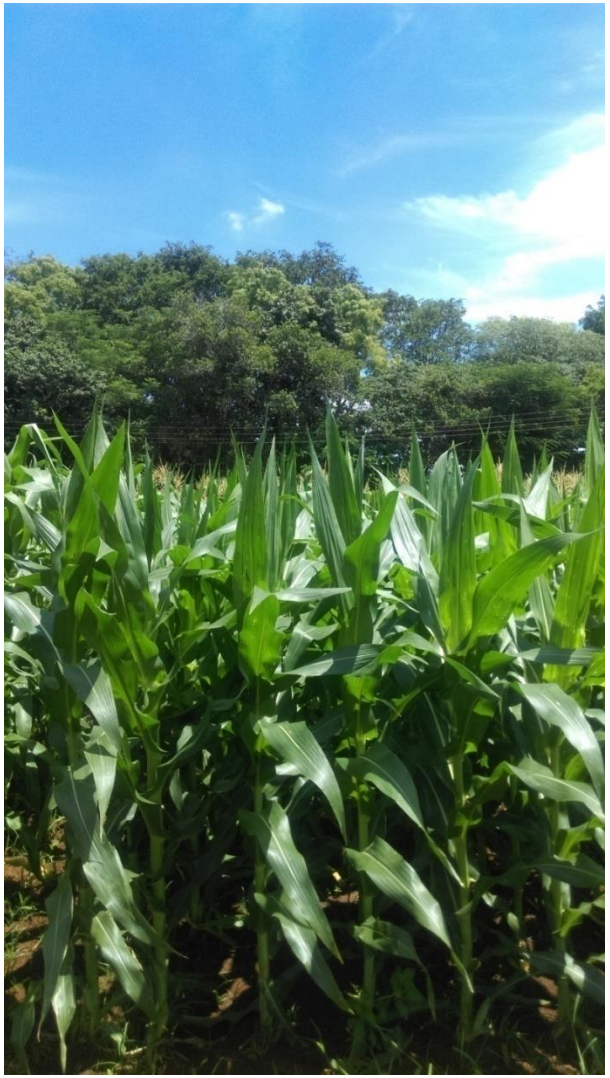
Gully Conservation Structures for SLM
(16 Measures Recommended)

Source: Department of Agriculture, Sri Lanka

SALT for Rain-fed Uplands in Central Highlands

Source: Department of Agriculture, Sri Lanka.

