Food and Agriculture Organization
of the United Nations

Promoting sustainable land management through evidence-based decision support

A guide with country insights

WOCAT
World Overview of Conservation Approaches and Technologies

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by
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World Overview of Conservation Approaches and Technologies

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Rome, 2023

Required citation:
Harari, N., Mekdaschi Studer, R., Bastidas Fegan, S., Schlingloff, S. & Brès, A. 2023. *Promoting sustainable land management through evidence-based decision support – A guide with country insights.* FAO, Rome. https://doi.org/10.4060/cc6118en

ISBN 978-92-5-137884-7

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Foreword

"Land is the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system", as per Article 1 of the United Nations Convention to Combat Desertification. The Food and Agriculture Organization of the United Nation (FAO)'s most recent assessment of the State of Land and Water (SOLAW 2021) shows that 34 percent of global cropland and pastures are degraded. Climate change, unsustainable management practices and uncontrolled land use changes are the main drivers of the land degradation process. Caring for land, especially agricultural land, is at the heart of the response to the converging challenges of food security, fight against poverty, adaptation to and mitigation of climate change, restoring ecosystems and nurturing biodiversity.

Yet caring for land implies actions at local, national and global levels to tackle the diverse land degradation drivers and create the condition for sustainable land management. The Decision Support for Mainstreaming and Scaling Up Sustainable Land Management (DS-SLM), a Global Environment Facility (GEF) funded project, was implemented by FAO from 2015 to 2019 in fifteen countries (Argentina, Bangladesh, Bosnia and Herzegovina, China, Colombia, Ecuador, Lesotho, Morocco, Nigeria, Panama, Philippines, Thailand, Tunisia, Türkiye, and Uzbekistan).

In co-production with the participating countries, the project produced a modular decision support framework (DSF) as a global knowledge product. This publication gives a snapshot on how the modular framework was applied in the countries, supporting the assessment of the decision-making processes, linking policy, finance and territorial planning at national and landscape level. It also gives examples on how DSF supports the generation of evidence through a knowledge management platform for informed decision; and how it provides inclusive strategies for scaling out SLM.

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More importantly, this publication focuses on the countries' experiences to mainstream and scale up sustainable land management. The fifteen country experiences show that a multiplicity of paths, actions and innovations can be generated focussing on each country's or landscape's specific challenges with solid and robust assessments allowing for inclusive decision-making.

Generating tools and approaches for country tailor-made responses to specific challenges and creating spaces for exchange and cooperation between countries are core FAO's approaches. It is therefore my pleasure to support this publication and to address a heartfelt thanks to all the global, national and local partners who have been part of the DS-SLM. I hope this tool could help to scale up and speed up global efforts on sustainable land use.

Acknowledgements

This technical guide was produced by FAO with the support of WOCAT under the coordination of Nicole Harari and Rima Mekdaschi Studer (WOCAT) and Aurélie Brès, Soledad Bastidas Fegan and Stefan Schlingloff (FAO).

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Abbreviations and acronyms

AFOLU	agriculture, forestry and other land use
CACILM	Integrated management of natural resources in drought-prone and salt-affected agricultural production landscapes of Central Asia and Türkiye (GEF/FAO project)
CBD	Convention on Biological Diversity
CIAT	International Center for Tropical Agriculture
COAG	FAO Committee on Agriculture
DS-SLM	Decision Support for Mainstreaming and Scaling Out Sustainable Land Management (GEF/FAO GCP/GLO/337/GEF Project)
DSF	decision support framework
EbA	ecosystem-based adaptation
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GPS	global positioning system
GSP	Global Soil Partnership
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
LADA	Land Degradation Assessment in Drylands (GEF/FAO Project)
LDN	land degradation neutrality
LUS	land use system
NDCs	nationally determined contributions
NGO	non-governmental organization
PRAIS	performance review and assessment of implementation system of the UNCCD
QA	Questionnaire on Sustainable Land Management Approach
QM	Mapping Questionnaire
QT	Questionnaire on Sustainable Land Management Technology
SDG	Sustainable Development Goal
SLM	sustainable land management
TSP	target setting programme
UNCCD	United Nations Convention to Combat Desertification
UNDER	UN Decade on Ecosystem Restoration
UNFCCC	United Nations Framework Convention on Climate Change
WOCAT	World Overview of Conservation Approaches and Technologies

Executive summary

Countries have different ecological, political, economic and cultural contexts and characteristics. Nevertheless, they share several common barriers to mainstreaming and scaling out sustainable land management (SLM). They also share key opportunities which can help to overcome these barriers and create an enabling environment to facilitate the implementation and spread of SLM. This process requires context-specific mechanisms and decision-making processes at different levels, grounded in the existing wealth of evidence about SLM.

This publication is a product of the GEF-funded FAO project 'Decision Support for Mainstreaming and Scaling Out Sustainable Land Management (DS-SLM)' which has developed a decision support framework (DSF). The DSF integrates experience from work with land degradation (LD) and SLM into an overall strategy for mainstreaming and scaling out SLM at different spatial and temporal scales. Such a strategy, put in place at the beginning of a project or programme, can ensure impact beyond a project's implementation area and timeframe. Furthermore, if SLM is integrated appropriately into existing decision-making processes, the dependency on project-bound financial and technical support decreases, and there is a better chance of enhancing a process with sustained impact.

The DSF is flexible and offers, through its modular format, different entry points. It is applicable at different scales, supports multi-sectoral and multi-disciplinary processes, encourages and facilitates networking, dialogue, and partnerships, and it takes into consideration the use and management of knowledge. The DSF is divided into seven modules as follows:

Module 1: SLM mainstreaming and scaling out strategy
Module 2: National/ subnational level assessment
Module 3: Selection of priority regions and landscapes
Module 4: Landscape/ local level assessment
Module 5: Land use/ territorial planning
Module 6: SLM implementation and scaling out
Module 7: Knowledge management for evidence-based decision-making

The innovativeness of the DSF lies in the design and application of SLM mainstreaming and scaling out strategies, which are simple and proactive, flexible, and can be adapted over time, developed at different levels, and use key decision-making processes and instruments. This is illustrated by summarized experiences and insights from 14 of the countries that participated, demonstrating how the DSF can be moulded to fit various different contexts. Each case shows how the DSF ensures that land degradation and SLM evidence is integrated into decision-making processes to mainstream and scale out SLM.

This publication serves as a step-by-step guide for the application and implementation of the DSF during planning, design and implementation of SLM interventions. It includes elements – both in its modules and proposed tools and methods – which can support countries in pursuing land degradation neutrality (LDN).

Part 1

Setting the scene and aims of the guidelines

Part 1. Setting the scene and aims of the guidelines

1.1 Rationale

Inappropriate land management practices – along with climate change and associated environmental and socioeconomic pressures – place enormous stress on natural resources. This undermines the land's productivity and ecosystem resilience. Land degradation (LD) is widespread through all ecosystems – but is particularly prevalent on farmland.[1]

Land degradation reduces productivity and food security, disrupts vital ecosystem functions, negatively affects biodiversity and water resources, while increasing carbon emissions and vulnerability to climate change. The result is a negative impact on the livelihoods of land users worldwide, with a particular burden on smallholders and rural communities. Women are particularly affected.

Sustainable land management (SLM) is crucial in addressing land degradation: through avoiding, reducing and reversing the impacts of land degradation. SLM ensures the optimal use of the land's resources as well as underpinning ecosystem services – for the benefit of present and future generations.

Land and water systems are still, just, managing to meet the demand placed upon them by an increasingly complex global food system. More than 95 percent of food is produced from the land, with little room for expansion. The environmental integrity of these systems must be safeguarded (FAO, 2021).

Crucial challenges include restoring ecosystem function and services, increasing production sustainably, enhancing resilience to climate variability, coping with change and extremes, protecting biodiversity including agrobiodiversity, and improving rural livelihoods. It is time to make the land the focus – and to put people "front and centre" of concerted efforts (UNCCD, 2022).

Local and national governments are generating increased momentum in implementing SLM at landscape scale as a means to address these issues, and simultaneously enhance food security and contribute to multiple Sustainable Development Goals (SDGs). This is in alignment with the decisions of the FAO committee on agriculture (COAG, 2016), which emphasises the importance of addressing land degradation (LD) and water issues, particularly in the context of climate change, and to implementing sustainable land, soil and water management through a country-driven approach, while enhancing governance over natural resources. Inclusive land and water governance requires deliberate linkages across institutions, scales and sectors, and engagement of all actors (COAG, 2016).

SLM combines practices and policies aimed at integrating socioeconomic principles with environmental concerns that maintain or enhance production and ecosystem services, reduce the level of production risks, and are economically viable, socially acceptable and protect natural resources (Thomas *et al.*, 2018). The concept of SLM is a unifying theme for global efforts to combat desertification, drought and land degradation, mitigate and adapt to climate change, and conserve biological diversity. SLM contributes to the objectives of the three Rio Conventions as well as their respective targets: land degradation neutrality (LDN) under the United Nations Convention to Combat Desertification (UNCCD), National Determined Contributions (NDCs) under the United Nations Framework Convention on Climate Change (UNFCCC), and Aichi targets under the Convention on Biological Diversity (CBD) (Figure 1) as well as targets under the Sendai Framework for Disaster Risk Reduction (SFDRR). The Global Environment Facility (GEF) argues that, through adoption of SLM, countries can implement the conventions – with their overlapping concerns – in a collaborative way (GEF, 2022).

Promoting wide adoption of SLM and achieving LDN on a broad scale is integral to the large majority of the 17 Sustainable Development Goals (SDGs) while directly supporting the achievement of SDG 15 (life on land). It is instrumental in halting biodiversity loss and has particular impact on SDG 15.3 (LDN), SDG 13 (climate action), SDG 6 (clean water and sanitation), and thereby contributing to SDG 1 (no poverty), SDG 2 (zero hunger), and SDG 3 (good health and wellbeing). Implementing SLM can furthermore contribute to enhanced gender equality (SDG 5), good governance and sustainable consumption and production (SDG 12).

BOX 1: Land degradation

In 2019, an analysis of national reports submitted to the UNCCD conservatively estimated that, on average, 20 percent of global land is degraded to some extent (UNCCD, 2022).

Human-induced land degradation primarily affects cropland. Although cropland covers only 13 percent of the land, it accounts for 29 percent of all degraded areas (FAO, 2021).

Estimates suggest human-induced degradation affects 34 percent of cropland and pasture (FAO, 2022).

The human cost is immense: 3.2 billion people are affected by land degradation, especially rural communities, smallholder farmers and the rural poor (GEF, 2022).

Less than one quarter of the lands' surface remains free from substantial human impacts. Biodiversity and ecosystem function has been severely affected with costs of more than 10 percent of annual global gross product. Loss of habitat between 1970 and 2012 has reduced populations of wild land-based vertebrates by 38 percent (IPBES, 2018).

The global water budget is under pressure. The decline in per capita internal renewable water resources was about 20 percent between 2000 and 2018 (FAO, 2022).

Land degradation is defined, categorized and presented in various ways. Nevertheless, the consensus is clear. It is widespread and serious.

Notes:

FAO. 2021. *The State of the World's Land and Water Resources for Food and Agriculture – Systems at breaking point.* Synthesis report. Rome

FAO. 2022. *The State of the World's Land and Water Resources for Food and Agriculture – Systems at breaking point.* Main report. Rome.

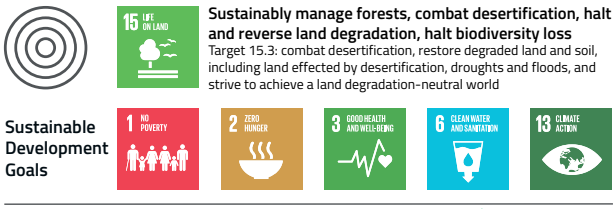
GEF. 2022. Combating Land Degradation. http://www.thegef.org; www.thegef.org

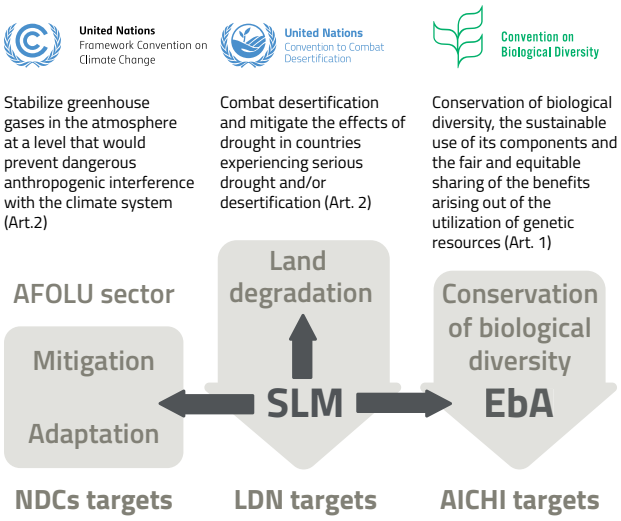
IPBES. 2018. *The Assessment Report on Land Degradation and Restoration. Summary for Policymakers.* IPBES Secretariat. Bonn. Germany.

UNCCD. 2022. Global Land Outlook, Second Edition. *Land Restoration for Recovery and Resilience.* UNCCD, Bonn, Germany.

[1] For additional information, please see: https://www.decadeonrestoration.org/types-ecosystem-restoration/farmlands

FIGURE 1
SLM as a holistic vehicle to achieve the objectives of the three Rio Conventions and the SDGs



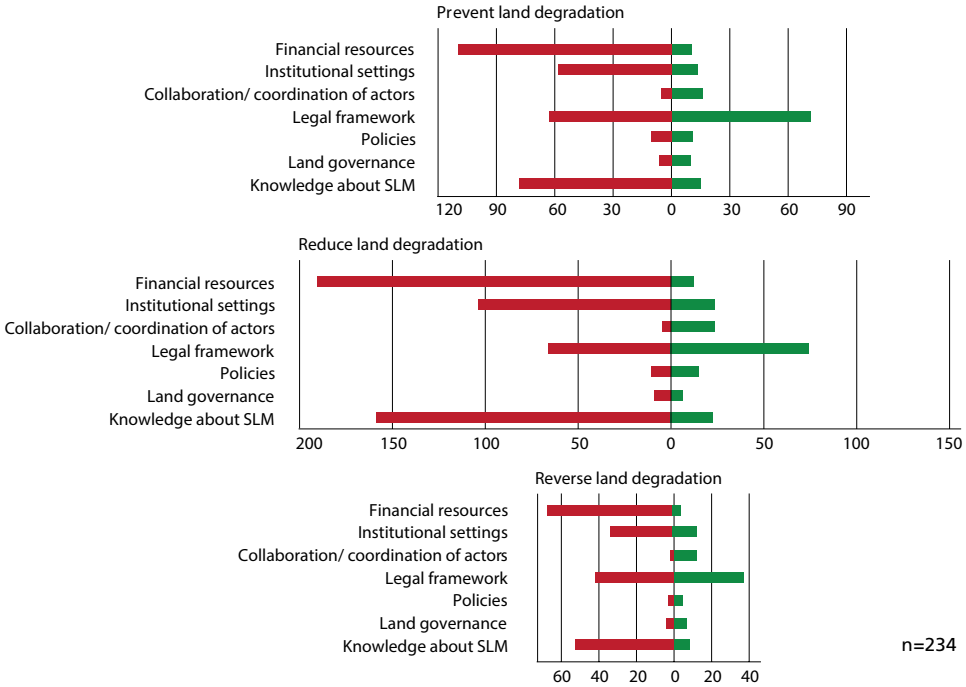


Source: Sanz, M., de Vente, J., Chotte, J-L., Bernoux, M., Kust, G., Ruiz, I., Almagro, M., Alloza, J.-A., Vallejo, R., Castillo, V., Hebel, A., & Akhtar-Schuster, M. 2017. *Sustainable Land Management contribution to successful land-based climate change adaptation and mitigation.* A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany. 173 p. https://www.unccd.int/sites/default/files/documents/2017-09/UNCCD_Report_SLM_web_v2.pdf

Mainstreaming and scaling out SLM is at the heart of the UN Decade on Ecosystem Restoration (UNDER). Initiated in 2021, the UNDER is being championed by the United Nations Environment Programme (UNEP) and the Food and Agriculture Organization (FAO) of the United Nations, in close collaboration with the Rio Conventions and other partners. The UNDER aims to catalyse the restoration of degraded and destroyed ecosystems as a proven measure to provide ecosystem services, enhance livelihoods, fight climate change and improve biodiversity. It addresses the concerns of the IPCC that damage to, and transformation of, ecosystems are key risks and will continue to escalate with global warming (IPCC, 2022). The UNDER is viewed by the UNCCD as especially relevant in the context of restoration activities that seek improvements in social and ecological systems (UNCCD, 2022). SLM is a key tool in UNDER's efforts – which focus on balancing ecological, social and developmental priorities in landscapes where different forms of land use interact, with the aim of fostering long term resilience (Critchley, Harari & Mekdaschi Studer, 2021).

BOX 2: Enabling and hindering factors in SLM implementation

An analysis of enabling and hindering factors in the implementation and adoption of SLM documented in the Global SLM Database show that financial resources are the most frequently cited constraint, followed by knowledge about SLM including technical support, the legal framework and institutional settings. This applies for all three categories of the LDN response hierarchy: avoid, reduce and reverse. The legal framework is also considered to be – by far – the most important enabling factor under all three stages of intervention.



Source: Liniger, HP., Harari, N., van Lynden, G., Fleiner, R., de Leeuw, J. Bai, Z., & Critchley, W. 2019. Achieving land degradation neutrality: the role of SLM knowledge in evidence-based decision-making. *Environmental Science and Policy.* 94. 123-134. https://www.sciencedirect.com/science/article/pii/S1462901118306403

TABLE 1
Barriers and opportunities in mainstreaming and scaling out SLM

MAINSTREAMING SLM	
Barriers	**Opportunities**
Institutional and political barriers	
• policy inconsistency and administrative changes in government; • weak harmonisation and coordination of policy, legal & regulatory frameworks; • lack of harmonised economic and environmental policies; • weak governance and enforcement of SLM-related legislation.	• policies and regulations supporting SLM & environmental management; • thematic entry points and vehicles for financing SLM including: – food security, climate change and water management; and – territorial issues such as rural development.
• lack of cross-sectoral coordination and cross-sectoral budgetary planning; • predominance of 'silo' approaches to SLM planning, budgeting and intervention; • sectors competing for land management, land area and natural resources.	• existing diverse coordination structures at all levels integrating SLM; • intersectoral coordination structures, acting and promoting coordination, and planning for development and cross-sectoral issues.
• lack of priority to combating land degradation in national planning and finance frameworks; • gap between centralized and localised planning and implementation processes; • top-down planning processes; local planning not encouraged; • strategies and action plans formulated but not implemented.	• existing SLM interventions already focus on aspects of SLM, such as ecosystems, sustainable agriculture, biodiversity, forest management and restoration, etc; • local planning increasing in importance; • territorial/ integrated land use planning increasingly multistakeholder and participatory.
Knowledge and technological barriers	
• lack of national, subnational and local data and information on land degradation and SLM; • lack of knowledge about suitable SLM practices and their impacts; • knowledge poorly used for awareness-raising & evidence-based decision support; • difficulties in integrating SLM knowledge into economic and social sectors.	• communication tools and awareness-raising to highlight importance of SLM; • project findings about suitable SLM used in decision-making; • sharing of evidence of costs and consequences of land degradation (costs of no action); • multistakeholder networks, platforms for exchange of knowledge and its use.
Sociocultural barriers	
• multiple actors with conflicting interests: lack of local participation; • poor understanding of the importance of SLM at all levels; • "development" biased towards infrastructure, and short-term economic benefit.	• increased understanding of the complexity of land degradation and its impacts.
Economic and financial barriers	
• inappropriate economic policies promoting exploitation of natural resources; • trade policies favouring products from non-sustainable land management; • insufficient budgetary allocation; limited access to finances at local levels; • inadequate investment and micro-entrepreneurship opportunities; • lack of economic incentives for shifting towards SLM and "perverse subsidies".	• development of regional and national investment frameworks; • national and local financing mechanisms where SLM can be integrated; • citing evidence of the contribution of SLM to CC mitigation and adaptation provides an opportunity for integrating SLM into CC financing mechanisms; • microentrepreneurs and private sector interest in SLM activities.

SCALING OUT SLM	
Barriers	**Opportunities**
Institutional and political barriers	
• top-down approaches to land management; • lack of linkages between local level and centralised national level.	• training and capacity building at all levels by governmental and non-governmental institutions, programmes and projects.
Economic and financial barriers	
• limited incentives for implementing SLM; • financial and technical assistance tied to project implementation; • limited access to credit by small farmers; • limited material resources and mechanisms for the provision of technical support.	• local capacity building and participatory processes developed by national and local financing mechanisms, including watershed funds and microcredit; • SLM integrated into financing mechanisms.
Knowledge and technological barriers	
• poor access to information by smallholders and others, mainly at local levels; • top-down capacity building with focus on farmers and not on a wider circle of stakeholders – and failing to understand and integrate technical knowledge; • lack of local access to information generated at national and global level; • fragmented existing knowledge and low valuation of local know-how; • lack of institutionalised extension; weak farmer-to-farmer communication; • limited links between applied research, GIS tools and common knowledge sharing; • skilled technicians in the land degradation and SLM domains concentrated in urban areas.	• local knowledge systems in place/ can be set up.; • information on the types of degradation, impacts available at local level; • in many cases strong local organizations, such as crop and livestock producers' associations, rural women's associations already exist; • partnerships with research institutions are commonly in place; • many programmes and projects addressing SLM practices are already in place.
Sociocultural barriers	
• complexity, and an unjustified assumption of high-risk limits the adoption of new technologies; • abandoned traditions of soil conservation, water and pastoral management; • youth migration from rural areas reducing labour and knowledge continuity.	• information on economic returns and gaps for promoting adoption of new technologies included in assessment methodologies; • programmes willing to "rescue" traditional knowledge.

Note: Barriers and opportunities in Table 1 are summarized from countries participating in the DS-SLM project; see Box 3)
Source: adapted from Bastidas Fegan, S. 2015. *DS-SLM Technical Guidelines Module 1: Mainstreaming SLM into National Policy Instruments.* Rome. FAO. https://www.wocat.net/library/media/171/

1.2 Mainstreaming and scaling out SLM: the need for wider spread and greater impact

Mainstreaming SLM is needed in order to alter the balance between practices that currently degrade natural resources, and those that sustainably manage the land – while ensuring that SLM action on the ground has long-term support. Although countries have different contexts and characteristics, several common barriers to, as well as opportunities for, mainstreaming and scaling out SLM[2] exist. These include financial resources and incentives, appropriate policies and governance, institutional settings, legal frameworks and coordination between sectors and technical know-how and knowledge (Box 2 and Table 1). The main purpose for mainstreaming of SLM into key decision-making processes is to overcome these barriers and creating an enabling environment, which in turn should facilitate scaling out: that is the implementation and spread of SLM on the ground (Bastidas Fegan, 2019). This requires context-specific mechanisms and decision-making processes at different levels, which should be grounded in the existing wealth of evidence about SLM at a range of scales – from local to global. SLM needs to be mainstreamed and institutionalised into decision-making processes so that policies, investments, planning, and technical assistance support durable SLM implementation and scaling out beyond the programme or project level.

If SLM is integrated appropriately into existing decision-making processes, the dependency on project-bound financial and technical support decreases and there is a better chance of enhancing a process with sustained impact. When land degradation and SLM related issues are mainstreamed into national and subnational development and sectoral plans as well as financing mechanisms (e.g. climate change adaptation, biodiversity conservation and land restoration), budgetary allocations for mitigating land degradation can be established, and integrated programmes, incorporating SLM, can be formulated.

The GEF/FAO project "Decision Support for Mainstreaming and Scaling Out Sustainable Land Management (DS-SLM)" worked with national teams of specialists – mainly from government and academia – in developing a decision support framework (DSF), to embed evidence-based experience from work with land degradation and SLM into an overall strategy for mainstreaming and scaling out SLM at different spatial levels and temporal scales (Box 3). The mainstreaming and scaling out strategy aims at:

i) targeting key decision-making processes (dealing with policies, financing, planning, education, etc.);
ii) addressing different levels of intervention (national, subnational, landscape and local); and
iii) identifying and implementing concrete mainstreaming activities.

Such a strategy, put in place at the beginning of a project or programme, can help to counteract the common problem of only addressing mainstreaming and scaling out successful SLM experiences from pilot interventions at the very end of a project's lifecycle. Simultaneously it can also help ensure impact beyond a project's implementation area and timeframe. A SLM Mainstreaming Tool was conceptualised and formulated to guide countries to develop mainstreaming and scaling out strategies (Bastidas Fegan, 2019).

BOX 3: DS-SLM project and decision support framework

The DS-SLM project (GCP/GLO/337/GEF Project) emerged from the situation where, even though tools and methods for assessment of land degradation and SLM were available (e.g., through LADA–WOCAT) widely accepted and used in different projects and programmes, the challenge remained: how to make use of evidence to support mainstreaming and scaling out SLM practices and remove local, national and regional barriers? To address this challenge, the decision support framework (DSF) was developed in a two-step approach:

a) DSF tested and validated by 14 countries as guidance for their activities within the DS-SLM project; and

b) consolidation of country experiences resulting in the DSF presented here for wide application by other countries aiming at mainstreaming and scaling out SLM.

For additional information please see:
https://www.wocat.net/en/projects-and-countries/projects/ds-slm
https://www.wocat.net/en/projects-and-countries/projects/land-degradation-assessment-drylands-fao-lada/

The DSF was used by 14 countries worldwide, and was adjusted to the specific challenges and needs of each country. The guidelines presented here are the result of this process and are based on the lessons learned.

1.3 Objective and target audience

The **aim** of these guidelines and lessons learned is to serve as a reference, and to provide a wide range of stakeholders with the means to assess, mainstream and scale out SLM at different levels, thus contributing to achieving LDN, restoration of ecosystems and sustainable use of natural resources.

The **specific objective** of the publication is to provide a framework and guidelines for evidence-based decision-making to support mainstreaming and scaling out of SLM at country level. Thus, it:

- guides countries and their institutions in the process of producing and applying land degradation and SLM evidence in decision-making processes, from the national to the local level, following seven modules and proposed tools and methods;
- guides international cooperation in their efforts to support the linkages between SLM evidence, practice and policy for sustainable and durable actions; and
- illustrates, through country-specific insights, how evidence can concretely and actively support mainstreaming and scaling out of SLM through informed decision-making.

The **target audience** of this publication comprises (a) professionals working for governmental institutions, international organizations, development cooperation, non-governmental organizations and academia, as well as (b) practitioners who are engaged in the process of generating and using evidence for mainstreaming SLM into decision-making processes and supporting substantial scaling out of SLM.

[2] *Note:* in this publication the terms "mainstreaming" and "scaling up" are used as synonyms. However, because the term "scaling up" is used inconsistently in the literature, "mainstreaming" is preferred here. For definitions please see Box 4.

This document is divided into three parts: Part 1 is an introduction to the guidelines with rationale, objectives, target audience and definitions. Part 2 comprises the actual guidelines and presents the DSF in detail, with its seven modules and related tools and methods. Part 3 presents lessons learned from the 14 countries that participated in the project: Argentina, Bangladesh, Bosnia and Herzegovina, China, Colombia, Ecuador, Lesotho, Morocco, Panama, the Philippines, Thailand, Tunisia, Türkiye and Uzbekistan. The publication ends with a conclusion that summarizes key messages to guide the mainstreaming and scaling out of SLM by different stakeholders.

In the context of this current document, definitions of the main relevant terms are provided in Box 4.

BOX 4: Terminology and definitions

In the context of this current document, the following terms are defined as follows.

Land degradation (LD): the degradation of land resources, including soils, water, vegetation, and animals. It is defined as a change in the land's health resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries (Bunning *et al.*, 2011).

Land degradation neutrality (LDN): a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remain stable or increase within specified temporal and spatial scales and ecosystems (decision 3/COP.12, UNCCD, 2015).

Land restoration: the process of avoiding, reducing and reversing land degradation to recover the biodiversity and ecosystem services that sustain all life on Earth (UNCCD, 2022).

Landscape: a social-ecological system that consists of a mosaic of natural and/or human-modified ecosystems, often with a characteristic configuration of topography, vegetation, land use, and settlements that is influenced by the ecological, historical, economic and cultural processes and activities of the area (LPFN, 2016) .

Land use planning: the systematic assessment of land potential and alternatives for optimal land uses and improved economic and social conditions through participatory processes that are multisectoral, multistakeholder and scale-dependent (Ziadat *et al.* 2017).

Mainstreaming/ Scaling up SLM: the vertical integration of SLM. It focuses on integrating SLM into main decisions, including law and policy but can also refer to integrating SLM into financing mechanisms, land use plans or education (adapted from Moore *et al.*, 2015).

Scaling out SLM: the horizontal spread of SLM. It focuses on the replication and dissemination of SLM, increasing the number of people or communities implementing SLM (adapted from Moore *et al.*, 2015).

Sustainable land management (SLM): the use of land resources, including soils, water, plants and animals, 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 (Liniger *et al.*, 2011).

SLM Approach: the ways and means used to implement one or several SLM Technologies. It includes technical and material support as well as the involvement and roles of different stakeholders. An Approach can refer to a project/ programme or to activities initiated by land users themselves (WOCAT, 2016).

SLM Technology: a physical practice that controls land degradation and enhances productivity and/ or other ecosystem services. A Technology consists of one or several measures, such as agronomic, vegetative, structural, and management measures (WOCAT, 2018).

Territorial planning (rural): a political-administrative and technical process aimed at organizing, planning and managing the use and occupation of the territory, contingent to its biophysical, cultural, socioeconomic, socio-political and institutional characteristics. This process should be participatory, interactive and based on explicit goals that promote wise and fair land use, taking advantage of opportunities, reducing risks, and protecting resources in the short, medium and long term (Paruelo *et al.*, 2014).

Notes:

Bunning, S., J. McDonagh and J. Rioux. 2011. Manual for Local Level Assessment of Land Degradation and Sustainable Land Management (Part 1) - Planning and methodological approach, analysis and reporting. FAO.

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LPFN. 2016 cited on https://www.fao.org/climate-smart-agriculture-sourcebook/concept/module-a3-landscapes/chapter-a3-1/en/

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Part 2

Guidelines for mainstreaming and scaling out SLM

Part 2. Guidelines for mainstreaming and scaling out SLM

These guidelines demonstrate how the decision support framework (DSF) is applied in mainstreaming and scaling out SLM through its seven modules. The activities and outputs are described for each module, and relevant tools and methods are indicated. Specific emphasis is given to the innovativeness of the framework, namely the combination of assessments and evidence with the concept of a mainstreaming and scaling out process. It serves as a **step-by-step guide** for the application and implementation of the DSF as part of the planning, design and implementation of SLM interventions. It supports stakeholders with SLM mainstreaming and scaling out from the very beginning of projects and programmes, then throughout their duration, and after they have finished. Ultimately, it leads to better on-the-ground implementation, and wider dissemination of SLM practices over a longer duration.

2.1 The decision support framework

The DSF guides countries through the process of evidence-based decision-making for SLM, from the national to the local level, following seven modules with proposed tools and methods (Figure 2).

The DSF contains the following **features**, it:

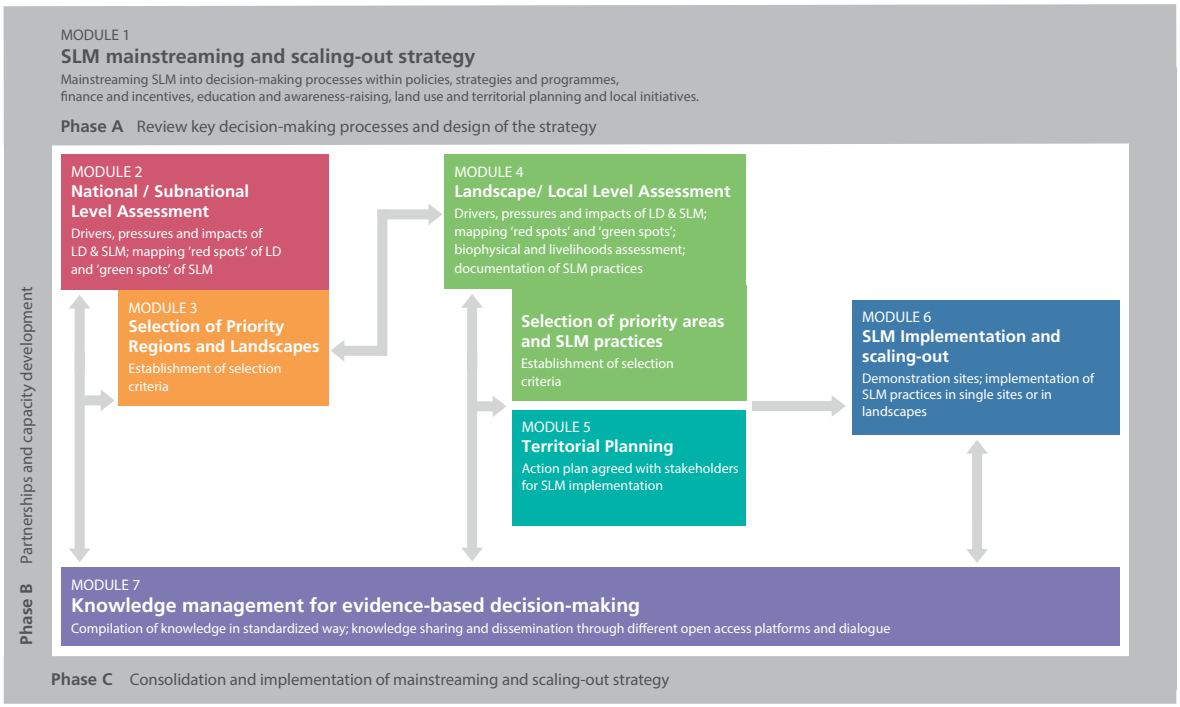
- is **flexible**, and can be tailored to countries' needs and contexts;
- offers, through its **modular format,** different entry points depending on a country's previous activities, existing data, available resources and gaps;
- is applicable at, and links, **different scales**;
- supports **multisectoral** and **multidisciplinary processes**, breaking down "silos" between sectors;
- encourages and facilitates **networking**, **dialogue**, and **partnerships**, leading to active involvement of multiple stakeholders;
- considers **use and management of knowledge** as an intrinsic part of the process.

For the seven modules, **specific tools** are suggested: Nevertheless, countries may decide to substitute them with other tools if they serve the purpose better in their particular context.

The DSF is divided into the following seven modules:

Module 1: SLM mainstreaming and scaling out strategy. Module 1 comprises the design of a mainstreaming strategy focusing on targeting and integrating SLM into key decision-making processes to facilitate the scaling out of SLM. This module is divided into three phases: (a) review of key decision-making processes and strategy design; (b) establishment of partnerships and development of capacities; and (c) consolidation and implementation of the strategy. Module 1 uses the evidence generated in, and lessons learned from, Modules 2 to 6, and stored in Module 7, to promote appropriate and informed decisions.

FIGURE 2
Decision support framework for mainstreaming and scaling out



Source: https://www.wocat.net/en/projects-and-countries/projects/ds-slm

BOX 5: Land Degradation Assessment in Drylands and World Overview of Conservation Approaches and Technologies

The GEF/FAO Land Degradation Assessment in Drylands (LADA) project (2006–2011) aimed at improving the ability to diagnose land degradation and its impacts. It developed a scientifically-based approach to assessing and mapping land degradation at different spatial scales and at various levels. The impacts of land use, including the effectiveness of current/ recent responses, thereby enabling adequate and SLM solutions to be devised. LADA provided an interlinked national and local level assessment of land degradation and SLM that enables stakeholders (multisectoral teams, technicians and land users) to identify and prioritize interventions on the ground for promoting the wider adoption of SLM.

The World Overview of Conservation Approaches and Technologies (WOCAT) is a global SLM network that has been setting standards for more than 25 years in promoting the assessment, sharing and use of knowledge to support adaptation, innovation, scaling out and mainstreaming of SLM. WOCAT has developed a benchmark framework and standardised tools for documentation, monitoring, evaluation and dissemination of SLM knowledge, covering all steps from data collection with several questionnaires, to the Global SLM Database and to evidence-based decision support. The Global SLM Database is officially recognised by the United Nations Convention to Combat Desertification (UNCCD) for the reporting of best SLM practices by the Parties.

Sources: http://www.fao.org/land-water/land/land-assessment/assessment-and-monitoring-impacts/en/; www.wocat.net

Module 2: National/ subnational level assessment. Module 2 provides a national/ subnational overview of land degradation and SLM. It focuses on the identification of the status, drivers, pressures and impacts of land degradation and SLM, the mapping of "hot spots" of land degradation (also referred to as "red spots"), areas with severe land degradation, and "bright spots" (also referred to as "green spots') where SLM is implemented. Depending on the country, a myriad of information and data may be available at the national/ subnational level and such evidence can be used instead of carrying out the assessment in Module 2. Results are fed into Module 7, as evidence for use in all other modules of the framework.

Module 3: Selection of priority regions and landscapes. In Module 3, the evidence from Module 2 is used to select priority regions and landscapes for intervention, based on a set of established criteria, varying from country to country. In countries where priority regions have already been identified, the focus is on prioritising landscapes within those regions.

Module 4: Landscape/ local level assessment. For the selected landscapes, an assessment is made of status, drivers, pressures and impacts of land degradation and SLM, and hot spots and bright spots are mapped. The local level assessment provides a greater degree of detail than under Module 2. It helps in understanding both the biophysical conditions and the livelihoods (sociocultural and economic conditions), and identifies and documents a range of promising SLM solutions. Assessment results deliver the evidence for the selection of priority areas for intervention at local level, and the selection of SLM Technologies and Approaches for implementation (for definitions see Box 4). In countries where priority landscapes have already been identified, Module 4 would be the entry point. Results are fed into Module 7, as evidence for use in other modules of the framework.

Module 5: Land use/ territorial planning. This module uses the land degradation and SLM evidence generated under Modules 2 and 4 to inform land use or territorial planning (see Box 3) in a participatory multi-stakeholder process. Depending on the focus and context, either the concept of land use planning or territorial planning is used (Metternicht, 2017).

Module 6: SLM implementation and scaling out. The implementation and scaling out of SLM takes place either (a) directly after the landscape/ local level assessment in Module 4, after a process of land use/ territorial planning under Module 5 or (b) as a result of mainstreaming SLM in appropriate mechanisms in Module 1. If considered necessary, testing (monitoring and evaluation) and implementation of selected potential and promising SLM practices for scaling out may be done in single sites before the wider implementation and scaling out in the landscape. Lessons learned are fed into Module 7 to inform future implementation and scaling out.

Module 7: Knowledge management for evidence-based decision-making. Module 7 is fed by and/or informs the other modules at various stages. It provides the evidence for decision-making processes in the various stages of the framework/ modules and constitutes a platform and repository of knowledge and information, which enables dissemination of evidence and dialogue.

2.2 The decision support framework and the landscape

The DSF highlights the landscape in two of its modules: in Module 3, when priority regions and landscapes are selected, and in Module 4, where there is assessment at the landscape/ local level. Table 2 summarizes the activities and outputs per module, and presents a number of tools, which can be applied under the modules. However, the list of tools presented is not exhaustive and focuses on FAO LADA and WOCAT tools (Box 5).

Consideration of the landscape level (see Box 4 for a definition) enables the demonstration of more complex interactions, synergies and trade-offs in impacts and more integrated and holistic approaches of SLM practices implemented locally (Liniger *et al.*, 2017). Hence, taking the landscape into consideration is fundamental to land degradation and SLM assessments (Modules 2 and 4). Drivers, pressures and impacts of land degradation and SLM in priority regions and their respective landscapes should be researched and understood in order to be able to prioritize landscapes for interventions (Modules 2, 3 and 4). The combination of different SLM Technologies within a landscape should be evaluated for final selection (Module 4) and implementation (Module 6). Furthermore, the landscape level is the more effective basis for targeting and homogenisation of policies (FAO, 2017), land use planning and leading to change/ transformation, fostering collaboration among different groups of land managers and stakeholders to achieve joint objectives within a shared landscape (Module 5). For successful mainstreaming and scaling out, consideration of the different decision-making processes in the landscape is crucial.

TABLE 2
Modules of the decision support framework and suggested tools

MODULE and explanation	Suggested tools
MODULE 1: Strategy for SLM mainstreaming and scaling out	
Outputs: SLM mainstreaming and scaling out strategy designed and implemented The strategy is developed with multiple stakeholders to identify activities for integration of SLM into national policies, strategies, programmes, financing and incentive mechanisms, education and awareness-raising, land use and territorial planning and local initiatives. The strategy may focus on different levels and should include targeted communication. The strategy should preferably be formulated during early phases of project and programme design and implementation. A multistakeholder consultative group can be formed to support the design, validation, monitoring and implementation of the strategy. Phase A is based on review and analysis of barriers and opportunities for SLM mainstreaming and scaling out, the formulation of mainstreaming objectives and activities, and the mapping of key decision-making processes (such as policies or incentives) and institutions. Phase B encourages the establishment of partnerships with institutions (e.g. policy institutions, financing mechanisms) at different levels to strengthen collaboration within and among the different modules. It includes the development of capacities of different actors upon needs and demands to support mainstreaming and scaling out processes. Phase C promotes the mainstreaming of SLM into key decision-making processes and wide SLM adoption, after the strategy has been consolidated.	• DS-SLM Mainstreaming Tool (Bastidas Fegan 2019 https://www.wocat.net/library/media/170/) • DS-SLM Technical guidelines. Module 1: Mainstreaming SLM into national Policy instruments (Bastidas Fegan 2015 https://www.wocat.net/library/media/171/) • Land Tenure for Sustainable Land Management Module (forthcoming on www.wocat.net)
MODULE 2: National/ subnational level assessment	
Outputs: National and subnational biophysical/ sociocultural maps, land degradation and SLM maps produced Land degradation and SLM are assessed at national/ subnational level, understanding state, drivers, pressures and impacts of land degradation in order to map and visualise hot spots of land degradation and bright spots where SLM is applied. The assessment is performed through negotiation and consensus among a broad set of national, district- and local-level experts, e.g. through one or more participatory expert assessment workshops.	• LADA–WOCAT Mapping Questionnaire (QM) https://www.wocat.net/library/media/18/ • QM step-by-step guidelines (Petri *et al.*, 2019) https://www.wocat.net/library/media/172/ • WOCAT guidelines for national stakeholder workshop https://www.wocat.net/en/decision-support-slm • WOCAT and partners' Google Earth engine geoportals for decision support https://wocatapps.users.earthengine.app/ • Collect Earth http://www.openforis.org/ https://collect.earth/ • Technical guide on integration of tenure into LDN (FAO & UNCCD, 2022)
MODULE 3: Selection of priority regions and landscapes	
Outputs: Priority regions and landscapes for action selected Based on the evidence about hot spots and bright spots, priority regions and landscapes for intervention and potential SLM solutions are identified. Key regions and landscapes of intervention and SLM practices for implementation are selected according to country priorities (e.g. for specific agroecological zones or socioeconomic contexts), negotiated context-specific criteria as well as potential synergies with other programmes and projects in place. This process is usually carried out in a multi-stakeholder setting at national/ subnational level.	• WOCAT guidelines for national stakeholder workshop setting the stage, https://www.wocat.net/en/decision-support-slm • WOCAT and partners' Google Earth engine geoportals for decision support https://wocatapps.users.earthengine.app/ • Similarity and Suitability Analysis for outscaling SLM https://repo.mel.cgiar.org/handle/20.500.11766/3582; https://repo.mel.cgiar.org/handle/20.500.11766/4679
MODULE 4: Landscape/ local level assessment	
Outputs: Landscape/ local level biophysical/sociocultural maps, land degradation and SLM maps produced, natural resources and livelihoods assessment conducted, SLM Technologies and Approaches documented LD and SLM are assessed at landscape/ local level (for different LUS or land management systems), understanding state, drivers, pressures and impacts of land degradation and SLM and mapping hot spots of land degradation and bright spots of SLM in priority landscapes, watersheds or local sites. Depending on the size of the country and level of details achieved in Module 2, the results from Module 2 may be directly utilised instead of repeating the assessment at landscape/ local level. The assessment is performed through negotiation and consensus among a broad set of landscape and local-level experts, e.g. through one or more participatory expert assessment workshops. Local level assessments of natural resources (soil, water, vegetation, animals) and livelihoods in priority landscapes and the documentation and evaluation of SLM Technologies and Approaches provide a basis for the selection of priority areas for interventions and SLM practices for implementation in a multistakeholder setting.	• LADA–WOCAT Mapping Questionnaire (QM) https://www.wocat.net/library/media/18/ • LADA-local assessment, http://www.fao.org/nr/kagera/tools-and-methods/lada-local-level-assessment-manuals/en/ • WOCAT SLM Technologies and Approaches Questionnaires and Database, https://qcat.wocat.net • WOCAT Climate Change Adaptation Questionnaire https://www.wocat.net/library/media/17/ • WOCAT guidelines for local stakeholder workshop https://www.wocat.net/en/decision-support-slm • Spatial planning in the context of the responsible governance of tenure (FAO, 2015) • Technical guide on regulated spatial planning and tenure (FAO, 2020) • EXACT http://www.fao.org/tc/exact/ex-act-home/en/ • Carbon Benefit Tool http://www.carbonbenefitsproject.org/