Land Terracing and Runoff Water Harvesting in Dry Zone Uplands

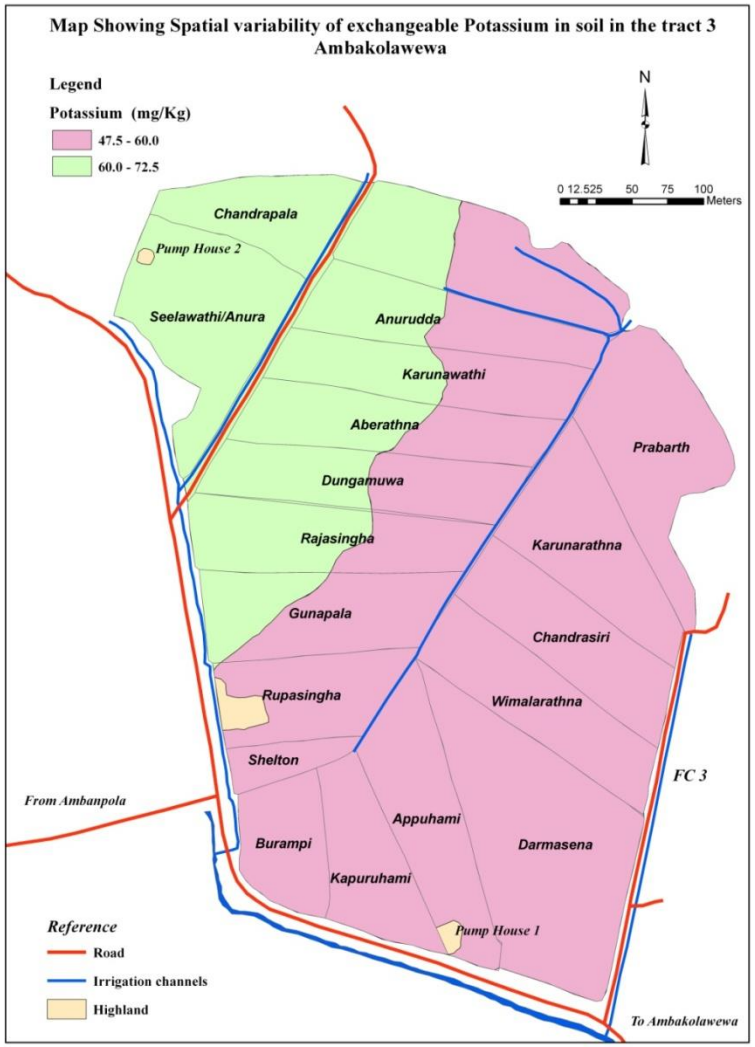


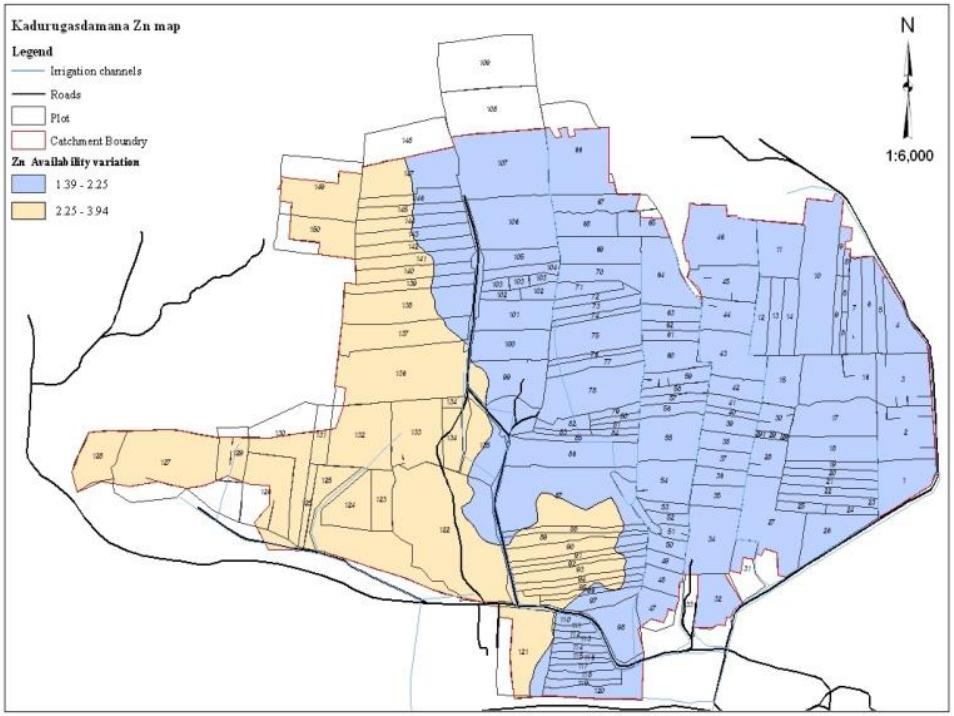
Source: Department of Agriculture, Sri Lanka