MODULE 5: Land use/ territorial planning	
Outputs: Land use or territorial plans integrating SLM developed Integration of the assessment results from Modules 2 and 4 into formal land use / territorial planning processes and/ or development of participatory territorial/ land use planning.	• Green Negotiated Territorial Development (GreeNTD) https://www.fao.org/3/i6603e/i6603e.pdf • Participatory Negotiated Territorial Development (PNTD) https://www.fao.org/3/i6133e/i6133e.pdf http://hubrural.org/IMG/pdf/fao_pe2_050402d1_en.pdf; • Participatory Land Use Development (PLUD) https://www.fao.org/land-water/land/land-governance/land-resources-planning-toolbox/category/details/en/c/1236454/ • Land resource planning for SLM http://www.fao.org/3/a-i5937e.pdf • Land Resource Planning Toolbox http://www.fao.org/land-water/land/land-governance/land-resources-planning-toolbox/en/ • Framework for Integrated Land Use Planning: an innovative approach (FAO, 2020) https://www.researchgate.net/publication/343524338_Framework_for_Integrated_Land_Use_Planning_an_innovative_approach_Acknowledgment
MODULE 6: SLM implementation and scaling out	
Outputs: SLM practices implemented and widely adopted by land users, activities supporting scaling out (e.g. farmer field schools, demonstration sites, training) applied SLM practices selected in Module 4 and considered in the land use/ territorial planning processes in Module 5 are tested/ implemented in identified landscapes/ local sites. Demonstration sites to support farmer-to-farmer learning and adoption of SLM are established. Further support activities such as training of local technical assistance teams (including extension services), organization of exchange visits, training of land users through farmer field schools etc. are carried out. Enhancement of scaling out with awareness-raising and capacity development using a broad range of communication tools and materials.	• Farmer Field Schools implementation guide http://www.fao.org/3/i2561e/i2561e.pdf and http://www.fao.org/3/a-i5296e.pdf
MODULE 7: Knowledge management	
Outputs: Knowledge management platforms established (or existing platforms used) for application and dissemination of evidence Compilation and sharing of knowledge in a standardised way, making information publicly available to all stakeholders at local, national and regional levels through different open access platforms, knowledge products, awareness-raising and dissemination events and media to ensure visibility and access to knowledge and evidence for informed decision-making.	• WOCAT Global SLM Database https://qcat.wocat.net • WOCAT website www.wocat.net

2.3 The decision support framework and land degradation neutrality

The DSF includes a number of elements (both its modules and the suggested tools and methods) which can support countries in pursuing LDN (SDG 15.3). Achieving LDN requires the uptake of SLM practices to increase the sustainable provision of ecosystem goods and services the human population will require. LDN is therefore one of the means/ pathways to mainstream and scale out SLM (Liniger *et al.*, 2019; Akhtar-Schuster *et al.*, 2016). SLM is relevant throughout the LDN hierarchy, which is presented in Figure 3.

In the following, for each module of the DSF, different possibilities are described of how the activities and outputs of the module – as well as the suggested FAO–WOCAT tools – can be used in the context of LDN.

Module 1: Strategy for SLM mainstreaming and scaling out

- **LDN vision:** When designing SLM mainstreaming and scaling out strategies, the vision for LDN (Orr, *et al.*, 2017) can guide the design and help to set priorities in terms of which key barriers to address, or which main objectives should be set in the strategy.
- **LDN targets:** The targets set by the countries can be taken into consideration during the strategy design, so that the SLM scaling out actions planned in the strategy support achievement of the LDN targets.
- **LDN planning:** The strategy is developed in a multistakeholder setting, where engagement by different stakeholder groups, and joint negotiation of key barriers, opportunities and objectives is the basis. Key decision-making processes are jointly identified and mutually agreed upon. Both the collaboration between actors and the contents developed during the strategy design process can be beneficial to/ be a useful basis for planning the process to reach the LDN targets and for defining instruments that can be used.
- **LDN implementation pathway:** A SLM mainstreaming and scaling out strategy can be used as a explicit plan to implement actions to reach LDN.
- **LDN enabling environment:** The mainstreaming of SLM into different decision-making processes and instruments – as defined in the strategy – helps to put in place, at different scales, an enabling environment for LDN (Verburg *et al.*, 2017). Therefore, for example, when SLM is mainstreamed into educational programmes at local level, awareness of, and knowledge about, SLM is enhanced which will facilitate the uptake of SLM.

FIGURE 3
The land degradation neutrality response hierarchy

Source: Orr, B., Cowie, A., Castillo Sanchez, V., Chasek, P., Crossman, N., Erlewein, A., Louwagie, G., Maron, M., Metternicht, G., Minelli, S., Tengberg, A., Walter, S. & Welton, S. 2017. *Scientific Conceptual Framework for Land Degradation Neutrality.* A Report of the Science-Policy Interface. United Nations Convention to Combat Desertification (UNCCD), Bonn, Germany. https://doi.org/10.1016/j.envsci.2017.10.011

Module 2: National / subnational level assessment

- **LDN baseline assessment:** Land degradation and SLM data and maps developed through participatory expert assessments can help to verify/ complement LDN baseline assessments produced with remotely sensed imagery. The application of the LADA–WOCAT Mapping Questionnaire (QM) provides insights on state, drivers, pressures, impacts of land degradation and existing SLM solutions in different land use systems, administrative units and at different scales (national/ subnational (Module 2) and landscape/ local (Module 4)). As a result of the QM, land degradation and SLM evidence is made available which can be used as a basis for the planning of interventions to reach LDN. For instance, the generated land degradation maps can provide evidence to identify the necessary responses (according to the LDN response hierarchy: avoid, reduce, reverse land degradation) in a land use system.

- **LDN monitoring:** The QM can be repeated regularly and results used as complementary information for the monitoring of LDN at the national/ subnational level.

Module 3: Selection of priority regions and landscapes

- **LDN planning:** The prioritisation of regions and landscapes based on a set of negotiated criteria in a participatory, multistakeholder process can (a) inform LDN implementation pathways and the planning of interventions on the ground that support reaching LDN, and (b) create a platform for exchange and negotiation so that interventions are endorsed by multiple actors.

Module 4: Landscape/ local level assessment

- **LDN baseline assessment:** see above (Module 2)
- **LDN monitoring:** The QM can be repeated regularly and its results therewith used as complementary information for the monitoring of LDN at the landscape/ local level. Moreover, the information compiled using the WOCAT Questionnaires and Database on SLM Technologies can be used for the ground-truthing and verification of results produced with remotely sensed data.
- **LDN planning for implementation:** The identification, documentation and evaluation of good SLM practices using the WOCAT Questionnaires and Database on SLM Technologies and Approaches can provide useful evidence to support decisions on which practices to scale out and where to reach the LDN targets.
- **LDN enabling environment:** The application of the LADA local socioeconomic assessment can help to better understand the socioeconomic context (livelihoods, governance and tenure etc.) in a particular location and thereby identify gaps/ bottlenecks and the particular actions needed to create an enabling environment for LDN.

Module 5: Land use/ territorial planning

- **LDN enabling environment:** The mainstreaming of SLM into land use/ territorial plans is a key element to establish an enabling environment for LDN (balancing environmental, economic and social justice priorities).
- **LDN planning for implementation:** Land use/ territorial plans guide decision-makers, public officials, farmer groups, land users, etc. to put SLM into practice.

Module 6: SLM implementation and scaling out

- **LDN implementation:** Established, proven practices are scaled out with the help of different support activities and incentives (technical, material, financial) for SLM uptake at farm level. The testing of promising SLM practices in specific sites can help to gain evidence on their suitability for scaling out to reach LDN.

Module 7: Knowledge management

Sharing and maintaining of knowledge on long-term open access knowledge management platforms for evidence based-decision making in LDN.

2.4 The innovativeness of the decision support framework

The DSF is innovative because evidence about the extent of land degradation and the effectiveness of SLM solutions – the basis for decision-making – is embedded in the DSF process of mainstreaming and scaling out SLM. A clearly defined strategy, developed between multiple stakeholders, departing in particular from the local level, is a prerequisite for successful, sustained scaling out so that wide uptake becomes a reality. There are a number of crosscutting issues that must not be overlooked: effective partnerships, capacity development and communication are all key in underpinning success and durability.

2.4.1 Evidence as a basis for decision-making

Land degradation and SLM evidence are essential for decision-making and facilitating the scaling out of SLM that is grounded in the best available research evidence, experiential evidence from the field, and relevant contextual evidence. Making informed decisions in a complex context like land management is difficult when knowledge and evidence are dispersed, disconnected and/ or simply lacking.

TABLE 3
Potential interests at national/ subnational and landscape/ local levels, and objectives for communication with decision-makers

Decision-making level	Main interests or issues	Main objectives for communication with decision-makers on land degradation and SLM
National	National development and environmental policies, strategies, and plans Economic development Macroeconomy	Understanding: • the status, causes and impacts of land degradation; • that land degradation is a significant barrier to economic development; • that SLM is a prerequisite for ensuring water, food and energy security; • that SLM contributes to the national economy (e.g. impact on gross domestic product, cost of inaction, land degradation economic valuations).
	SLM's contributions to, and conflicts with, other sectors	Understanding the linkages of SLM with other development issues (e.g. food security, tenure security, climate change, trade and poverty).
	Allocation of resources to ministries, national programmes and projects within sectors	Understanding: • the economic, social and environmental consequences of land degradation; • that SLM is an investment, not a cost or an externality.
	Coordination of sectoral agencies involved in land use	Understanding that SLM is a multisectoral approach that addresses economic, social, and environmental aspects.
	Regulations for all sectors (e.g agriculture, forest, water, land tenure, trade)	Understanding that: • land degradation hinders all land-use sectors; • SLM contributes to the integrated management of natural resources and ecosystem services.
Subnational	Planning	Understanding land use systems and the status, causes, impacts and trends of land degradation as well as the benefits of SLM for livelihoods.
	Land use conflicts	Understanding that land degradation contributes to conflicts.
	Financing mechanisms and incentives	Knowledge about: • socioeconomic, sociocultural and ecological impacts of SLM Technologies; • costs and benefits of SLM Technologies; • SLM Technologies to be incentivised.
	Economic and trade systems related to production	Understanding SLM responses through enterprise development related to strengthening production chains (e.g. sustainable livestock management).
Landscape/ local	Local-level management plans	Understanding: • land use systems in a given area; • land management in community areas and farms.
	SLM practices (Technologies and Approaches)	Knowledge about: • suitability of existing and new SLM practices to specific contexts and needs; • socioeconomic, sociocultural and ecological impacts of SLM Technologies.
	SLM Technology costs	Understanding: • the costs and revenues of SLM Technologies; • access to finance and incentives.

Source: Bastidas Fegan, S. 2015. *DS-SLM Technical Guidelines Module 1: Mainstreaming SLM into National Policy Instruments.* Rome. FAO. https://www.wocat.net/library/media/171/

In the DSF, evidence is generated in the national/ subnational level assessment (Module 2) and the landscape/ local level assessment (Module 4). This evidence is the basis for decision-making processes for the selection of priority regions and landscapes (Module 3), the selection of priority areas and SLM practices (Module 4) and land use/ territorial planning (Module 5). Knowledge management (Module 7) is an integral part, compiling and making available evidence in a standardised way, facilitating knowledge exchange, and use of knowledge for analysis and synthesis through different platforms. Ideally, SLM projects or interventions incorporate knowledge management right from the beginning and information remains available after the project ends.

Throughout the DSF and its modules, the continuous building-up and use of evidence triggers and facilitates **interinstitutional**, **multisectoral** dialogue, which is fundamental for coordinating and mainstreaming SLM (Module 1). A space is provided which:

- brings together all stakeholders involved in land management in a region or area, and **builds common ground** among them;
- **facilitates dialogue** and interaction between a wide range of stakeholders and experts from different institutions and sectors; and
- provides them with **tools**, **methods** and **evidence** to reach joint solutions, take joint decisions and actions.

Finally, interinstitutional and multisectoral dialogue creates:

- **trust:** an important precondition for later joint action;
- **buy-in and ownership** through participation in the process; and
- helps to identify **evidence gaps** for further collaboration and targeted research.

2.4.2 Crosscutting elements of the decision support framework

The following elements combine and unify the modules of the DSF into a well-functioning whole. They cut across all modules and below-mentioned decision-making processes and instruments (see Table 4).

Partnerships with relevant institutions (e.g. governmental, non-governmental, communities and academia), that are

involved in or have the capacity to influence the identified decision-making processes, are key to the realisation of each module and provide a link between all parts of the DSF, thereby strengthening the strategy. An important feature also is the participation of the communities and land users who are affected in making decisions and implementing the plans. Strategic partnerships based upon comparative advantage, cost-effectiveness and collaboration should be targeted for effective implementation.

Capacity development is key to the implementation of the DSF. Capacity development activities are needed throughout the DSF to ensure successful mainstreaming and scaling out. Capacity development takes different forms, depending on the activities under each module: dialogue and discussions within national working groups/ steering committees; participatory expert/ stakeholder workshops; training and Training of Trainers (ToTs) on the use of proposed tools and methods; knowledge sharing events such as exchange visits, demonstration sites, and farmer field schools.

Targeted communication can support capacity development by aiming at different stakeholder groups at different levels, considering their specific interests (Table 3). Information derived from assessments in the different modules and decision-making processes and instruments relevant to national politicians and decision-makers may differ to that required by land use planners and local decision-making groups. Alternatively, national decision-makers will focus on national policy decisions, macroeconomic impacts and fiscal measures, and local decision-makers may focus on the types and costs of SLM Technologies. Communication takes different forms: platforms, media, published material, reports, videos, etc. A comprehensive and tailor-made communication strategy addressing each target group should be designed and implemented to support SLM mainstreaming and scaling out. Such a communication strategy can be developed alongside the mainstreaming and scaling out strategy.

2.4.3 Mainstreaming and scaling out strategies

The innovation of the DSF is to identify and target key decision-making processes and instruments through establishing and implementing a well-defined mainstreaming and scaling out strategy. Decision-making processes represent opportunities for promoting SLM despite complex, and at times adverse, institutional, financial and legal settings – and the fact that priority is devoted to other development issues. Existing decision-making processes at the national, subnational and local level may facilitate or hinder the implementation of SLM. SLM mainstreaming starts from addressing existing barriers to SLM implementation and scaling out, and focuses on the integration and institutionalisation of SLM into the prevailing thinking and decision-making processes. In order for SLM projects and programmes to be successful and have an impact beyond project and programme implementation areas and lifecycles, a SLM mainstreaming and scaling out strategy should be initiated at the beginning of, and followed throughout, a SLM project or programme. In formulating such strategies, the idea is to go beyond the conventional approach of mainstreaming results of pilot projects through, for example, the production of policy briefs or inviting relevant institutions to share project findings at dissemination events (Bastidas Fegan, 2019).

The DSF **supports countries in the design and implementation of mainstreaming and scaling out strategies** (Module 1) and related activities needed to promote the integration of SLM. A **mainstreaming tool** was developed to guide the process of formulation, planning, and monitoring of mainstreaming strategies and activities (Bastidas Fegan, 2019).

The objectives of SLM mainstreaming and scaling out strategies are to:

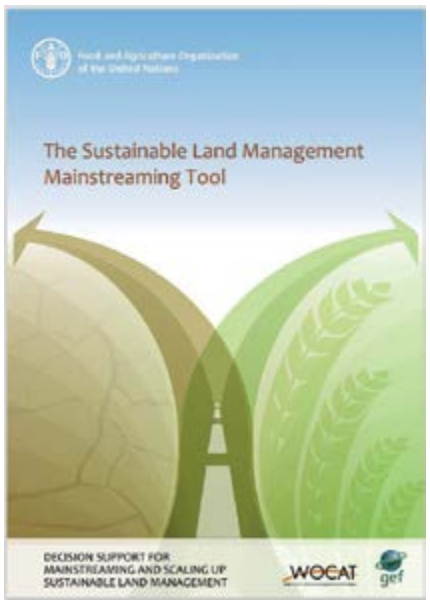
- establish a **pathway for integrating SLM** into national, subnational and local policy, planning, education and finance-related decision-making processes that can facilitate SLM implementation and scaling out;
- establish **partnerships** and develop **capacities** with key institutions and stakeholders for mainstreaming and scaling out SLM; and
- **apply** the strategy and **provide long-term support** for the implementation of SLM.

BOX 6: Designing SLM mainstreaming and scaling out strategies

Guidance for the development of a mainstreaming and scaling out strategy is provided in the mainstreaming tool (Bastidas Fegan, 2019). The design of a SLM mainstreaming and scaling out strategy is divided into two parts including five steps:

The first part covers an initial **rapid assessment of barriers (step 1) and existing decision-making processes (step 2)**. Instead of a lengthy policy or institutional analysis, a rapid assessment provides guidance on which barriers should be overcome, and which decision-making processes should be tackled, and therefore on the formulation of specific objectives and activities for an active process of mainstreaming and scaling out SLM. The formulation of concrete objectives and activities lies at the centre of the design process. Institutions that need to be involved for each objective are identified and at the end, an action plan is formulated for implementation of the strategy.

The second part is the actual **formulation of the strategy including the strategy's objectives and activities (step 3), institutions and stakeholders involved (step 4) and the formulation of an action plan (step 5)**. Although the steps follow a natural progression, elements may overlap or occur out of sequence.



For more information please see Bastidas Fegan, S. 2019. *The DS-SLM Sustainable Land Management Mainstreaming Tool - Decision Support for Mainstreaming and Scaling up Sustainable Land Management.* Rome. FAO. https://www.wocat.net/library/media/170/

The **key features of a SLM mainstreaming and scaling out strategy** (Box 6) are:

- can be developed at **national/ subnational** and/or **landscape/ local levels**;
- simple and proactive: focus on a **few viable strategic objectives and activities** that can easily be presented to decision-makers and a project team/ team of officers, and its partners can undertake;
- **flexible and can be adapted over time** depending on upcoming opportunities and needs; and
- build on **identifying key decision-making processes and instruments** (Table 4) in which SLM should be integrated, and therefore will better enhance SLM implementation and scaling out.

To target country-specific mainstreaming and scaling out of SLM, **six key decision-making processes and related instruments** are proposed. Identifying these decision-making processes and instruments will help to make the strategies as concrete as possible (Table 4).

TABLE 4
Key decision-making processes and instruments through which to mainstream and scale out SLM

Decision-making processes	Types of instruments
Policies and regulations	• Policy framework (e.g. agriculture, economy, environment, tenure, development etc.) • Sectoral policies • Legal framework (laws, regulations) • National strategies and action plans
Incentives and financing	• Financing frameworks (budget allocations) • Economic and non-economic incentives (including security of tenure) • Microcredit programmes • Financing mechanisms and funds (e.g. watershed development funds) • Certification schemes
Education and awareness-raising	• SLM curricula (e.g. university, higher education) • Training modules for professionals (e.g. advisory services) • Awareness campaigns and material
Land use/ territorial planning	• Land use and territorial planning processes at all levels • Budgetary allocations for SLM by administrative units • Information and monitoring systems
Programmes and projects	• National and subnational sectoral and cross-sectoral programmes and projects (e.g. environment, agriculture, climate change, small business)
Local initiatives	• Local organizations (e.g. producers' associations, Indigenous People's organizations) • Local management plans (e.g. landscape or farm level)

Source: adapted from
Bastidas Fegan, S. 2015. *DS-SLM Technical Guidelines Module 1: Mainstreaming SLM into National Policy Instruments.* Rome. FAO. https://www.wocat.net/library/media/171/
Bastidas Fegan, S. 2019. *The DS-SLM Sustainable Land Management Mainstreaming Tool - Decision Support for Mainstreaming and Scaling up Sustainable Land Management.* Rome. FAO. https://www.wocat.net/library/media/170/

A key innovative instrument is the **integration of SLM into financing mechanisms** such as environmental or watershed development funds and into **microcredit programmes**. Traditionally, the environmental and agricultural sectors do not liaise closely with the economic or finance sector, although one of the main barriers to SLM implementation and scaling out is the lack of financial resources. Furthermore, the **integration of SLM into land use/ territorial planning processes** is key in considering mainstreaming and scaling out strategies. Once SLM is integrated into a formal land use plan, either at national, watershed, or landscape level, resources are more likely to be allocated.

Part 3

Selected results from countries in mainstreaming and scaling out SLM

Part 3. Selected results from countries in mainstreaming and scaling out SLM

In this chapter, most prominent insights and results from 14 of the participating countries were selected and are summarized. The country examples illustrate how the framework has been used in a flexible manner, depending on the different contexts, facilitating the embedding of land degradation and SLM evidence into decision-making processes to mainstream and scaling out SLM and reach land degradation neutrality (LDN). The presented results are not exhaustive and do not represent all activities and outputs produced by the countries under each module of the framework.