Protected Houses for Small Holder Vegetable Growers

Source: Department of Agriculture, Sri Lanka

Yaya Approach in Fertilizer Use





General Recommendation

Site Specific Recommendation

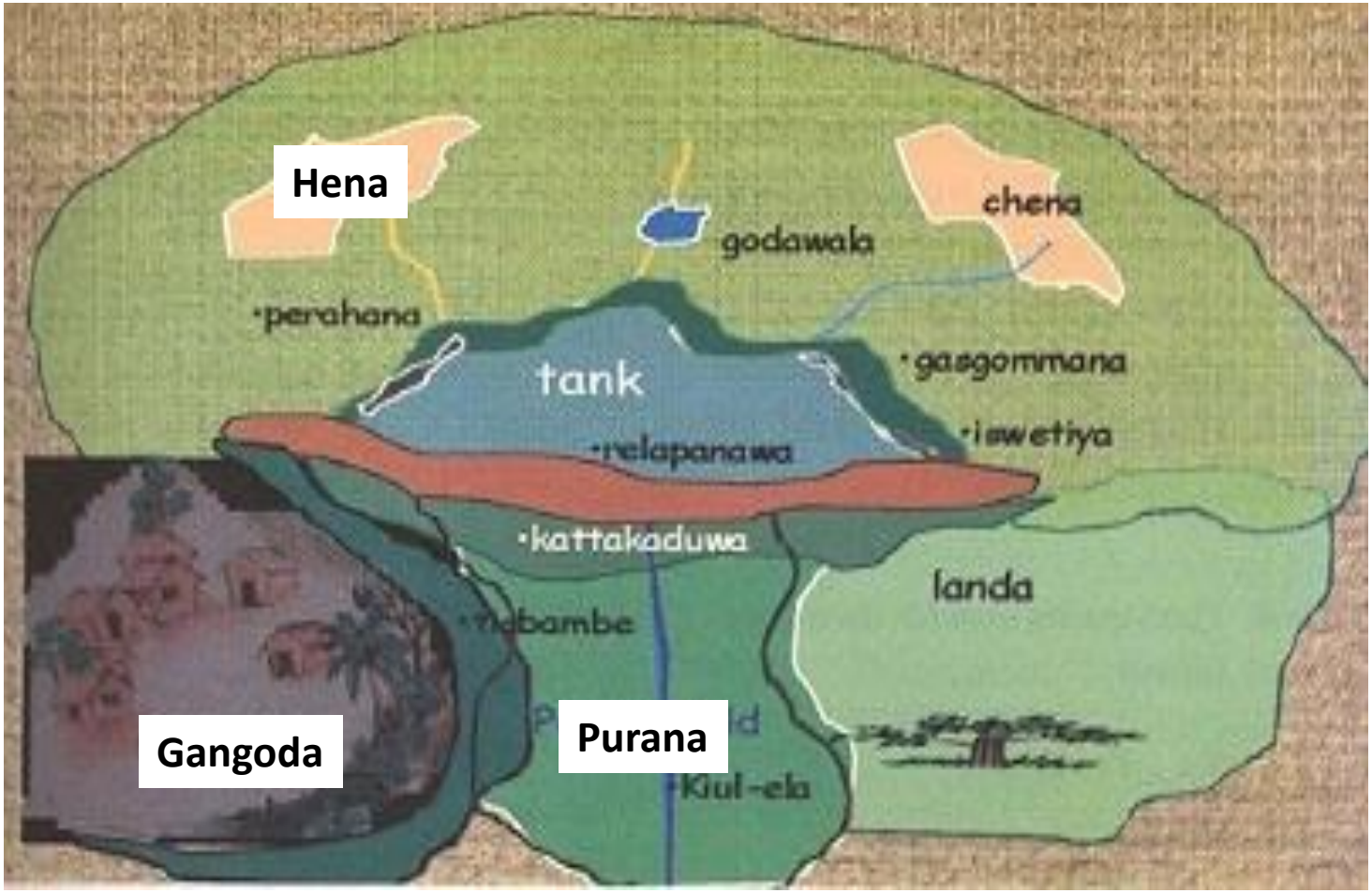
Yaya Specific Recommendation

Source: Department of Agriculture, Sri Lanka.

Yaya Approach in Direct Seeded Rice Farming

Source: Department of Agriculture, Sri Lanka.

Minor Tank Based Small Farming Villages in the Dry Zone



Source: Dharmasena, P.B. 2004. J. Soil Sci. Soc. Sri Lanka. 16:25p.

Low Input Sesame Farming in Rain-fed Uplands

Source: Department of Agriculture, Sri Lanka

Kandyan Forest Gardens in Mid Country Wet Zone

Source: Department of Agriculture, Sri Lanka.

Narrow Irrigation Terraces in Central Highlands

Source: Department of Agrarian Development, Sri Lanka.

SLM for Small Holder Tea Industry

Source: The RDAL Project, Ministry of Environment, Sri Lanka.