3.1 Argentina

Implementing Partner: Secretary of Environmental Policy in Natural Resources of the Ministry of Environment and Sustainable Development

CONTEXT

Argentina is the eighth largest country in the world and spans a wide latitude. This means it covers a range of ecosystems and climatic conditions – from very cold climates in the south to subtropical climates in the north. A total of 70 percent of Argentina's national territory is arid, semi-arid or sub-humid, of which about 80 percent suffers from land degradation. This includes water erosion, wind erosion, salinization, and loss of land cover mainly caused by unsustainable land use, in particular by overgrazing and deforestation. Argentina was one of the six countries under the GEF-funded FAO LADA project (Land Degradation Assessment in Drylands), where mapping methodologies were co-developed, including the LADA–WOCAT Questionnaire for Mapping (QM) of land degradation and sustainable land management (SLM) Through LADA, the National Observatory of Land Degradation and Desertification (Observatorio Nacional de la Degradación de Tierras y Desertificación, ONDTyD), a successful multi-sector partnership, was established.

MODULE 1

National Observatory of Land Degradation and Desertification: a successful multi-sector partnership

ONDTyD provides for a permanent national system of standardized evaluation and monitoring of land degradation and SLM at multiple scales, which strengthens capacity in land degradation and SLM through its interinstitutional and interdisciplinary team. It not only works at national level but supports projects locally, using a network of pilot sites covering very diverse environmental and social situations.[3] The ONDTyD itself is an example of successful SLM mainstreaming. As all SLM-related projects are monitored under the Observatory, Argentina can analyse, synthesize and scale out SLM activities and guide SLM knowledge management at the national level. One successful example is the evidence produced for the country's LDN process (see below). Moreover, all existing land degradation and SLM evidence and information is shared through the portal of the Observatory.

MODULE 2

Land degradation mapping and application of evidence in the land degradation neutrality process

A national land use systems (LUS) map with twenty-five categories was produced by an ONDTyD ad-hoc Mapping Commission, and later validated in consultation with local experts from both the ONDTyD pilot sites and other external institutions including the Council of Scientific and Technical Research (CONICET) and the National Institute of Agricultural Technology (INTA) from all regions, using an online web-application (Box 7). The validation process covered the 60.6 percent (1 421 polygons) of the country's area (Figure 4): after revision by specialists only 6.5 percent were identified as wrongly categorized and reassigned to a new LUS category. This expert-based process helped to validate the final LUS map of Argentina, which formed the basis for the national assessment of land degradation.

Due to the extent of Argentina, the diversity of LUS and cost considerations, the LUS validation web-application was adapted to perform the land degradation assessment based on QM, setting the basis of a system that was later used to validate the country's LDN indicators derived from remote sensors. All the ONDTyD pilot sites carried out the QM assessment, collecting important information about land degradation (type, trends and causes) and also about SLM practices (targets and effectiveness).

The ONDTyD ad-hoc Mapping Commission was also tasked with assisting in the UNCCD PRAIS[4] National Reporting. The main task in this context was to report on Strategic Objective (SO) 1: *To improve the condition of affected ecosystems, combat desertification/land degradation, promote sustainable land management and contribute to land degradation neutrality.* For this, the following indicators were calculated:

- Indicator SO1–1: Trends in land cover
- Indicator SO1–2: Trends in land productivity or functioning of the land
- Indicator SO1–3: Trends in carbon stocks above and below ground

Based on the three indicators, the proportion of land degraded over the total land area was calculated, serving as SDG 15.3.1 indicator (Figure 5).

[3] For additional information on pilot sites, please see: http://www.desertificacion.gob.ar/wp-content/uploads/2019/02/ONDTyD_sintesis2012-2017.pdf

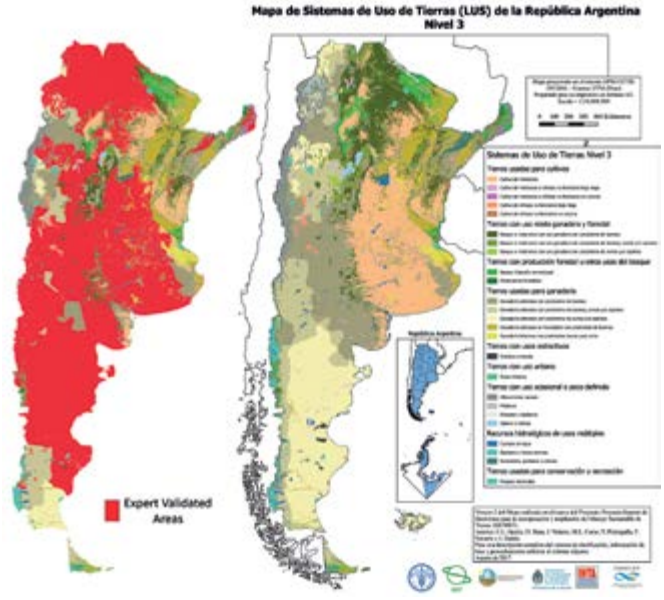
[4] For additional information, please see: https://prais.unccd.int/node/53

BOX 7: Web-application for participatory validation of map information

Many projects include activities where experts and participatory information needs to be collected and related to geographic coordinates or elements of a map. This usually involved use of paper maps, geographic information systems (GIS), spreadsheets, databases etc. Typically, experts or technicians need to meet, which involves the organization of workshops, travelling and high expenses. In order to ease the participatory collection of expert opinion and facilitate data gathering, Argentina developed a web-application, which: a) does not require GIS or advanced computer knowledge; b) uses a web environment that can be adapted to any requirement with no need for the user to install any software; c) makes it easy for the expert to connect and provide opinion; and d) reduces costs of building databases and analyzing data. The web-application was developed using OpenLayers, Geoserver, Postgres, Postgis and QGIS. It was applied for the participatory validation of the LUS map, the data collection for land degradation mapping (according to the LADA–WOCAT QM), and for validating Land Productivity Dynamics models in the context of the LDN baseline. The web-application has the potential to be used in other contexts and countries, to make expert consultation simpler and cheaper, to collect data in a systematic and objective way, and to facilitate the interpretation and analysis of results.

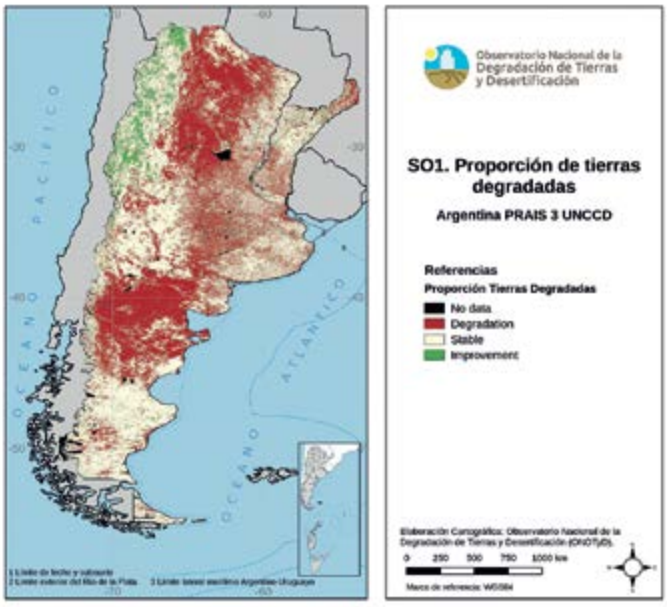
Source: Teich, Ingrid, Mariano Gonzalez Roglich, María Laura Corso, and César Luis García. 2019. "Combining Earth Observations, Cloud Computing, and Expert Knowledge to Inform National Level Degradation Assessments in Support of the 2030 Development Agenda". *Remote Sensing* 11, no. 24: 2918. https://doi.org/10.3390/rs11242918

FIGURE 4
Final land use map of Argentina after expert validation



Note: A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).
Source: Bran D., C. Garcia y M. L. Corso. Mayo. 2018. *Memoria y Productos de la Comisión Ad hoc para el Mapeo de Sistemas de Uso de Tierras (LUS) y la Degradación de Tierras (DT).* Ministerio de Ambiente y Desarrollo Sustentable (MAyDS) y Observatorio Nacional de Degradación de Tierras y Desertificación (ONDTyD). Buenes Aires. https://www.wocat.net/documents/546/MemoriaComisi%C3%B3n_MapeoLUS_DT_mayo18.pdf

FIGURE 5
Proportion of land that is degraded over total land area



Note: Argentina's 2017–2018 PRAIS3 reporting on SDG 15.3.1.
Source: SD MST. 2018. *Informe sobre la Séptima Reunión/Taller de la Comisión Ad hoc para el Mapeo de Sistemas de Uso de Tierras (LUS) y la Degradación de Tierras (DT)/Taller de Mapas de degradación e indicadores UNCCD.* Ministerio de Ambiente y Desarrollo Sustentable (MAyDS) y Observatorio Nacional de Degradación de Tierras y Desertificación (ONDTyD). Buenes Aires. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/argentina#module-2

MODULE 4

SLM practices to support knowledge dissemination and implementation

Within the framework of Argentina's *'Programa de Acción Nacional de Lucha contra la Desertificación, Degradación de Tierras y Mitigación de la Sequía actualizado a la Meta 2030 (Resolución SAyDS N° 70/2019)*[5] six regional guides (Figure 6) for each region of Argentina were developed. The guides describe **relevant suitable SLM practices for prevailing land degradation problems in a specific region**. They aim to:

a) facilitate the **incorporation of SLM practices into provincial and national strategies**; and
b) serve as **models for SLM implementation**.

Members of the National Observatory of Land Degradation and Desertification (ONDTyD) surveyed over 70 good practices to develop the guides, based on a technical consensus about the suitability of different SLM practices for different contexts and regions. The process of consensus-finding was a useful exercise in itself for the stakeholders involved. More information about the single SLM practices can be found on the SLM platform of ONDTyD.[6]

The guides support the process of mainstreaming and scaling out SLM by promoting the systematisation of experiences in a homogeneous and simple way. Through the SLM practices Commission, a network of SLM experts was created and continues to be active in the validation of new good SLM practices – and for project evaluation. Surveying new potential SLM practices was established as a permanent activity of the Ministry of Environment. New SLM practices are evaluated based on the harmonised criteria set up by the SLM practices Commission.

MODULE 6

Implementation of SLM through actions by inter-institutional stakeholders

In a national open call the ONDTyD sought proposals to support the scaling out of SLM through **demonstrations, capacity building** and **training**. The selection criteria included representativeness of the site; presence of land degradation; evidence of change of land use and the team/ institution proposed.

FIGURE 6
Six regional SLM guides for the six regions of Argentina

Note: A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).
Source: Observatorio Nacional de la Degradación de Tierras y Desertificación, ONDTyD.
https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/argentina#module-1

[5] For additional information, please see:
https://www.argentina.gob.ar/ambiente/tierra/bosques-suelos/desertificacion/programa-accion-nacional

[6] For additional information, please see:
http://www.desertificacion.gob.ar/manejo-sostenible-de-tierras/practicas-de-mst/#¨

Two local sites were selected, both already pilot sites of the ONDTyD, which represent a larger area with common land degradation problems and expansion of agriculture. Implementation was guided by the lead institutions of the pilot sites.

Site 1: Grazing land, dryland: Semi-arid Chaco, Salta

This site is located in drylands with a dry and thorny forest where low rainfall, high temperatures and soil characteristics limit forage production. Here, cattlemen are dedicated to intensive livestock production, based on replacing the forest with tropical pastures or, by selective clearing of certain species and *desbarejado* (elimination of the undercover below the trees). *Deschampado* is an SLM alternative constituting silvopastoralism – where pastures are established under forest trees, in place of the natural vegetation under the forest canopy. This enables expansion of livestock production without removing the larger trees. Grasses that can grow under shade are planted and fences constructed to regulate grazing. In this way deforestation, loss of biodiversity and land degradation is reduced.

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©Mariana Victoria Stamati

Top: Visit of producers and students to the SLM Technology site *deschampado*. Bottom: Border between an area with the SLM Technology *deschampado*, where the regrown pastures are visible under the trees (left) and an area without the Technology (right).

The stakeholders that interact in the pilot site help generate and validate information for SLM implementation: this sets the scene for scaling out. A new initiative in the pilot site builds capacity of staff of the Ministry of Environment, Province of Salta, in assessing, monitoring and implementing livestock systems under forest (*sistemas de ganadería bajo bosque*) which will contribute to the scaling out of the silvopastoral SLM Technology *deschampado* in the region.

Site 2: Cropland and grazing land in humid area: Watershed Arroyo Estacas, Entre Ríos

Located in an area with sloping land, intense rainfall and problems of soil erosion, this region is characterized by a *Prosopis* forest which is threatened by agriculture. Cleared land is suitable for cattle and the growing soy, wheat, maize and sorghum. The objective here is to integrate a series of SLM technologies to combat land degradation. The technologies were selected on the basis of experience with controlling soil loss and increasing carbon stocks at the sub-basin level. These can be applied at different scales and can be replicated in other regions of the country.

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Top: Terraces and collector channels/ waterways.
Soil erosion (middle) and reservoir terraces on a demonstration farm (bottom) in Entre Ríos.

1) **Land systematization for prevention and mitigation of soil erosion and waterlogging:** use of channel terraces and drainage waterways for the removal of excess water in a non-erosive form.

2) **Land systematization for the integral conservation for ecosystem services at sub-basin level:** use of reservoir terraces and vegetated borders, biodiversity corridors / connectors integrating patches of native forests. Evacuation terraces, channels collectors, runoff retarders.

3) Agricultural systems based on the pillars of **conservation agriculture**: implementation of minimum tillage, crop rotation, mulching – as well as rational water use and integrated pest management.

4) **Livestock management based on native forest and natural grassland management:** development of management plan for livestock lots adding the integral benefits of native trees and grasses in the production systems.

The implementation of these technologies requires close collaboration and consensus with the land users in the watershed. Once technicians and land users have a broad and integrated view of the conservation of natural resources in the region, the adoption of the technologies becomes much easier.

MODULE 1

Local-level mainstreaming of SLM

SLM was mainstreamed at the local level, working with local organizations, focusing on education and awareness-raising as well as integration of SLM into policies and regulations.

In the pilot site at semi-arid Chaco a community communication strategy for SLM was developed which included the promotion of SLM through radio broadcasts and training. Furthermore, the topic of SLM was incorporated in the formal education system at secondary school level. In order to receive political support in the Chaco pilot site, a "Municipal Declaration of Interest" was issued. The local authorities of the municipality have highlighted the role of SLM in local development and have drawn up an act enforcing the activities to be carried out. This institutional support helps to promote the continuity of SLM activities and raises awareness.

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The province of Entre Rios, where the Watershed Arroyo Estacas pilot site is located, has a long history of soil conservation. They have created a commission to review and update their soil conservation law (Soil Conservation Act 8318), and the DS-SLM project has made a substantial contribution, as the DS-SLM technical team is part of the commission. Furthermore, the law obliges producers to submit SLM plans: therefore considerable work was done to to strengthen the capacity of the professionals who are responsible for preparing such plans.

Argentina: knowledge products, links and references

DS-SLM country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/argentina

Website of the the National Observatory of Land Degradation and Desertification (ONDTyD): www.desertificacion.gob.ar

Good practices guide for the northwest region (provinces of Catamarca, Jujuy, Salta, Santiago del Estero y Tucumán):
http://www.desertificacion.gob.ar/wp-content/uploads/2019/03/MST_Guias_buenas_practicas_NOA.pdf

Good practices guide for the northeast region (provinces of Chaco, Corrientes, Entre Ríos, Formosa, Misiones and Santa Fé):
http://www.desertificacion.gob.ar/wp-content/uploads/2019/03/MST_Guias_buenas_practicas_NEA.pdf

Good practices guide for the Nuevo Cuyo region (provincias of La Rioja, Mendoza, San Luis and San Juan):
http://www.desertificacion.gob.ar/wp-content/uploads/2019/03/MST_Guias_buenas_practicas_NUEVO_CUYO.pdf

Good practices guide for the central region (Buenos Aires and Córdoba):
http://www.desertificacion.gob.ar/wp-content/uploads/2019/03/MST_Guias_buenas_practicas_CENTRO.pdf

Good practices guide for the region Patanogia north (La Pampa, Neuquén and Río Negro):
http://www.desertificacion.gob.ar/wp-content/uploads/2019/03/MST_Guias_buenas_practicas_PATAGONIA_NORTE.pdf

Good practices guide for the region Pagagonia south (Chubut, Santa Cruz and Tierra del Fuego):
http://www.desertificacion.gob.ar/wp-content/uploads/2019/03/MST_Guias_buenas_practicas_PATAGONIA_SUR.pdf

SLM Technology Deschampado videos: https://www.youtube.com/watch?v=6QTNKj5htt0 and https://www.youtube.com/watch?v=SvSdDBQN37Q&t=190s

Forest and pasture management journey video: https://inta.gob.ar/videos/la-paz-jornada-manejo-del-monte-y-del-pastizal-natural

News article INTO – Instituto Nacional de Tecnología Agropecuaria:
https://inta.gob.ar/noticias/conservacion-y-sistematizacion-de-tierras-profesionales-del-sector-aportaron-multiples-miradas-para-su-adopcion-definitiva

Teich, Ingrid, Mariano Gonzalez Roglich, María Laura Corso, and César Luis García. 2019. "Combining Earth Observations, Cloud Computing, and Expert Knowledge to Inform National Level Degradation Assessments in Support of the 2030 Development Agenda". *Remote Sensing* 11, no. 24: 2918. https://doi.org/10.3390/rs11242918

3.2 Bangladesh

Implementing Partner: Department of Environment, Ministry of Environment, Forest and Climate Change

CONTEXT

In Bangladesh, about six million ha or 43 percent of the country is affected by various forms and degrees of land degradation (LD). These include, among others, deforestation, loss of soil fertility and organic matter, accumulation of pollutants, soil erosion, soil acidification, riverbank erosion, and salinization of the soil (Rahman *et al.*, 2012). There has been relatively little monitoring or documentation of the range of benefits generated by sustainable land management (SLM) practices. This evidence is essential to support decision-makers in the transition towards more sustainable practices, multi-sectoral approaches and green economic growth. Therefore, Bangladesh's Ministry of Environment, Forest and Climate Change (MoEFCC) prioritized the establishment of a national overview of land degradation and the identification of suitable SLM practices for mainstreaming and scaling out through formulation of a national SLM mainstreaming strategy.

MODULE 2

National web-platform for monitoring land degradation and proposing SLM solutions

A national web-platform for land degradation monitoring to support a multi-sectoral and integrated approach for SLM, resilient livelihoods and climate change adaptation was developed. It helps to a) visualize land degradation status over the whole country; b) share and disseminate land degradation data (specifically soils, water and vegetation); and c) linking land degradation data with relevant local SLM solutions available in the WOCAT Global SLM Database. The open access web-platform is available under http://mldb.doe.gov.bd and helps decision-makers as well as researchers to identify the degraded land areas (priority areas) and potential SLM solutions.

MODULE 4

Choosing the best SLM for the areas that need it most

Through an expert consultation of the MoEFCC and other key agencies, land degradation maps were generated, the most important land degradation types were identified, and four priority areas for action were determined:

- groundwater depletion in croplands of the high Barind Tract;
- forest degradation in the Chittagong Hill Tract;
- saline prone and waterlogged areas in the Khulna region; and
- deforestation and coastal land degradation in Cox's Bazar district.

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Top: Subnational consultation with experts and land users. Bottom: SLM expert documenting SLM practices in Bagha, Rajshahi using the WOCAT App developed by Thailand.

Subnational multi-stakeholder consultation workshops with governmental, non-governmental and research institutions as well as land users were conducted in the four priority areas to:

a) identify and validate hotspots of LD, land degradation types, processes and impacts;
b) select existing and promising SLM technologies to prevent or mitigate land degradation (according to feasibility of implementation; innovativeness; high potential for spread);
c) discuss barriers and opportunities for SLM adoption and identify the stakeholders relevant for supporting SLM mainstreaming and scaling out.

Over 50 potential SLM solutions were identified and a selection was made for in-depth documentation using the WOCAT SLM Technologies Questionnaire for their publication in the Global SLM Database. The documentation was facilitated by the availability of a newly developed mobile app for SLM Technology documentation following WOCAT Questionnaire.

The following are examples of SLM Technologies that were documented.

High Barind Tract:

Alternate wetting and drying in rice cultivation

The High Barind Tract (HBT) is the hottest region of the country and water scarcity is a common problem. Farmers use deep tube wells to tap into underground water for their farming. This results in a consistent reduction in the level of the water table. To address this problem "Alternate Wetting and Drying" is a good choice, because it is not necessary to keep the water standing throughout the whole growing season. Through this method, up to 25 percent less water is consumed, and money saved. After transplanting rice seedlings, shallow standing water is permitted and then the field is drained – and wetted again – alternately using strategically located perforated plastic pipes. For each irrigation cycle, the water depth is closely controlled.

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Alternate wetting and drying method in rice cultivation at degraded High Barind Tract, Rajshahi (picture showed in early tiller stage).

https://qcat.wocat.net/en/wocat/technologies/view/technologies_4671/
https://qcat.wocat.net/en/summary/4671/?as=html

Chittagong Hill Tracts:

Natural vegetative strips

While shifting cultivation was environmentally sustainable in the past with low population pressure, it has gradually begun to degrade the land with the shortening of fallow periods. One of the best remedies is the adoption of natural vegetative strips (NVS) on cultivated slopes. NVS are narrow strips of naturally growing grasses and herbs, intentionally left unploughed along the contours of hilly-sloped lands. These strips – about 4 metres apart – serve as buffers that prevent the soil from eroding during heavy rains and intensive cultivation. Over time, they form stable terraces along the contours. The Soil Conservation and Watershed Management Center in Meghla, Bandarban has shown that NVS reduce soil erosion by more than 90 percent and are easy to establish, as they do not require extra labour during land preparation. NVS play a vital role in improving plant growth, but also filter out pesticides, nitrates and soluble phosphorus from runoff.

©FAO/ F. Arafat

Natural Vegetative Strip in slope cultivation.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_5504/
https://qcat.wocat.net/en/summary/5504/?as=html

Conservation of medicinal plants involving ethnic communities

The Chittagong Hill Tracts are renowned for their rich biodiversity. In this area, traditional environmental knowledge plays an important part in the daily lives and customary practices of Indigenous Peoples. Medicinal plants are a key component of the local health care system – but their numbers have diminished rapidly with land use change. In 2008, International Union for Conservation of Nature (IUCN) began to support the cultivation and conservation of medicinal plants by Indigenous Peoples. Degraded land gradually started to regain its health, and topsoil erosion was reduced. It now has good canopy cover, and functions as a habitat for birds and monkeys. Herbal healers have access for raw materials and the local community can collect dead branches for firewood. This Technology is simple, and it is replicable without external financial or technical support.