SLM for Tea Plantation Industry

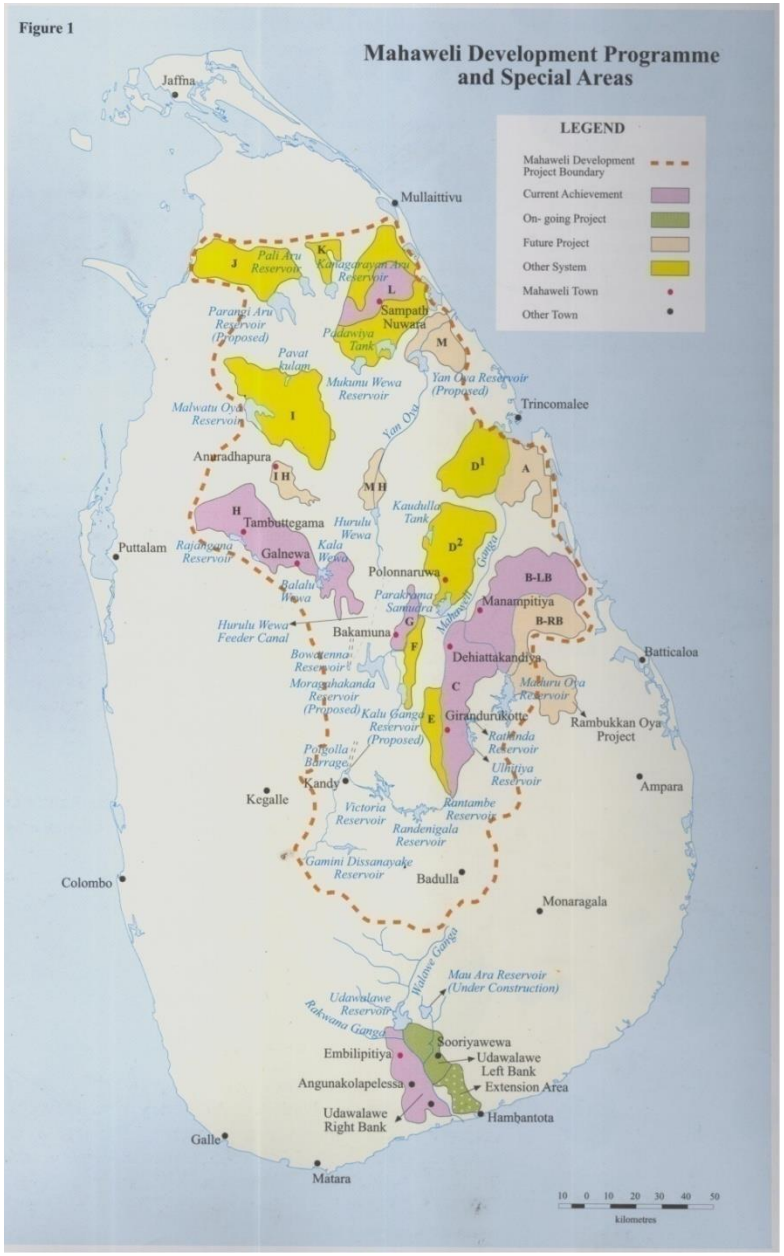
Source: Tea Plantations in Sri Lanka

Dug Well Farming for Small Holders in the Dry Zone

- Jaffna Peninsula
- Kalpitiya Peninsula
- Central Dry Zone

Source: Department of Agriculture, Sri Lanka.

Water Diversion Among River Basins



Source: Mahaweli Authority of Sri Lanka and Irrigation Department.

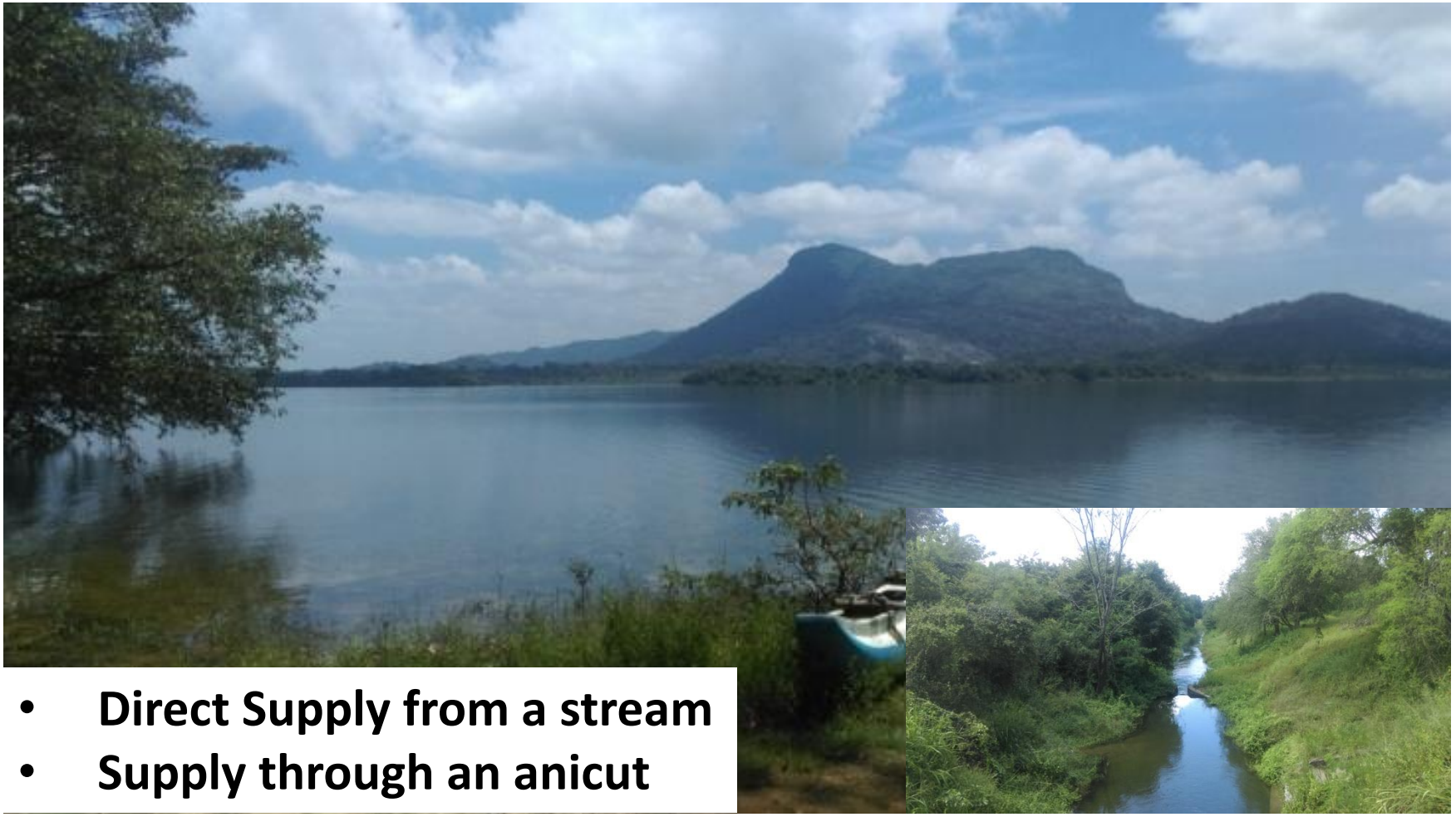
Anicut Based Water Diversion

Source: Department of Agrarian Development, Sri Lanka.

Cascaded Minor Tanks for Water Harvesting

Source: Department of Agrarian Development, Sri Lanka.