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Protection from land degradation through conservation of medicinal plants.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_4287/
https://qcat.wocat.net/en/summary/4287/?as=html

Cox's Bazar and Chittagong Hill Tracts:

Green shelterbelts of *Casuarina equisetifolia* ("Jhau") along the coast

The coastal zone of Bangladesh is extremely vulnerable to the impacts of climate change. The population is mostly poor and devastating cyclones have killed thousands and destroyed homes and infrastructure. Creation of green shelterbelts is usually cheaper and ecologically more beneficial than other measures – and serves to conserve biodiversity. As a general guideline, a shelter-belt protects an area up to 10 times its height on the leeward side, depending on the strength of the wind. Jhau (Casuarina equisetifolia) is one of the most promising non-mangrove species for creating shelterbelts. It is an evergreen tree, fast growing, salt tolerant, grows in sand and can also tolerate occasional inundation by sea water. This is a climate change adaptation measure that has significantly contributed to reduced losses in the face of tropical cyclones and storm surges.

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Greenbelt plantation with Jhau (*Casuarina equisetifolia*).
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4333/
https://qcat.wocat.net/en/summary/4333/?as=html

Khulna region:

Pitcher irrigation to manage moderately saline soils

The coastal area of Bangladesh is suitable for cropping: but more than a third is affected by salinity. Crop yields and quality of life are low and all the time food demand is increasing. To address the problem, the Salinity Management and Research Centre has developed "pitcher irrigation Technology" which reduces soil salinity, increases water use efficiency and improves soil productivity. An earthen pitcher is placed on a raised bed and filled with fresh water. Seeds are sown on the bed and the water seeps out very slowly. This supplies irrigation water continuously on the surface of the plant bed and rootzone of the crops. Salt movement is hampered so soil salinity doesn't increase through the cropping season. Pitcher irrigation also enhances germination and uptake of nutrient by plants. Farmers have responded quickly and the Technology has spread rapidly.

©Amarendra Nath Biswas

Vegetable (sweet gourd) cultivation through pitcher irrigation technique in coastal saline area.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4112/
https://qcat.wocat.net/en/summary/4112/?as=html

BOX 8: Refugee camps and land degradation, a unique challenge

Refugee camps present a unique environmental problem – where an influx of massive numbers of people can rapidly overwhelm the area's natural resources. What can be done? Cox's Bazar in Bangladesh presents a current case that tests sustainable land management to the limit. The two southernmost upazilas (administrative units) of Cox's Bazar district in the southeast corner of Bangladesh, namely Teknaf and Ukhia with a local population of about 470 000 are overburdened with refugee movement and camps. After the huge influx of refugees in August 2017, the Rohingya currently constitute the largest refugee movement in the world: about 900 000 people are living in 34 camps that occupy around 2 685 hectares of land, most of which belongs officially to the forest department.[i] Satellite image analysis revealed that 7 220 hectares of land became degraded in just one year: 1 380 hectares within the camps and 5 840 hectares outside. Wood was the only source of energy available initially. It is estimated that more than 850 tonnes of wood are extracted daily from neighbouring lands. Soil erosion, land and mudslides are the result of this deforestation, making land restoration a priority.

Priority areas for action and SLM practices

Five broad land cover classes were delineated: water, settlement, bare land, sparse vegetation and dense vegetation. For each, the level of land degradation (low, medium, high) was identified (Figure a). Table a shows the number of hectares of degraded areas inside and outside the refugee camps.

Geographic locations of potential SLM practices to restore the degraded land were identified throughout Cox's Bazar South Forest Division for restoring degraded landscapes and supporting vulnerable host and refugee communities (Figure b). The specific SLM activities proposed were:

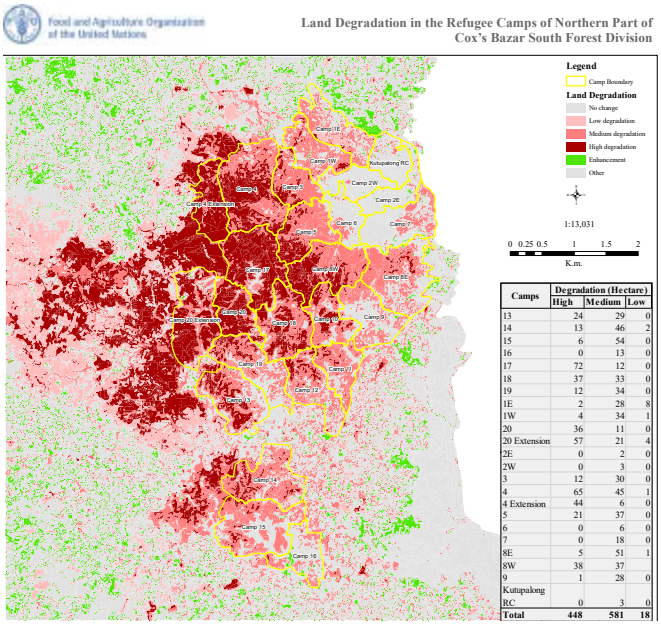
(1) Land stabilisation
(2) Land restoration
(3) Forest restoration
(4) Afforestation / reforestation
(5) Seedling distribution
(6) Habitat restoration

[i] For more information please see: https://data.humdata.org/dataset/outline-of-camps-sites-of-rohingya-refugees-in-cox-s-bazar-bangladesh

BOX 8 continued: Refugee camps and land degradation, a unique challenge

FIGURE a

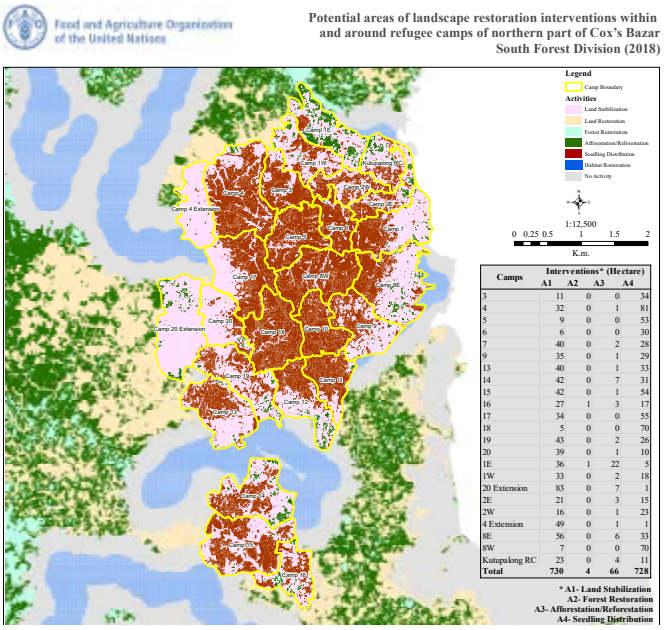
Land degradation in the Refugee Camps of Northern Part of Cox's Bazar South Forest Division. Land covers of 2017 and 2018 were overlaid to assess land degradation over the one-year period.



Camps	Degradation (Hectare)		
	High	Medium	Low
13	24	29	0
14	13	46	2
15	6	54	0
16	0	13	0
17	72	12	0
18	37	33	0
19	12	34	0
1E	2	28	8
1W	4	34	1
20	36	11	0
20 Extension	57	21	4
2E	0	2	0
2W	0	3	0
3	12	30	0
4	65	45	1
4 Extension	44	6	0
5	21	37	0
6	0	6	0
7	0	18	0
8E	5	51	1
8W	38	37	
9	1	28	0
Kutupalong RC	0	3	0
Total	448	581	18

FIGURE b

Potential areas for SLM restoration interventions within and around refugee camps of northern part of Cox's Bazar South Forest Division.



Camps	Interventions* (Hectare)			
	A1	A2	A3	A4
3	11	0	0	34
4	32	0	1	81
5	9	0	0	53
6	6	0	0	30
7	40	0	2	28
9	35	0	1	29
13	40	0	1	33
14	42	0	7	31
15	42	0	1	54
16	27	1	3	17
17	34	0	0	55
18	5	0	0	70
19	43	0	2	26
20	39	0	1	10
1E	36	1	22	5
1W	33	0	2	18
20 Extension	83	0	7	1
2E	21	0	3	15
2W	16	0	1	23
4 Extension	49	0	1	1
8E	56	0	6	33
8W	7	0	0	70
Kutupalong RC	23	0	4	11
Total	730	4	66	728

* A1- Land Stabilization
A2- Forest Restoration
A3- Afforestation/Reforestation
A4- Seedling Distribution

TABLE a

Overview of hectares of degraded land

Land cover 2017	Land cover 2018	Degradation severity	Degraded area inside camps (ha)	Degraded area outside camps (ha)
Dense vegetation	Bare land	high degradation	494	633
	Settlement			
	Water			
	Sparse vegetation	low degradation	50	2 575
Sparse vegetation	Bare land	medium degradation	836	2 632
	Settlement			
	Water			
			Total ha: 1 380	Total ha: 5 840

The areas for potential SLM interventions were identified by analysing the NDVI-based land cover categories in February 2018, considering land degradation between February 2017 and February 2018, and taking into account the suitability analysis for the six above mentioned SLM activities for restoration in three zones: i) inside the camps (Zone A); ii) one km buffer around the camps (Zone B); and iii) within 1–5 km around the camps (Zone C). The analysis supports the development of a regional site-specific plan for inside and outside the camps, showing where which SLM practices should be implemented (Table b). Training supported refugees and host communities (outside the camps) to implement the SLM activities.

TABLE b

Selection of SLM activities according to land cover

Land cover 2018	Activity
Bare land	1. Land stabilization 2. Land restoration
Dense vegetation	3. Forest restoration
Sparse vegetation	4. Afforestation/Reforestation 6. Habitat restoration (wild)
Settlement (inside camp)	5. Seedling distribution
Settlement (outside camp)	No activity
Water	No activity

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Forest restoration in Cox's Bazar before 2017 (left) and after 2018 (right).

Source: Ritu, S., Jalal, R. and Henry, M. 2018. Potential areas of landscape restoration interventions within and around refugee camps of northern part of Cox's Bazar South Forest Division. *FAO and Bangladesh Forest Department (BFD)*, Dhaka, Bangladesh. https://www.fao.org/3/ca3659en/ca3659en.pdf

MODULE 6

Scaling out with extension services

The Department of Agricultural Extension carried out a feasibility analysis on the potential SLM solutions in the degraded areas through surveys with farmers compiling information on the main barriers and opportunities to adoption and to identify the most suitable SLM technologies to promote. The following three technologies were then tested and piloted:

- **High Barind Tract:** Aman rice cultivation through zero tillage practices to decrease soil disturbance, improve yields and reduce greenhouse gas emissions.
- **Chittagong Hill Tracts:** Use of Natural Vegetative Strips (NVS) supporting vegetable cultivation on steep slopes, by reducing runoff and soil erosion.
- **Khulna region:** Vegetable production with salt tolerant varieties through minimum tillage practices, applying compost and mulch.

DAE organized Training of Trainers (ToT) in the pilot sites to teach farmers about the SLM technologies. In order to raise wider awareness of SLM, DAE also conducted exposure visits with participants from relevant national organizations to demonstrate the SLM solutions for combatting soil erosion in the Chittagong Hill Tracts, creating drought resilience in the High Barind Tract and addressing salinity in Khulna region.

©FAO/ Arif Tanjim

©FAO/ M. Henry

Top: Expert consultation to design the SLM mainstreaming and scaling up strategy (Kamrul Hossain). Bottom: The baseline information to implement the strategy is founded on quantitative information for soil, vegetation and water degradation, drawn from remote sensing and field validation.

MODULE 1

SLM Mainstreaming strategy at country level

An SLM mainstreaming strategy was jointly designed in a consultation meeting by the Department of Environment (DoE) under the Ministry of Environment, Forest and Climate Change (MoEFCC), in collaboration with the Department of Agriculture Extension (DAE) and the Soil Resource Development Institute (SRDI) under the Ministry of Agriculture (MoA), Barind Multipurpose Development Authority, and the Forest Department (FD) under MoEFCC, with technical support from FAO.

The strategy proposes a focus on the implementation of SLM practices to:

1) reduce soil fertility decline and carbon depletion;
2) restrict conversion of forest and crop land to non-forest and non-agricultural land use;
3) reduce waterlogging and salinization problems;
4) reduce soil erosion on sloping lands and river banks;
5) develop sustainable value chains through promotion of markets; and
6) improve livelihoods of local communities through promoting best SLM practices.

The proposed strategy provides recommendations to reduce land degradation on 5 100 km^2 by the year 2030 and to achieve national land degradation neutrality (LDN) targets by promoting and scaling out of SLM at the national level. The strategy proposes national level involvement of agriculture, forestry, livestock, fisheries, land, water, finance and youth sectors under the eight respective ministries and capacity strengthening of extension service providers and producers.

Bangladesh: knowledge products, links and references

Bangladesh country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/bangladesh

Bangladesh SLM practices documented under the DS-SLM project:
https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_BGD&filter__qg_funding_project__funding_project=1

BANCAT. 2019. Selected Natural Resource Management Approaches and Technologies. WOCAT initiative in Bangladesh (BANCAT). https://www.wocat.net/library/media/134/

FAO. 2021. Cox's Bazar, Bangladesh PROGRESS SUMMARY May to August 2021. https://www.fao.org/3/cb7401en/cb7401en.pdf

International Organization for Migration (IOM) & FAO. 2017. *Assessment of fuel wood supply and demand in displacement settings and surrounding areas in Cox's Bazaar District,* Dhaka, Bangladesh. https://fscluster.org/coxs-bazar/document/assessment-fuel-wood-supply-and-demand

Rahman, Mahmudur, Mostafizur Rahman, Tamanna Akter Tanu & Masuder Rahman. 2012. Spatial Environmental Impact on Land Degradation in Bangladesh. *Asian Journal of Applied Science and Engineering*, 1, 84-90. https://www.academia.edu/11039482

Ritu, S., Jalal, R. and Henry, M. 2018. Potential areas of landscape restoration interventions within and around refugee camps of northern part of Cox's Bazar South Forest Division. *FAO and Bangladesh Forest Department (BFD)*, Dhaka, Bangladesh. https://www.fao.org/3/ca3659en/ca3659en.pdf

Shoaib, J. U. 2018. HANDS ON WOCAT TOOLS. World Overview of Conservation Approaches and Technologies (WOCAT) and Department of Environment DoE, Bangladesh. https://www.wocat.net/library/media/148/

Further maps on land degradation and potential restoration within and around refugee camps of northern part of Cox's Bazar South Forest Division in can be found under:

http://www.fao.org/3/ca3364en/ca3364en.pdf
http://www.fao.org/3/ca3659en/ca3659en.pdf
http://www.fao.org/3/ca3365en/ca3365en.pdf
http://www.fao.org/3/ca3053en/ca3053en.pdf
http://www.fao.org/3/ca3363en/ca3363en.pdf
http://www.fao.org/3/CA2920EN/ca2920en.pdf

3.3 Bosnia and Herzegovina

Bosnia and Herzegovina is administratively divided into two entities: the Federation of Bosnia and Herzegovina and the Republic of Srpzka (Figure 7). Within this division is also the Brcko District of Bosnia and Herzegovina, which does not belong to either of the entities: it is a self-governing district under the sovereignty of Bosnia and Herzegovina. The lowest level of political division of Bosnia and Herzegovina comprises the municipalities.

FIGURE 7
Administrative division of Bosnia and Herzegovina into Republika Srpska entity (1), Federation of Bosnia and Herzegovina entity (2), Brčko District (3)

Source: geoBoundaries, 2020. https://www.geoboundaries.org

Federation of Bosnia and Herzegovina

Implementing Institution: Federal Ministry of Agriculture, Water Management and Forestry and Faculty of Agricultural and Food Sciences, University of Sarajevo

CONTEXT

The Federation of Bosnia and Herzegovina is predominantly mountainous. About 84 percent of Federation of Bosnia and Herzegovina has a gradient of more than 13 percent and some 40 percent of the soil is very shallow, meaning that the land requires special care and management (Čustović *et al.*, 2020). An estimated 50 percent of the land is affected by some form of degradation. Major land degradation drivers are i) outmigration and rural depopulation; ii) unenforced policies and measures to protect the land; iii) inappropriate land use and agricultural management systems leading to soil erosion and pollution; and iv) climate extremes such as droughts and floods.

In 2017, as a result of the UNCCD LDN process, the Government of the Federation of Bosnia and Herzegovina tasked the Federal Ministry of Agriculture, Water Management and Forestry as well as cantonal ministries to work on the development of land protection policies, to introduce and promote the concept of LDN and to incorporate it in the process of planning and future development. The goal of achieving LDN by 2030 is very challenging and to that end a multistakeholder LDN Working Group was established and land use studies were initiated to prepare a thematic database and a land cover/ land use map. The database also comprises agroecological zoning maps, showing the suitability of land for specific agricultural crops.

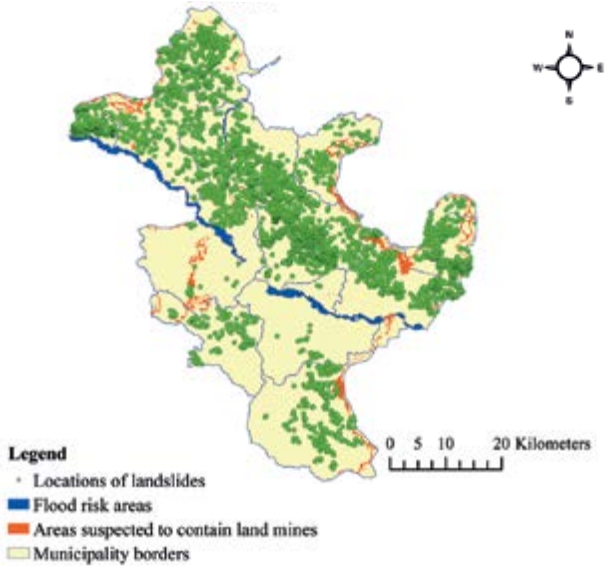
MODULE 3

Identification of priority areas for SLM interventions

Based on the results of the land use studies, the LDN Working Group identified two "most important land degradation hot spots": Tuzla canton (anthropogenic influences) and Herzegovina-Neretva canton (natural influences, drought, and fires, followed by erosion as a result of degradation processes).

Tuzla canton is the country's industrial and mining centre and therefore the area with the largest degraded surfaces in Federation of Bosnia and Herzegovina (Stjepić Srkalović *et al.*, 2019). The canton is also under pressure from climate extremes: drought and floods. Degraded land is a result of strip mining, the disposal of waste material and the deposition of ash from the thermal power plant, the disposal of municipal and industrial waste, the construction of settlements, industrial and infrastructural facilities as well as erosion and landslides (Figure 8).

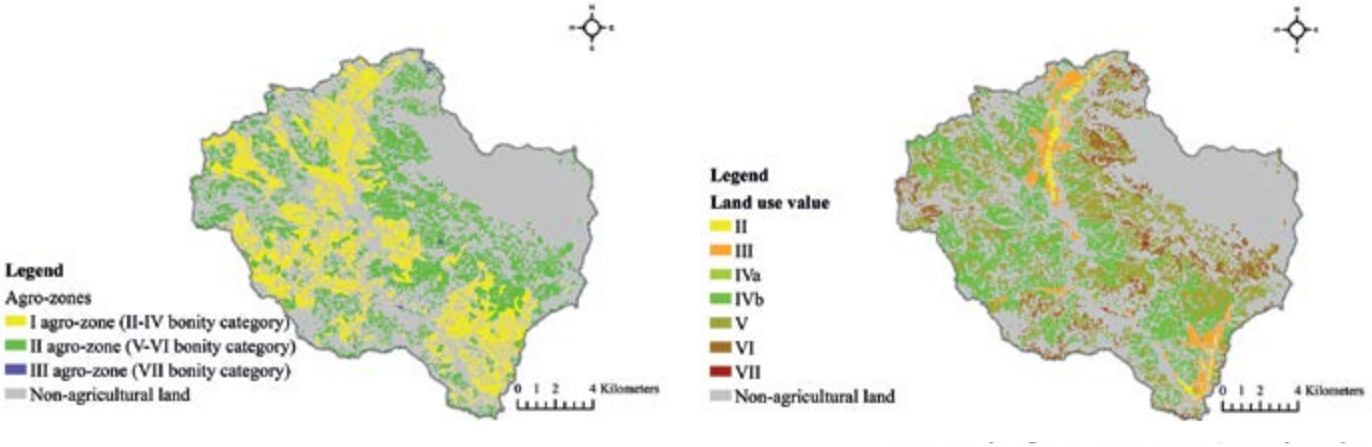
FIGURE 8
Areas with the highest degree of land degradation in Tuzla canton



Source: Čustović H., Ljuša M., Schlingloff S. 2020. *Sustainable land management – approaches and practices in Bosnia and Herzegovina.* University of Sarajevo. https://www.wocat.net/library/media/240/

Based on a national/ subnational consultation and land degradation and SLM assessment, nine priority municipalities in Tuzla canton were identified: Tuzla, Gradacac, Gracanica, Banovici, Sapna, Zivinice, Kalesija, Kladanj, Srebrenik. In Herzegovina-Neretva canton, Ravno municipality was selected. Land use studies of the nine municipalities provided an inventory of the state of land resources, which subsequently served as a basis for defining hot spots and bright spots in these municipalities. A multistakeholder working group for Tuzla canton was established (including land users) to identify good SLM practices, apply the Participatory Land Use Development (PLUD) and prepare the Cantonal Mainstreaming Strategy.

FIGURE 9
Srebrenik municipality – agrozones map (left) and map of land use value (right)



Source: Custovic H., Ljusa M, 2018. *Land capability study for Municipality of Srebrenik.* Faculty of Agriculture and Food Sciences, University of Sarajevo.