Approaches in Feeding Major Irrigation Reservoirs



- Direct Supply from a stream
- Supply through an anicut

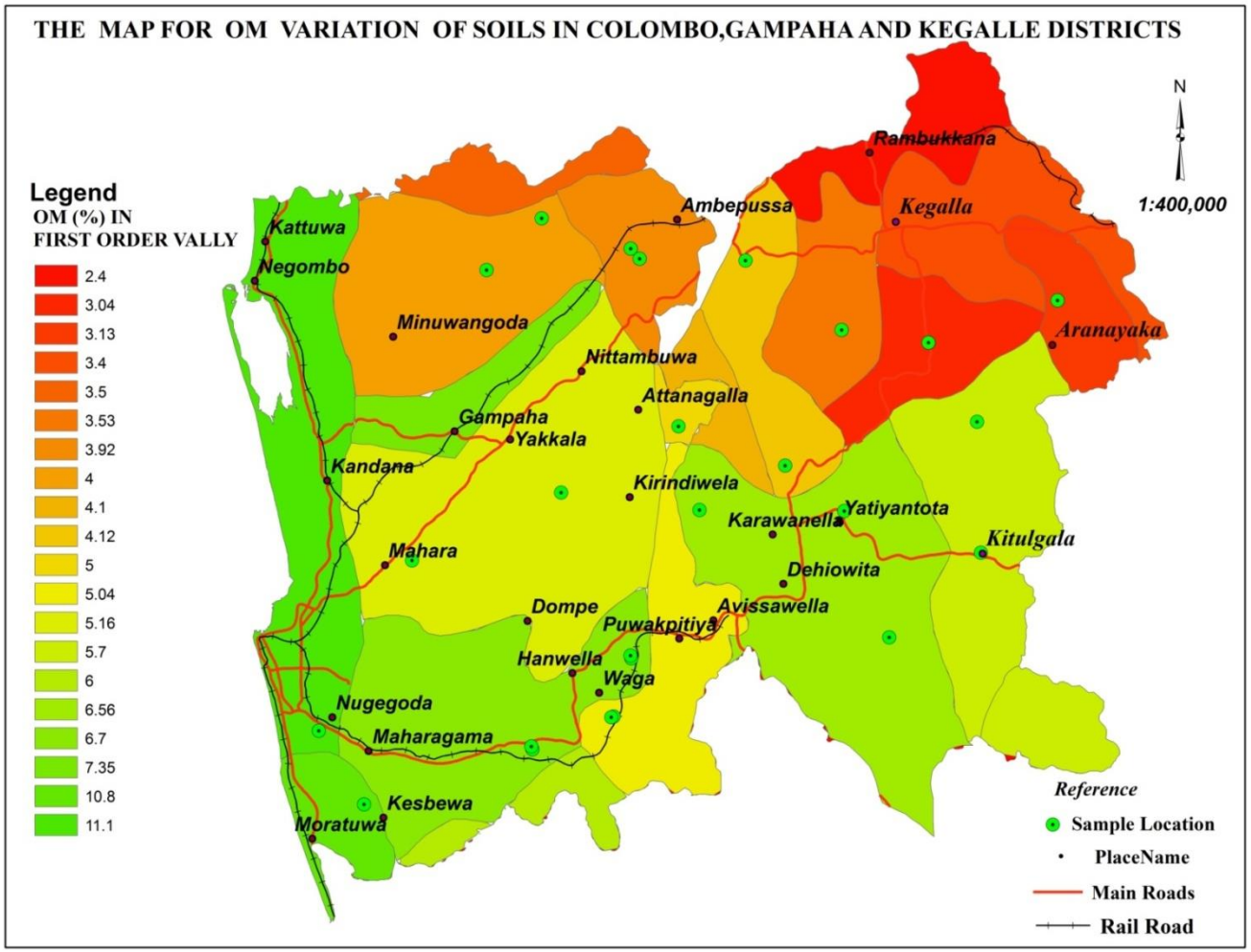
Source: Irrigation Department and Mahaweli Authority of Sri Lanka

Technology for De-silting Irrigation Reservoirs

- Partial De-Silting
- Complete De-silting
- Community De-silting

Source: Irrigation Department and Department of Agrarian Development

Mapping Natural Resource Base for SLM



Source: Department of Agriculture, Sri Lanka

Institutions Involved in Generation of SLM Technologies and approaches in Sri Lanka

- Department of Agriculture
- Department of Irrigation
- Department of Agrarian Development
- Department of Export Agriculture
- Department of Animal Production and Health
- Department of Export Agriculture
- Forest Department
- Department of Wildlife Conservation
- Tea Research Institute
- Rubber Research Institute
- Coconut Research Institute
- Tea Small Holdings Development Authority
- Mahaweli Authority of Sri Lanka
- HADABIMA Authority of Sri Lanka
- Private Sector Organizations
- Civil Society (NGO and CBO)

Summary

1. **The WOCAT Network aims at making unite the efforts in knowledge management and decision support for up-scaling SLM among all stakeholders including national governmental and non-governmental institutions and international and regional organizations and programs.**

2. **It welcomes technologies and approaches on success stories related to SLM.**

3. **Contribution from member countries to this database helps addressing land degradation problem and enhancing the productivity of farming lands at Global, Regional and National levels.**

Thank You

Soil Degradation

1. Soil erosion
2. Compaction
3. Surface sealing
4. Water logging
5. Soil subsidence
6. Aridification
7. Loss of active surface
8. Nutrient depletion
9. Loss of organic matter
10. Eutrification
11. Dystrification
12. Salinization
13. Alkanization
14. Pollution