MODULE 4

Land capability studies for spatial planning, land protection and sustainable production

Land capability studies and environmental strategies are the most important basis for mainstreaming LDN into land protection policy. A decree[7] prescribes the obligation of producing land capability studies and maps. By using defined land use value and soil bonity (i.e. soil quality) categories, land capability defines the natural potential of soils in terms of agricultural and food production and defines the zones for various land use types. Soil land use value (divided into three agrozones) and soil bonity categories (divided into 8 categories) in accordance with the Law on Agricultural Land. are the following. Category I representing the best quality soils and Category VIII the lowest.

- Agrozone I (Category I-IV soils), with land solely intended for agriculture
- Agrozone II (Category V-VI soils), land that for construction purposes after the conversion of use
- Agrozone III (Category VII-VIII soils), land that has little or no use for agriculture

Land capability studies have been prepared for the selected nine municipalities of Tuzla Canton with the aim of "balancing" land use. Figure 9 shows agrozones and land use value for Srebrenik municipality.

This classification protects the most valuable agricultural land used for food production. Areas of agricultural land cannot be reduced or used for non-agricultural purposes.

Promoting SLM innovations and land consolidation

Over 130 SLM Technologies from (mainly) European countries with potential for Bosnia and Herzegovina were selected from WOCAT's Global SLM Database. Taking into account the different climate zones in Bosnia and Herzegovina, the following key SLM Technologies were selected by the project team from that list:

- Cultivation of blueberries on infertile/ degraded soils
- Addressing shallow landslides by using wooden pole structures
- Contour ploughing
- Fish bone structures for erosion protection
- Agroforestry
- Construction of water reservoirs
- Construction of irrigation systems
- Flood protection, rehabilitation and regulation of river basins and tributaries
- Vegetated buffer strips

In addition, the SLM Approach "land consolidation" was prioritized. The promotion of the selected SLM Technologies and Approach was undertaken during WOCAT introduction workshops in Federation of Bosnia and Herzegovina, in consultative meetings, conferences and roundtables. In order to substantiate the performance of SLM measures, demonstration sites for three of the most promising (as selected by the stakeholders) Technologies were set up. These were as follows:

[7] For additional information, please see: Official Gazette of the Federation of B&H, No. 63/04 and No. 50/07

Cultivation of blueberries using plant pots

Cultivation of blueberries using plant pots on degraded soils of the disposal sites of the Djurdjevik coal mine. This Technology has multiple benefits and contributes to socioeconomic development in the region. The demonstration site was established in cooperation with the coal mine and Zivinice municipality who are responsible for its maintenance.

©Milenko Blesić

Row cultivation of blueberries in plant pots. Živinice municipality.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4126/
https://qcat.wocat.net/en/summary/5189/?as=html

Fish bone structures for erosion protection

Fish bone structures for erosion protection was demonstrated in the municipality of Banovici in cooperation with the municipality. The Technology is applied where households are affected by erosion and has the advantage of simple application and low cost for establishment. Wooden pole structures are placed in parallel, to reduce shallow landslides (2–3 m) in relatively small surfaces. Can be combined with drainage system for better results.

©Archive of the Kladanj municipality

Construction of wooden structures to stop the landslide in Borak, Kladanj municipality.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4285
https://qcat.wocat.net/en/summary/5190/?as=html

Contour ploughing

Contour ploughing – for the entire country. The idea to promote this Technology originated from the Global SLM Database consultation. The way land is cultivated (up and down the slope or along building capacity of farmers contour) has a strong influence on erosion. Training of farmers is crucial as only a small number are ploughing along the contour.

©Melisa Ljuša

Contour ploughing and training of farmers in Srebrenik municipality.

Land consolidation

One of the most frequently mentioned constraints for agricultural development in Federation of Bosnia and Herzegovina is fragmentation of land holdings, which is directly related to and affecting SLM. Although the Law on Land Consolidation of Federation of Bosnia and Herzegovina was adopted in 2016, very little progress has been made. Land estates are extremely fragmented, and the Law on Succession does not treat agricultural land differently from other forms of property, and this leads to further fragmentation. This situation makes SLM difficult to implement and more expensive.

Land consolidation integrates spatial-planning, legal, organizational, economic and technical measures to re-allocate and group spatially fragmented and scattered land parcels into one or several larger pieces. It involves three main phases:

1. Preparation: assessment of the state of the land and a participatory feasibility study.
2. Second phase: negotiation and exchange of fragmented parcels of land.
3. Final phase: preparation of legal arrangements, including an updated cadaster.

Land consolidation efforts supported by the Herzegovina-Neretva Government had already been initiated in Ravno municipality (a feasility study was carried out in 2008), where the average parcel size is 0.145 ha and the road network is poor or non-existent. The results of the land consolidation process of the Donja Luka site in Ravno municipality are shown in Figure 10.

As shown in Table 5 land consolidation contributed to a significant decrease in the total number of parcels, and in the average number of plots per landowner, and an increase in the average parcel/ piece size.

TABLE 5
Parcel and owner number and average size of parcel before and after land consolidation

	Before land consolidation	After land consolidation
No. of parcels	744	127
No. of owners	121	116
Average no. of parcels per owner	6.15	1.10
Average parcel size	0.13 ha	0.80 ha

Source: Čustović H., Ljuša M., Schlingloff S. 2020. *Sustainable land management – approaches and practices in Bosnia and Herzegovina.* University of Sarajevo. https://www.wocat.net/library/media/240/

In addition to the visible metric indicators, it should be noted that the newly formed parcels were more regular in shape and had an access road (see Figure 10). The market value of the new plots increased due to the possibility of more competitive production as well as access to the roads. After land was consolidated, the municipality focused on enabling intensive and sustainable production including by renewing the irrigation system. The municipality aims to keep local people in the municipality and ensure an economic basis for a living. Although implemented in a very small (pilot) area, outcomes raised great interest and willingness of other land users to become part of a land consolidation process. Other cantons and local communities are very interested in the process, even though it is expensive. The new Federal Law on land consolidation may facilitate implementation and funding of land consolidation in the future.

MODULE 5

Participatory land use development

For the purpose of developing the mainstreaming strategy the adapted Participatory Land Use Development (PLUD) methodology tested in 16 Bosnia and Herzegovina municipalities was applied (Biancalani *et al.*, 2004).[8] The PLUD process was followed, supported by land capability maps and ecological-economic and agroecological zoning, to identify priority areas for SLM interventions to prevent and reduce land degradation and rehabilitate degraded land. Dialogue on SLM was facilitated with municipalities, including SLM in relevant planning documents.

FIGURE 10
Donja Luka site, Ravno municipality: before (left) and after (right) land consolidation.

Source: Čustović H., Ljuša M., Schlingloff S. 2020. *Sustainable land management – approaches and practices in Bosnia and Herzegovina.* University of Sarajevo. https://www.wocat.net/library/media/240/

[8] *Note:* PLUD was developed within FAO project "Inventory of Post War Situation of Land Resources in Bosnia and Herzegovina" (GCP/BIH/002/ITA). "Participatory Land Use Development in the municipalities of Bosnia and Herzegovina" — Guidelines available at: https://www.researchgate.net/publication/324123882_Participatory_Land_ Use_Development_in_the_municipalities_of_Bosnia_and_Herzegovina_-_Guidelines

MODULE 1

Participatory Land Use Development as a tool for SLM mainstreaming

The process of developing the mainstreaming strategy gathered stakeholders from cantonal and local levels in a SLM working group at the level of the Tulza Canton. The strategy aimed at integrating LDN goals and measures, as well as incorporating SLM into the two most important cantonal documents: The Tuzla Canton Development Strategy and the Cantonal Land Management Plan. At the municipal level, the strategy development process has helped to promote SLM practices locally, and to scale them out to other areas of the canton. This mainstreaming development procedure helped in understanding the problems at the local level, as well as the way municipalities in the Sprece River Basin are linked from the point of view of joint problems, impacts (especially in neighboring municipalities), possible solutions and therefore joint cooperation to overcome common problems. The cooperation between the Tuzla Canton Ministry of Agriculture, Water Management and Forestry and municipalities has also been strengthened.

The working group prioritized the following measures for the canton during the development of the Mainstreaming Strategy:

- remediation of degraded land;
- comprehensive approach for protecting land from various degradation processes, especially water erosion in hilly and mountainous areas;
- a sustainable water supply for agriculture and the population in hilly/ mountainous areas;
- construction of flood protection infrastructure; and
- development of land capability study (soil quality).

As these are significant measures that require major investment for Tuzla region a focus was put on the following SLM measures:

1) those that make a significant contribution to the local community as a whole, through capital investments led by institutions (e.g., construction of irrigation systems, land consolidation);
2) technologies that can make a major contribution at farm level, which are not expensive and can be easily implemented (e.g. contour ploughing, fish bone structures for protection against erosion).

In order to demonstrate the effectiveness and utility of SLM, building capacities of stakeholders of stakeholders from farmers to decision makers is needed. Experience shows that education about SLM is crucial as well as dissemination of information. Furthermore, to increase visibility, media campaigns were held in the most popular and mostly read daily newspaper "Oslobodjenje"[9], TV (BHT1, Al Jazeera[10], Tuzla Canton, N1) and on Radio Federacija BiH and a training on SLM and land degradation was organized for journalists, including field visits.

Federation of BiH entity: knowledge products, links and references

Bosnia and Herzegovina country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/bosnia-and-herzegovina

Bosnia and Herzegovina SLM practices documented under the DS-SLM project: https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_BIH&filter__qg_funding_project__funding_project=1

Biancalani R., Brown D., DeWit P., Clementi S., Ljuša M. 2004: Participatory Land Use Development in the Municipalities of Bosnia and Herzegovina-Guidelines, FAO and Cooperazione Italiana http://www.fao.org/fileadmin/templates/nr/images/resources/pdf_documents/PLUD_Guidelines_final_eng_1_.pdf

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Čustović H., Ljuša M. 2018. Final report of the LDN Target Setting Programme – Federation of BiH. https://knowledge.unccd.int/sites/default/files/ldn_targets/2019-01/Bosnia%20and%20Herzegovina%20LDN%20TSP%20Country%20Report%20and%20Commitments.pdf

Čustović H., Ljuša M. 2018. Land capability study for Srebrenik Municipality. Faculty of Agricultural and Food Sciences University of Sarajevo.

Čustović H., Ljuša M. 2017. Land capability study for Tuzla City. Faculty of Agricultural and Food Sciences University of Sarajevo.

Čustović H., *et al.* 2008. Feasibility study - consolidation of land in Popovo polje.

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[9] For additional information, please see: https://www.oslobodjenje.ba/dosjei/teme/gubi-li-bosna-i-hercegovina-tlo-pod-nogama

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The Republic of Srpska

Implementing Institution: Ministry of Agriculture, Forestry and Water Management and Institute of Agroecology and Soil Science, Faculty of Agriculture, University of Banja Luka (Republic of Srpska).

CONTEXT

The Republic of Srpska is characterised by heterogenous soil types. As a result of unsustainable land use, there are various types of land degradation. The main causes of this degradation are surface damage through mining, industry and road construction. Soil erosion and landslides are common (Markovic and Lukac, The Republic of Srpska, 2011).

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Coal mining and disposals in Gacko, Herzegovina (top). Furrow water erosion in Manjača, north the Republic of Srpska (bottom).

In the Republic of Srpska there is a low level of awareness amongst decision-makers about land degradation, the importance of land generally – and about SLM. Furthermore, due to socioeconomic crises, there is a pressing lack of funding, leading to a low priority being given to planning and management of land resources. In addition, there are evident inconsistencies in the existing data about land degradation and land resource protection.

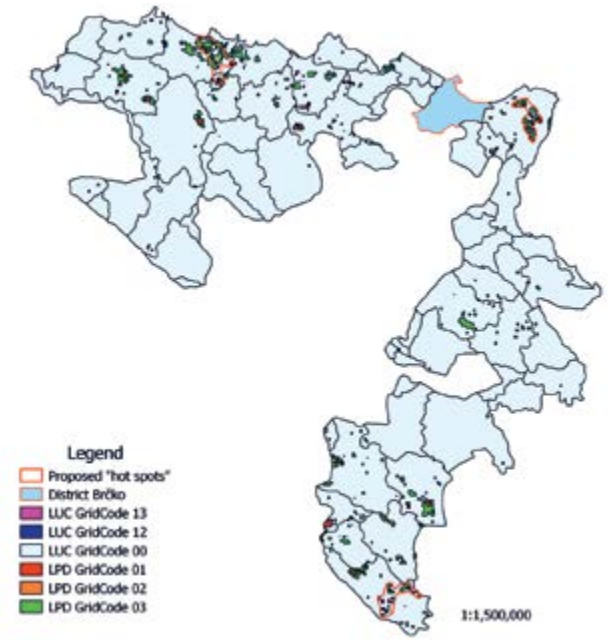
Under the LDN Target Setting Process process, a main conclusion was that the Republic of Srpska does not have reliable soil/ land data aligned with LDN indicators required by UNCCD. Therefore, the LDN working group agreed to use global data, while highlighting the priority to establish a soil monitoring system. A Steering Committee (formed from universities, ministries, municipalities and NGOs) was nominated and accepted at the beginning of the DS-SLM project – and continues to function as an advisory body.

MODULE 3

Selection of priority areas for intervention at municipal level

The selected LDN indicators dataset identified areas with decreased land productivity within the country. Potentially degraded areas were validated in the field and three "hot spots" were identified as in need of urgent intervention. The integration of environmental and socioeconomic aspects placed Herzegovina, Semberija and Lijevče polje (Figure 11) as places of highest priority for future interventions (Kapović Solomun *et al.*, 2018).

FIGURE 11
LDN "hot spots" in the Republic of Srpska



Source: Kapović Solomun, M., N Barger, A Cerda, S Keesstra, M Marković. 2018. Assessing land condition as a first step to achieving land degradation neutrality: A case study of the Republic of Srpska. *Environmental Science & Policy* 90, 19–27. https://www.sciencedirect.com/science/article/pii/S1462901118306580

For the DS-SLM project, the following criteria were applied for the selection of pilot areas:

- areas of priority for the Government of the Republic of Srpska and strategic framework (environmental protection, rural development, forestry etc.);
- severity of land degradation;
- areas of intensive agriculture production;
- agricultural/ forest land under public ownership;
- areas endangered by the most important land degradation drivers: floods, drought and wildfires;
- ecologically vulnerable areas, specifically karst, flood and drought-affected regions;
- number of farmers (women) dependant on the land;
- readiness of local governments to cooperate and support activities;
- possibility of exchanging knowledge with other local communities; and
- active participation of local stakeholders in capacity building and willingness of local stakeholders to participate in training, educations, and site visits.

The priority municipalities selected were Trebinje, Šamac and Pelagićevo, which have similar land degradation problems, existing investment from the Government of RS, potential for scaling out, and willingness of local communities to participate.

MODULE 4

Selection of sustainable land management solutions for government-supported scaling-out

In the three municipalities local stakeholder training workshops for documenting and compiling existing and innovative SLM practices were conducted. An inventory of existing SLM practices was made and for promising and potential practices, WOCAT's Global SLM Database was consulted. Twenty-six relevant and useful SLM Approaches, and 48 SLM Technologies were identified from different countries, including:

- Sustainable water resources management for irrigation [Italy]
- Drip irrigation [Türkiye]
- High-altitude afforestation for erosion control [Armenia]
- Integrated farming on irrigated lands for adaptation to changing climate [Tajikistan]
- Afforestation with Pinus halepensis after the fire of 1979 [Spain]
- Community resource planning, using GIS community asset maps & vulnerability atlases [Dominica]

Some examples of the SLM Technologies, which were selected and promoted in the Republic of Srpska, are as follows:

©Mihajlo Marković

Irrigation of potato in Lijevče field, Gradiška municipality, north Republic of Srpska.

©Mihajlo Marković

Terraces, against water erosion, made by gradual plowing, Herzegovina, Gacko municipality, Republic of Srpska.

©Mihajlo Marković

Circumferential (diversion or interception) canals to protect the agricultural area in the plain from mountain waters, Nožičko, Srbac municipality, north Republic of Srpska.

©Ilija Komljenović

Liming of soil, with the aim to remove excess soil acidity, repair soil structure and water-physical properties and provide plants in Ca, Gradiška municipality, Republic of Srpska.

©Vasiljević Mirela

Afforestation of bare land in the Herzegovina region, a vulnerable area characterized by karst landscapes. Afforestation increases water-infiltration and holding capacity of the soil and reduces land degradation.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4367/
https://qcat.wocat.net/en/summary/4672/?as=html

Using co-financing from the World Bank-International Development Association (IDA) and the Ministry of Agriculture, Forestry and Water Management (MAFWM) – together with a private company – demonstration sites and landscapes for testing and disseminating SLM practices were established in the three municipalities. The demonstration sites were used for measuring and monitoring effects and impacts of SLM technologies both for the needs of farmers and for the researchers.

MODULE 6

SLM implementation and scaling out

The following SLM technologies were successfully scaled-out on the territory of Republic of Srpska:

- Irrigation scaled-out to other municipalities by a public call resulting in expansion of irrigation to 436 ha in Bratunac, 280 ha in Ljubinje, 160 ha in Maglajani, and 620 ha in Bijeljina. On irrigated areas, yields were higher by 35–40 percent (8.1 t/ha compared to 5.8 t/ha).
- Flood protection (construction of embankments on the Sava and Drina rivers; maintenance of water channels etc.).
- Soil amelioration for natural forest regeneration on 275 ha.
- Reforestation by planting seedlings of 232 ha.
- Control of weeds and removal of undesirable forest species on 232 ha.
- Hoeing of seedlings on 93 ha.
- Improvement of coppice forests on about 120 ha.

MODULE 1

SLM Mainstreaming strategy and environmental education

An institutional analysis was carried out to identify programmes, incentive mechanisms, local financing mechanisms and environmental funds with their geographical and thematic areas of intervention, in order to support implementing and scaling out of best practices. SLM objectives, targets, obstacles, barriers, impacts to achieve and opportunities for scaling out SLM practices in line with existing state and entity strategies, relevant legislation for future activities and implementation of SLM measures in RS were all analysed.

The objectives of the mainstreaming strategy for the Republic of Srpska were defined as:
- establishment of an inter-sectoral advisory body;
- mainstreaming SLM into incentive mechanisms and funds;
- territorial planning; and
- capacity building.

Partnerships and mechanisms for mainstreaming and scaling out SLM, taking into account assessment findings at national/ local levels (e.g. integrating activities into national investment plans, under intersectoral planning approaches) were established during a set of consultative meetings and workshops where different ministries, the fund of environmental protection and energy efficiency, a public company, local community representatives and NGOs came together. Previously developed partnerships for SLM implementation were encouraged and operationalized with extension programmes, financial institutions, incentive mechanisms, programmes and projects in order to implement and scale out best practices.

Achieving SLM and LDN requires incorporation of these concepts in relevant legislation and strategies, promotion and awareness-raising, the involvement of local communities in SLM and LDN processes, and decision-makers to be the driving force behind these concepts and processes. To this effect, the importance of SLM was promoted through media (national TV stations) and social networks (YouTube), websites of the Government of the Republic of Srpska, relevant ministries and other institutions and local communities.[11] Promotional materials on SLM best practices for sharing and disseminating knowledge were created and distributed to workshop participants.

The "STOP LAND DEGRADATION" educational and promotional activity was implemented in cooperation with the government, universities, the NGO "Mother Nature" and FAO, on the occasion of "World Day of Soil" in kindergartens and schools of the Republic of Srpska. Promotional activities continue to be implemented and are considered key for mainstreaming and scaling out.

©M. Kapovic Solomun

Promotional activities in a kindergarten.

The Republic of Srpska: knowledge products, links and references

Bosnia and Herzegovina country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/bosnia-and-herzegovina

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https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_BIH&filter__qg_funding_project__funding_project=1

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http://radiotrebinje.com/posumljavanje-hercegovine-kao-strategija-odrzivog-upravljanja-zemljistem/?pismo=lat
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https://www.youtube.com/watch?v=eTnVftrfbsc

3.4 China

Implementing Partner: State Forestry and Grassland Administration

CONTEXT

Much of the land area of the The People's Republic of China (PRC) – especially in the western provinces – lies in arid or semi-arid zones and is thus highly vulnerable to drought and desertification. A combination of climate change impacts, unsustainable agricultural practices, deforestation and mismanagement of water resources has led to some 27 percent of the country suffering from land degradation, or more than 2.6 million km^2. The direct annual economic losses due to wind erosion alone – from decreased agricultural production and the economic costs of dust and sandstorms – are estimated to be equivalent to nearly 1 percent of the country's GDP (GEF, 2008). Land degradation seriously affects sustainable development. In the northwest of Western China wind erosion is the main problem, leading to "sandification"; in the Loess Plateau and the Karst regions it is mainly water erosion that leads to land degradation.

In 2004, the Chinese government and the Global Environment Facility (GEF) launched a first of its kind in the world partnership programme, the PRC-GEF Partnership to combat Land Degradation in Dryland Ecosystems. An independent review of the first ten years (Critchley, 2013) demonstrated that there was evidence of strong provincial programmes and large expanses of improved SLM – some 900 000 hectares – achieved under an integrated ecosystem management approach. Several GEF projects have been accommodated directly under the umbrella of this partnership, or have been closely related, such as the GEF/ FAO LADA (from 2006 to 2010) and the GEF/FAO DS-SLM projects, with a common goal of improving land and water resources, reducing poverty, increasing incomes, combating climate change and bringing together agencies for coordinated action in Western China.

MODULE 2

Assessment of land degradation at the national level

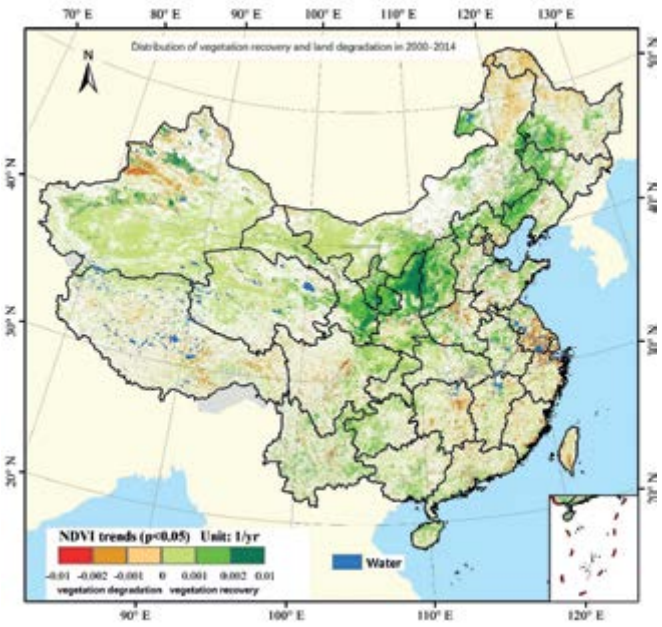
Based on the results of China's five-year national land degradation and desertification monitoring and assessment (last assessment in 2014), and long history and experiences to combat land degradation, the arid and semi-arid areas were identified as priority regions for intervention, focusing on grassland, forestland and deserts. As part of the GEF/ FAO LADA project, a national map was produced based on the analysis of changes in NDVI from 2000–2014 (Figure 12). This map was used in DS-SLM to identify the landscapes and land uses for assessing and reviewing SLM good practices and for identifying provinces for priority intervention, the provinces were: Inner Mongolia, Shaanxi, Gansu and Qinghai.

MODULE 4

Partnership for producing SLM knowledge for scaling out

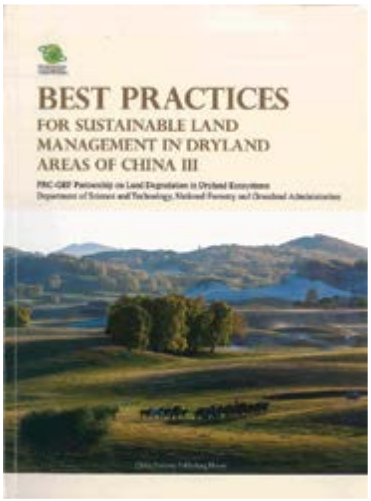
The PRC-GEF Partnership provided the framework to produce three volumes of SLM Best Practices publications – using the WOCAT Questionnaires on SLM Technologies and Approaches and Technology and Approach summary – in dryland areas of China. The selection of 'best practices' for the dryland areas was based on local level land degradation assessments (based on the LADA local methodology).

FIGURE 12
Distribution of vegetation recovery and land degradation in 2000–2014, China



Source: Zan, Guosheng, Haijing Tian, Bang Wang & Guosheng Wang. 2018. *The Strategies, Policies and Methods of Mainstreaming and scaling out Land and Degradation and Sustainable Land Management of China.* Academy of Forestry Inventory, Planning and Design, State Forestry Administration, China. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/china

The third volume of "Best Practices for Sustainable Land Management in Dryland Areas of China" covers the four provinces in Western China: Inner Mongolia, Shaanxi, Gansu and Qinghait (PRC-GEF Partnership, 2018). It presents 27 SLM Technologies and Approaches which were selected by national, provincial and local teams in view of their suitability for mainstreaming and scaling out. They can be classified into different groups such as shifting sand fixation by barriers and silvoculture, soil and water conservation in farmland and by tree planting, seedlings breeding and prevention, land degradation control and "green development" and in the Karst Region, wetland protection and integrated management of small watersheds.



Source: PPRC-GEF Partnership. 2018. Best Practices for Sustainable Land Management in Dryland Areas of China III. China Forestry Publishing House. Beijing. ISBN 978-7-5038-9786-3.Beijing. ISBN 978-7-5038-9786-3.

Some examples of the documented Technologies and Approaches are presented below.

Salix and tamarisk sand barriers

Sand dunes in the Qinghai province are stabilized by planting 20–30 cm long cuttings of *Salix cheilophila* and *Tamarisk desertorum* or other in spring in ditches arranged in rows or grids. The seedlings that grow into tall and dense forests not only stabilize the sand but also improve the ecological environment.

©Yang Defu

Salix cheilophila afforestation in hilly areas.

Stone dike terraces

The Technology consists of horizontal terraces with a stone ridge suitable in hilly mountainous areas which have enough stones. The terraces increase cultivable land area, allow crop diversification, prevent soil erosion and mitigate disasters due to flooding. Benefits often only become apparent long-term.

©Xie Aiping

Newly constructed stone dike terraces, Gansu province.

Individual-pant drip irrigation

In this Technology, plastic bottles are hung up upside down from the branches of the tree. Holes drilled in the bottle cap control size and rate of water drops dripping towards the roots. *Zanthoxylum planispinum* var. *dintanensis* is a drought tolerant variety unique to Guizhou. It plays an important role in rocky desertification control, ecological function improvement, and soil erosion control.

©Luo Ya

Plastic bottles are tied to the branches of winged prickly ash trees (*Zanthoxylum planispinum* var. *dintanensis*), Guizhou province.

Planting of windbreaks

On sandy soils mixed afforestation of windbreak species not only reduces the damage by wind and sandstorm but also combines animal husbandry with forests, increases the income of farmers and herdsmen through grazing and forage production and prevents diseases and pests through mixed plantation. This Technology is simple and easily promoted.

©Shusen Wang

Mixed windbreak plantation for conservation grazing, Inner Monglia.

MODULE 1

Assessment of land degradation at the national level

To identify barriers and opportunities for mainstreaming and scaling-out SLM, surveys of existing SLM key decision-making processes at all levels were conducted, policies reviewed and national SLM targets identified. The results were presented in a national SLM report (2018) in the form of policy recommendations. A country-wide operational strategy for mainstreaming and scaling-out of SLM through national policy instruments came into operation in 2017. The operational strategy of SLM was cross-cutting and has been included in policy, law, and science and technology projects.

The SLM scaling-up planning team first discussed the strategy elements with local government, land stakeholders and farmers – focusing on plans to mainstream and scale out SLM practices in future national projects. A SWOT analysis was done at different levels to identify bottlenecks, gaps and opportunities for the promotion and scaling-out of SLM. Certain best practices were implemented in suitable landscapes, and a strategy was developed showing how, who, where, and what could be done for each level of intervention for mainstreaming and scaling out SLM in China. Box 9 sets out the recommendations for scaling out SLM in Wengniute Banner developed by the Wengniute Forestry and Grassland Administration and stakeholders from Wulanaodu county (Report 2019).

BOX 9: Planning and implementing SLM in Wengniute Banner

(1) Formulate plans for sandification prevention/ control, and a related regional development strategy.

(2) Establish mechanisms for inter-sectoral governmental coordination and stakeholder cooperation.

(3) Establish large-scale and specialized sand control methodologies.

(4) Establish multi-source funding mechanism for prevention and control of sandification.

(5) Adopt more effective sandification control models.

(6) Fortify technological support for improved treatment measures.

(7) Formulate approaches and methods for implementation.

(8) Carry out training and capacity building.

(9) Strengthen SLM publicity.

Mainstreaming and scaling-out SLM best practices in China can be catalysed through targeted action on the ground and strategic decision-making from local to national levels. Hence, capacity building and awareness raising about SLM for farmers, private companies and local government in priority landscapes is key. In addition, it is essential that there is inter-sectoral partnership and cooperation with government at all levels, enhanced exchange with local enterprises and farmers, and strengthened cooperation with research and technical extension.

China: knowledge products, links and references

China country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/china

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3.5 Colombia

Implementing Partner: Unit for Rural Agricultural Planning, Ministry of Agriculture and Rural Development

CONTEXT

Fifty percent of mainland Colombia suffers from some degree of soil erosion. Five percent of the land is affected by salinization and 24 percent is susceptible to desertification. Land degradation causes multiple problems including soil compaction, decreased soil fertility, siltation and pollution. The main drivers of land degradation are unequal distribution of land, leading to land conflicts, and dominance of private interests over the collective good, as well as unplanned and inappropriate management of land – and deforestation.

A multitude of policies and programmes form a framework for SLM processes and projects. These include: (a) the National Policy for the Sustainable Management of Soils – Ministry of Environment and Sustainable Development (MADS); (b) the Policy of Productive and Social Management of Rural Property – Ministry of Agriculture and Rural Development (MADR), Unit for Rural Agricultural Planning (UPRA); (c) the National Programme for the Monitoring of Soil and Land Degradation – Institute of Hydrology, Meteorology and Environmental Studies (IDEAM); (d) the National Plan for Ecological Restoration, Rehabilitation and Recovery of Degraded Areas – MADS; and (e) the National Development Plan – National Planning Department (DNP). Both the Ministries of Environment and Agriculture are responsible for managing and implementing actions related to land degradation and SLM. This illustrates a challenge and opportunity: on the one hand the importance of land degradation and SLM is well recognised, on the other hand it means a coordination challenge to develop and agree a joint framework to address land degradation issues and promote SLM solutions.

MODULE 1

Establishment of an institutional technical group to guide evidence-based decision-making

For the implementation of DS-SLM activities in Colombia, an agreement between MADR-UPRA and FAO was established, and an institutional technical group (a "roundtable"), comprising eleven national institutions, was established to guide the SLM mainstreaming and scaling out process, and to validate and promote methodologies and technical tools. A specific role in the technical group was played by academic and institutions, namely: (a) the National University of Colombia, Faculty of Agronomy; (b) the University of Applied Sciences and Environment; (c) the Institute of Geography Agustín Codazzi responsible for the country's soil studies; (d) Agrosavia (the Agricultural Research Institute) responsible for research and extension in agricultural production; and (e) IDEAM, responsible for environment and land degradation studies. The institutional technical group created by the DS-SLM project has continued its activities through MADS and IDEAM beyond the project timeframe as focal points of the UNCCD.

MODULE 2

Inclusion of land degradation evidence in departmental development plans

A subnational assessment was carried out in the Caribbean region of Colombia, in the four departments of Cordoba, Sucre, Bolívar and Atlántico, covering an area of about 6.5 million hectares.[12] This area lies in a dry and semi-humid tropical *zonobioma*, where less than 20 percent of the area is still covered with natural forests and shrubs. Vast areas are used for livestock, others for the production of maize, cotton, yucca, yams, palm oil and fruit crops. Some silvopastoral and agroforestry practices exist. The region is highly degraded: 70 percent shows some degree of water erosion and 25 percent some degree of salinization. According to climate scenarios, the region could face a decrease in precipitation of 20 percent by 2030.

This area was also selected for its post-conflict social conditions. It is included in the Peace Accords and is a priority in the development plans, with an emphasis on the land – namely the territorial development programme (*programa de desarrollo con enfoque territorial*) of the Montes de María region. The institutions of the roundtable agreed on the need to carry out a land degradation assessment and implement SLM practices due to the current rapid rate of degradation.

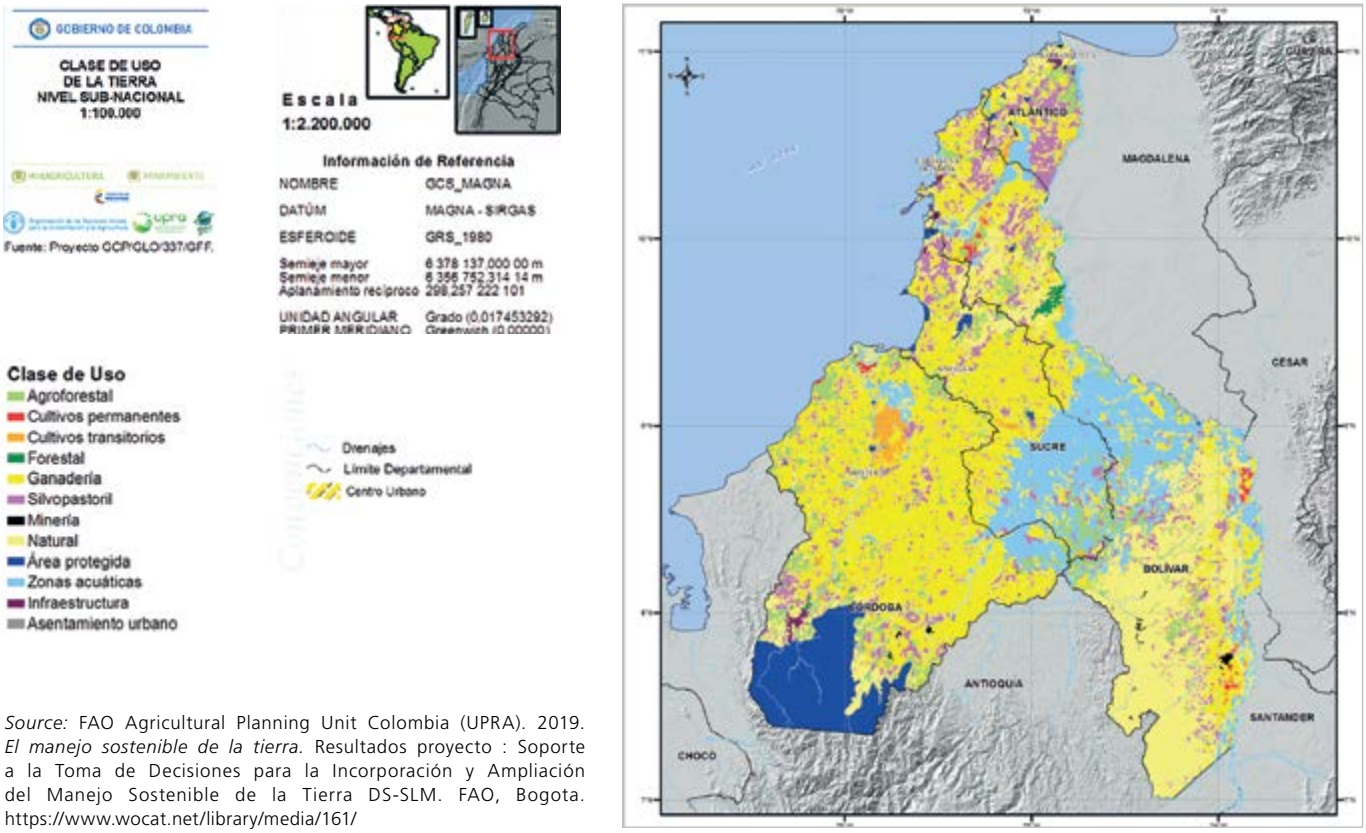
Existing national cartography material from IDEAM and other national institutions was used (e.g. national erosion map, national salinization map, national land cover map, and the national ecosystem map) to develop a land use systems (LUS) map (Figure 13) for the selected region, and to carry out the land degradation and SLM assessments, following the FAO–WOCAT QM methodology, in collaboration with six regional/ local environmental institutions. The results of the land degradation assessments, showing physical, chemical and biological degradation as well as causes and impacts of LD, were validated through expert workshops and field visits (Figure 14).

A stakeholder workshop was held in the Caribbean region to validate and disseminate the results, with the participation of environmental and agricultural sector institutions from the region, including unions and land users. A consensus was reached on new trends in land use and sites of the greatest degradation, as well as identifying agriculturally-related causes.

The findings were disseminated and provided to the departmental and environmental authorities, in order to be incorporated into development plans, departmental land use plans, and agricultural production and ecological restoration programmes. The Government of the Department of Atlántico incorporated the land degradation assessment results into the formulation of their land use plan and agricultural plan. Some municipalities took the results into account for development of their land use plans.

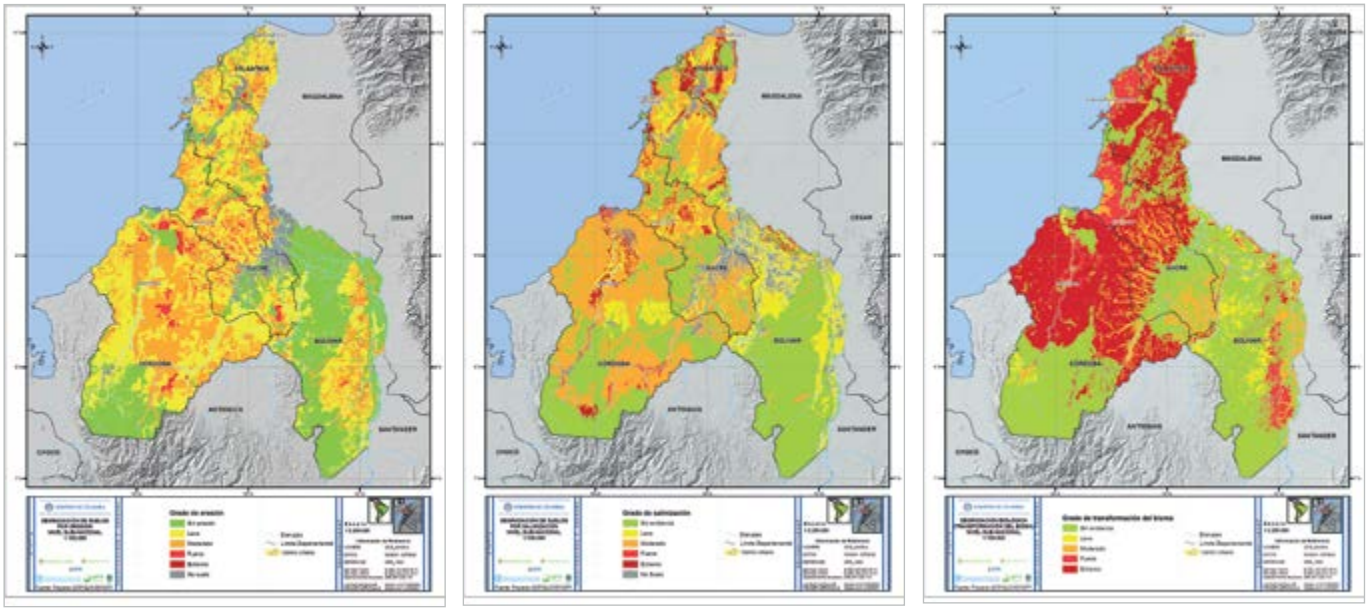
[12] *Note:* Due to the high ecological diversity and large size of the country, it was decided not to include a national assessment which would require significant economic resources and an extended time period.

FIGURE 13
Land use system map in the departments of Cordoba, Sucre, Bolívar and Atlántico



Source: FAO Agricultural Planning Unit Colombia (UPRA). 2019. *El manejo sostenible de la tierra.* Resultados proyecto : Soporte a la Toma de Decisiones para la Incorporación y Ampliación del Manejo Sostenible de la Tierra DS-SLM. FAO, Bogota. https://www.wocat.net/library/media/161/

FIGURE 14
Physical, chemical and biological degradation in the departments of Cordoba, Sucre, Bolívar and Atlántico



Physical degradation (erosion)
Low: 67.1%
Medium: 23.7%
High: 4.1%

Chemical degradation (salinization)
Low: 55.6%
Medium: 31.5%
High: 0.6%

Biological degradation (transformation of bioma)
Low: 36.6%
Medium: 13.4%
High: 13.8%

Source: FAO and UPRA. 2019. *El manejo sostenible de la tierra.* Resultados proyecto : Soporte a la Toma de Decisiones para la Incorporación y Ampliación del Manejo Sostenible de la Tierra DS-SLM. FAO, Bogota. https://www.wocat.net/library/media/161/

MODULE 3

Selection of priority landscapes in the caribbean region

Prioritisation of landscapes was based on the results of the subnational assessment, and was done in collaboration with the technical group and the environmental authorities of the Caribbean region, giving particular consideration to areas with:

- post-conflict priority for development in the Peace Accords;
- agricultural use with different land degradation processes;
- current agreement with national planning authority (UPRA) for productive management plans or land suitability zoning;
- projects planning to implement good SLM practices;
- territorial planning instruments with recent information and of adequate scale;
- availability of information and cartography, in particular the degradation assessment;
- representativeness of the area for scaling out SLM practices in other areas of the country – which can then contribute significantly to LDN targets.

As a result, three priority landscapes were selected:

Hills with high erosion risk (Montes de María)**:** Areas of hills and valleys, undulating and flat relief, with a diversity of land uses, erosion and landslides due to deforestation and burning of natural forests. Post-conflict priority areas for development under the Peace Accords.

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Degraded lands in landscape (Montes de María) after burning natural forest (top) and recovery after agroforestry interventions (bottom). Photos are taken in the same region but not in the same place.

Biodiverse wetlands with livestock pressure and salinization risk (Ciénagas del Bajo Sinú)**:** Wetland areas in the lowland with high level of biodiversity. The main use is fishing, but fluctuations of the swamp allow agriculture and livestock on a transitory basis. These activities have caused soil degradation due to salinization, a decrease in flora and fauna, and contamination by agrochemicals. Some people have been displaced by violence, but are returning under the Peace Accords.

Irrigated cotton production with salinization risk *(zonas algodonera)***:** Flat areas of alluvial origin, with high productive potential in the middle and lower part of the Sinu River catchment. These areas have a mechanised agricultural tradition with high levels of agricultural inputs where food crops were replaced by cotton. Biodiversity has been lost, and soils have undergone compaction and salinization. Land degradation and fluctuating international cotton prices have generated an environmental and economic crisis.

At the local level, within the priority landscape (Montes de María) with high erosion risk, a municipality (San Juan Nepomuceno with 63 500 ha) was selected in light of the above criteria, and the mapping of land degradation was repeated in collaboration with five local institutions, experts and land users to understand causes and impacts of LD, and draw recommendations for improving land management. A map was drawn up to show in which land use system what type of intervention is proposed: prevention of land degradation (yellow); mitigation of land degradation (orange); rehabilitation of degraded land (red); and no intervention (green) (Figure 15), following the LDN response hierarchy.

MODULE 4

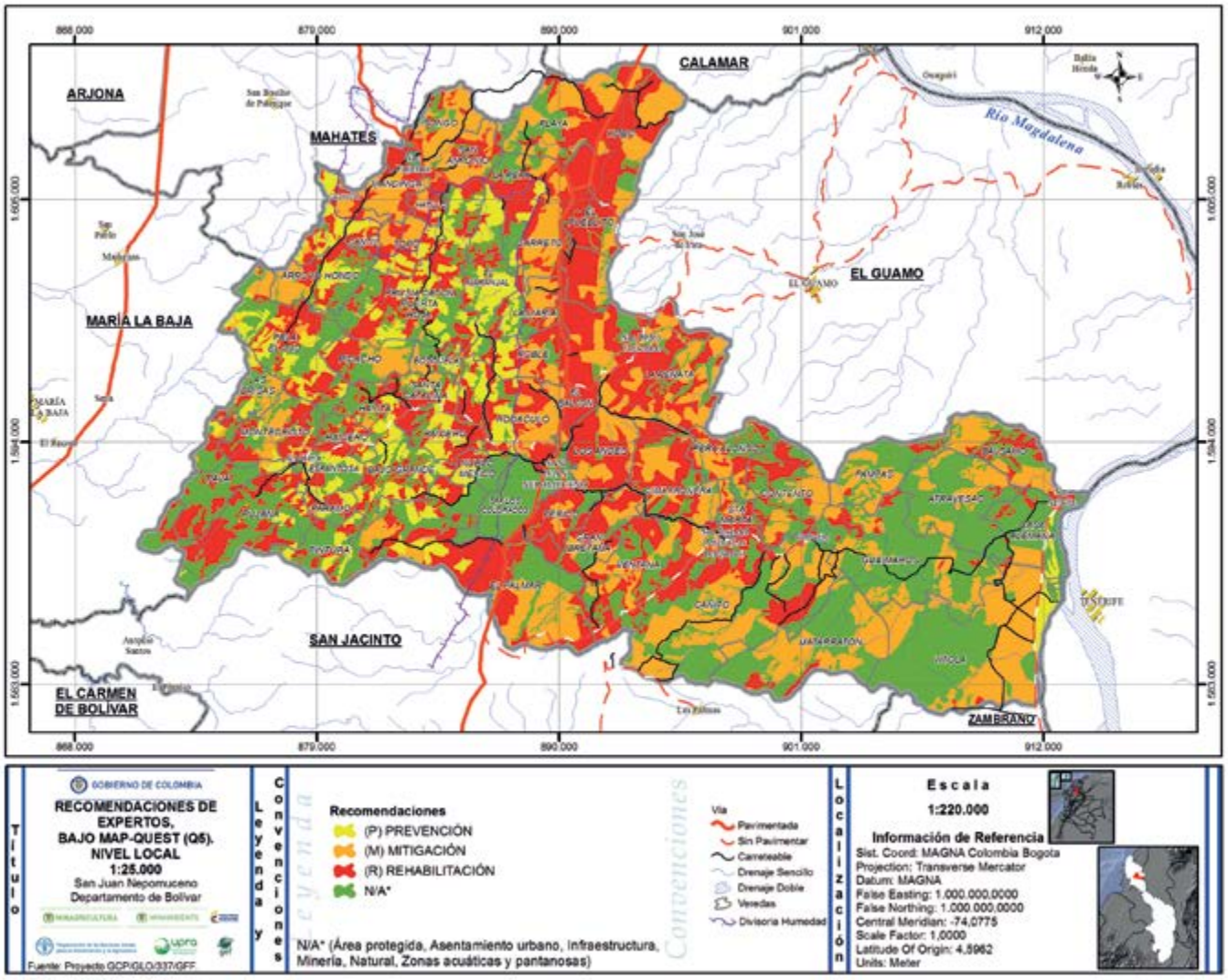
Synergies with local ngos and projects for assessing and scaling out SLM practices

In collaboration with local NGOs, the FAO and the National Natural Parks authorities, all working on ecological restoration and land rehabilitation projects, five sites were identified where SLM practices had been implemented in order to carry out the local level assessment. The aim of the assessment was to demonstrate the impacts of SLM Technologies and provide evidence to convince stakeholders to mainstream SLM, and to support scaling out.

Existing SLM technology groups, responding to the prevailing land degradation types and with high potential for adoption by land users (after a process of capacity building) were identified. These include:

- Silvopastoral systems
- Agroforestry
- Cotton-maize association systems
- Temporary agriculture in wetlands
- Reforestation

FIGURE 15
Map of recommended intervention measures following the land degradation neutrality response hierarchy: prevention (avoid), mitigation (reduce), rehabilitation (reverse)



Source: FAO and UPRA. 2019. El manejo sostenible de la tierra. Resultados proyecto : Soporte a la Toma de Decisiones para la Incorporación y Ampliación del Manejo Sostenible de la Tierra DS-SLM. FAO, Bogota. https://www.wocat.net/library/media/161/

For each of the five technology groups, several relevant SLM Technologies were identified, and eventually, out of a list of 35 Technologies, five Technologies were documented and their impacts assessed.

Silvopastoral system

It is a system consisting of grass (*Brachiaria spp.*) with scattered nitrogen-fixing trees and forage shrubs (*Leucaena leucocephala*) delimited by a live fence of live fig nut (*Jatropha curcas*) to divide the paddocks. It contributes to increase livestock productivity and reduce soil degradation. This Technology was implemented in several cattle farms with low productivity, ranging in size from 15 to 80 hectares, which is the common size range of farms in the Montes de Maria sub-region.

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Comparison of the area where the SLM Technology was implemented (foreground) with neighbouring areas without the Technology (background).
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3898
https://qcat.wocat.net/en/summary/3898/?as=html

Agroforestry system

This tropical agroforestry system is composed of at least 15 species of timber and fruit plants. Some of the species planted are pineapple, banana, bitter palm, cocoa, orange, soursop, mango, avocado, aubergine, bean, vara santa, smoke, guasimo, ebony, cedar and oak. The main purpose of the Technology is to improve production, reduce and prevent soil degradation, protect the watershed and its downstream areas (in combination with other technologies), preserve and enhance biodiversity, reduce the risk of natural disasters, adapt to extreme events and climate change, and create a beneficial economic impact.

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General view of the agroforestry system planted on slopes.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4120/
https://qcat.wocat.net/en/summary/4120/?as=html

Intercropping of cotton and maize

The goal of this Technology is the implementation of sustainable cotton production within family farming. It combines zero tillage, maintenance of organic residues as soil cover, intercropping of cotton and maize, targeted pest control, use of different seed varieties, establishment of subsistence crops (pancoger) for food security and promotion of family farming (inclusion of women and youth). The maize and cotton plants were planted in an arrangement of 4 and 8 rows, respectively, with a distance of 80 cm between rows. In addition to harvesting two products, this arrangement allows for pest control.

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Rotation of maize and cotton crops.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4087/
https://qcat.wocat.net/en/summary/4558/?as=html

'Amphibian' agriculture

This Technology describes the commercial fish farming in ponds integrated with subsistence crops on raised beds, based on the 'amphibian' production system of the Sinu Culture and adapted to the possibilities and current context of the inhabitants of the Ciénaga Grande, lower Sinu River, Caribbean region. Closed ponds were built for fish farming, using the water of the marshes. With the soil extracted from the ponds, raised dikes were formed dividing the ponds and used to plant subsistence crops such as maize, yams, cassava, beans, tomatoes, bananas, coconuts, mangoes, among others.

©Juan Manuel Coneo

Aerial view of ponds for fish farming and various subsistence crops on ridges.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4089/
https://qcat.wocat.net/en/summary/4089/?as=html

Protected regeneration

This Technology includes active and passive reforestation by planting of different tree species and the exclusion of grazing in the area. It is designed and implemented with the objective of protecting the aquifer recharge zones in the Municipality of Morroa, Sucre. The following measures were applied: planting of forest species, building of live fences, application of fertilisers and organic residues and no tillage.

©Luisa Vega

Change in land use from extensive cattle ranching to forestry and agroforestry.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4086/
https://qcat.wocat.net/en/summary/4086/?as=html

An indicator system was designed to quantitatively demonstrate the benefits of SLM Technologies to land users, subnational and national authorities and policy makers. It included:

a) **Cover change** (before and after SLM): A simple monitoring, comparing Google Earth images of pilot sites with areas of 20–70 ha and mapping cover change in GIS (Figure 16, Table 6).

FIGURE 16
Extensive livestock farming with reconversion to agroforestry systems

26 January 2010 (Google Earth)

21 January 2018 (Google Earth)

Source: UPRA and Minagricultura. 2019. *Indice de cobertura de la tierra para los sitios pilotos seleccionados.* FAO Bogota. https://www.wocat.net/library/media/157/

TABLE 6
Percentage and difference of land cover with and without sustainable land management

Silvopastoral livestock	Without SLM (2010)	With SLM (2010)	Difference
Bare and degraded land	49.0%	26.2%	–22.9%
Shrub and/or herbaceous vegetations associations	2.4%	29.7%	27.4%
Grassland (natural and planted)	45.0%	30.7%	–14.3%
Other transitory crops	3.6%	13.4%	9.8%

b) **Impacts on soils** (before and after SLM): Establishing quantitative indicators (soil moisture, soil cover, compaction, organic matter) to complement qualitative soil data in the WOCAT SLM Technologies Questionnaire (Figure 17). This also links to the Guidelines for Soil Assessment produced by the the Global Soil Partnership (GSP).[13]

c) **Impacts on biodiversity** (before and after SLM): Indicators of biodiversity and agrobiodiversity change were used in a simple way, through the number of species used counted for each technology.

The results obtained from the impact assessment helped to show the efficiency of SLM Technologies in view of climate change adaptation and mitigation, and conservation of biodiversity and then led to proposed changes in current land management systems. The results were disseminated to the subnational environmental authorities, as well as the Ministries of Agriculture and Environment, and also to Agrosavia and UPRA, responsible for agricultural planning and research in the country.

During the local level assessment, training sessions and workshops with land users were held in order to demonstrate the beneficial changes related to SLM Technologies: namely improved productivity, recovery of biodiversity, better economic income and eventually, quality of life.

FIGURE 17
Extensive livestock with reconversion process to a silvopastoral system

Source: Vega, Luisa F. 2019. Sistema silvopastoral. WOCAT database. https://qcat.wocat.net/en/summary/3898/?as=html

[13] For additional information, please see: http://www.fao.org/global-soil-partnership

MODULE 1

SLM mainstreaming in territorial development plans

A SLM mainstreaming strategy was formulated following the methodology of the mainstreaming tool (Bastidas Fegan, 2019). The main instruments of policy, planning and financial management of the agriculture and environment sectors were analysed at different levels to integrate and promote actions that lead to the decrease of land degradation processes, and help to guarantee productive and environmental sustainability.

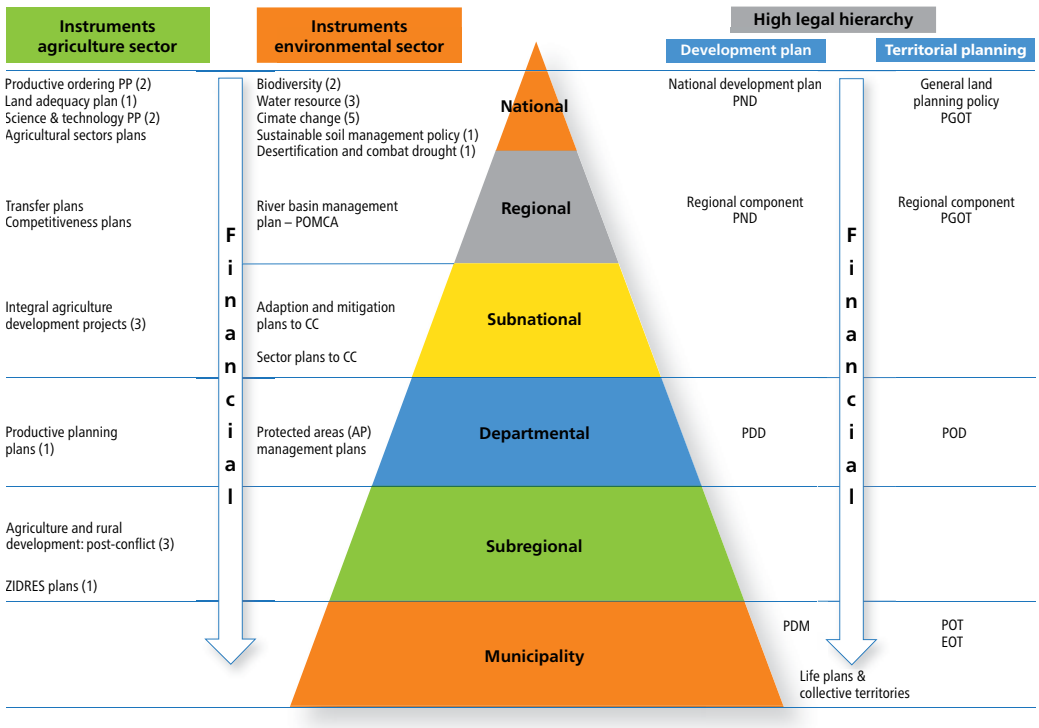
The SLM mainstreaming strategy established included four mainstreaming objectives:

- Mainstreaming objective 1: To **promote land degradation assessments** in areas of environmental and social importance, and to identify SLM best practices.
- Mainstreaming objective 2: To integrate the LD/SLM assessments into **planning instruments** for rural development and land use of the agriculture and livestock sector and into sectoral policy frameworks (territorial development plans).
- Mainstreaming objective 3. To **scale out SLM best practices** through field activities and strategic decision-making processes at the local level.
- Mainstreaming objective 4. To **build capacities** of institutions, extensionists and producers for demonstrating, awareness-raising and spreading out SLM.

The mainstreaming strategy included an umbrella activity consisting of establishing the institutional technical group which was essential for consultation, orienting and implementing the tools for the land degradation and SLM assessments. The technical group supported the process of providing evidence to, and empowering institutions from, the productive and environmental sectors in the topics of land degradation and SLM.

A detailed action plan was established for each mainstreaming objective. The process for mainstreaming SLM in territorial development plans at different levels (objective 2) is shown in the Figure 18.

FIGURE 18
Process for mainstreaming SLM in territorial development plans at different levels



PP: Policies plans and programs
ZIDRES: Areas of Interest in rural, economic and social
POMCA: River basin management plan
CC: Change climate sector plans
AP: Natural protected areas
PND: National development plan
PGOT: General land planning policy
PDD: Departmental development plan
POD: Departmental planning plan
PDM: Municipality development plan
POT: Municipality planning plan
EOT: Land use planning scheme

Source: Ruiz S. L., J. C. Álvarez, J. Otero & C. Olivera. 2019. *Guía herramientas metodológicas para evaluar el estado de degradación de las tierras y su aplicación en instrumentos de Planificación territorial.* UPRA – FAO, Bogotá. https://www.wocat.net/documents/525/GUIA_HERRAMIENTAS_DE_MST_instrumentos.pdf

Review and analysis allowed the prioritisation of three instruments and guidelines of how to integrate a SLM focus into these. The instruments were prioritized according to their importance and hierarchy for planning within the environmental and agriculture sector, but also because they are binding that is obligatory for the departments and regional environmental authorities. The three instruments are:

- Land Management Plan (*plan de ordenamiento territorial municipal*;
- Guide for the development of the Watershed Management Plan (*plan de ordenamiento de cuencas hidrográficas*); and
- Guide for the elaboration of the Productive and Social Management Plan of Property at department level (*plan de ordenamiento productivo y social de la propiedad departamental*).

Specifically, the following activities were undertaken to integrate evidence of land degradation and benefits of SLM into the identified instruments:

- The formulation of the Territorial Plan (*plan de ordenamiento territorial*) of the municipality San Juan Nepomuceno and regional agricultural development plans;
- Revision and analysis of the guide for the development of the Productive and Social Management Plan of Property at department level (*plan de ordenamiento productivo y social de la propiedad departamental*) (UPRA), development of guidelines on the integration of SLM concepts;
- Revision and analysis of the guide for the elaboration of the Watershed Management Plan (*plan de ordenamiento de cuencas hidrográficas* – (Ministry of Environment and Sustainable Development)), where the incorporation of the FAO–WOCAT methodology and tools was proposed;
- Incorporation of guidelines on land degradation and SLM in the Productive and Social Management Plan of Property in the department of Bolivar for the incorporation of SLM at department level; and
- Incorporation of the concept and assessment methodology of land degradation and SLM in the formulation of plans for Climate Change Adaptation (with Ministry of Environment and Sustainable Development).

Mainstreaming of objectives 3 and 4 were addressed through the overall process of project implementation at all levels, given that awareness-raising and capacity building covering the issues of land degradation and SLM are essential in different areas of the country, and for various stakeholders: institutional, professional, and technical personnel, and producers. There is little awareness of the impacts caused by conventional agricultural and livestock practices.

Finally, another result of the SLM mainstreaming process, achieved through the inter-sectoral dialogue, is the fact that the overall institutional setting involved in the project has integrated the different components of land degradation and SLM assessments into their mandates. In this sense, the Geographic Institute Agustín Codazzi (IGAC) will engage in national soil studies while the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) will develop an updated national LUS map and continue with the development of the land degradation assessments, UPRA will invest in changes to sustainable land use and management and Agrosavia will continue research on SLM practices.

Colombia: knowledge products, links and references

Colombia country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/colombia

Colombia SLM practices documented under the DS-SLM project:
https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_COL&filter__qg_funding_project__funding_project=1

Corporación colombiana de investigación agropecuaria – Agrosavia. http://www.agrosavia.co

FAO Colombia and Rural Agricultural Planning Unit Colombia (UPRA). 2018. DS-SLM Video Colmbia. UPRA Bogota. https://www.wocat.net/library/media/146/ and https://www.youtube.com/watch?v=NzmkW5PRpmc

FAO Colombia and Rural Agricultural Planning Unit Colombia (UPRA). 2019. *El manejo sostenible de la tierra.* Resultados proyecto : Soporte a la Toma de Decisiones para la Incorporación y Ampliación del Manejo Sostenible de la Tierra DS-SLM. FAO, Bogota. https://www.wocat.net/library/media/161/

Oficina de FAO en Colombia. http://www.fao.org/colombia/es/

Rural Agricultural Planning Unit Colombia (UPRA) and Minagricultura. 2019. *Indice de cobertura de la tierra para los sitios pilotos seleccionados.* FAO Bogota. https://www.wocat.net/library/media/157/

Unidad de Planificación rural agropecuaria – UPRA. 2019. Estrategia para incorporar el manejo sostenible de tierras (MST) en la toma de decisiones (integración en tres ámbitos, nacional, departamental y local) con énfasis en instrumentos de planificación en Colombia. Presentación https://www.wocat.net/library/media/157/

Unidad de Planificación Rural Agropecuaria – UPRA. www.upra.gov.co

3.6 Ecuador

Implementing Partner: Ministry of Environment, Water and Ecological Transition

CONTEXT

In Ecuador, almost 19 percent of the national territory is threatened by land degradation, such as deforestation, soil erosion and loss of soil fertility. The annual deforestation rate is approximately 3 percent, leading to complete deforestation in 30 years at current rates, while soil erosion affects almost 60 percent of the land. Annual losses due to land degradation amount to 10.9 percent of the agricultural gross value product. Reduction of land degradation and its impacts is therefore a priority for Ecuador. However, even though there is much detailed cartography on land cover and land uses available, land degradation has mainly been analysed in the context of drylands and desertification or with relation to erosion. Little consolidated approaches and data about the scale and severity of the land degradation problem at national level and in all ecosystems was available prior to the DS-SLM project. As is common worldwide, there was a lack of inter-sectoral collaboration regarding land degradation and SLM, despite the fact that their impact cuts across the mandates of multiple agencies. As a result, no national land degradation and SLM evidence was available in Ecuador.

MODULE 1

Inter-institutional collaboration

Through the Ministry of Environment (MAE, currently Ministry of Environment, Water and Ecological Transition – MAATE), an Inter-Institutional Technical Core Group (ITCG) to coordinate information collection and action on land degradation and SLM was created. The establishment of the ITCG helped to facilitate a coordinated process of information gathering, inter-institutional work and dialogue between different ministries and institutions, including the academia, leading to the joint creation of national land degradation maps. Furthermore, the joint use of assessment tools helped to stimulate interaction between these previously isolated stakeholders.

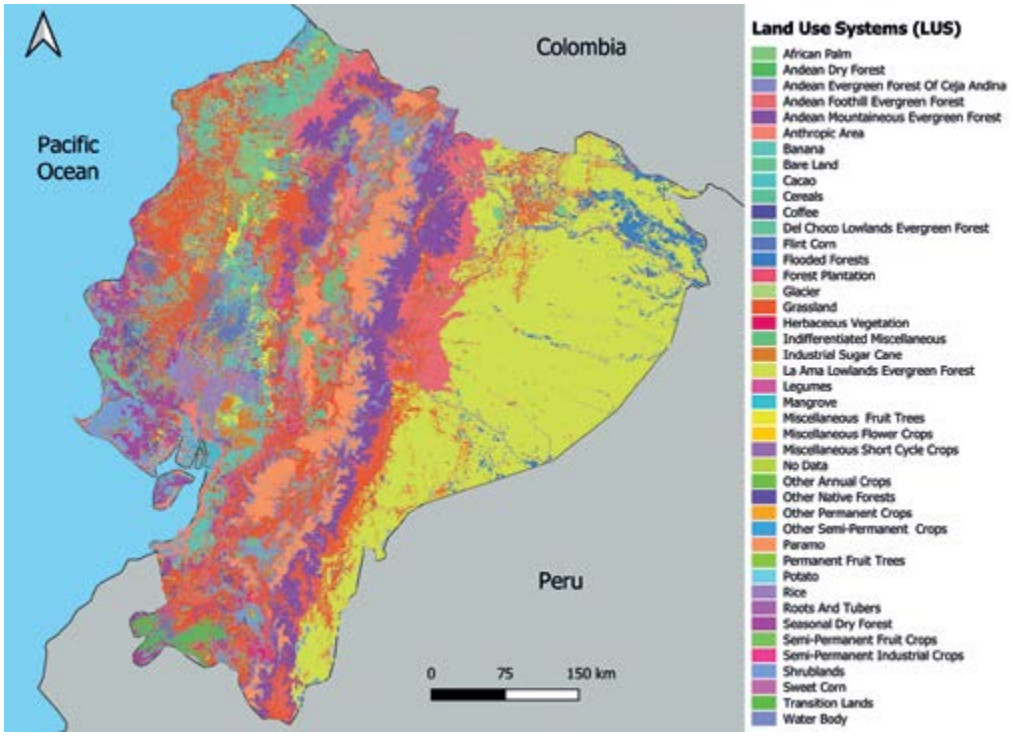
While the ITCG participated actively during implementation of the DS-SLM project, it was difficult to maintain this inter-institutional collaboration after the project had terminated. However, due to the approval of the GEF project "LDN target-setting and restoration of degraded landscapes in Western Andes and Coastal Areas" led by MAATE the ITCG will be reactivated to support the LDN target setting process.

MODULE 2

First-time national land degradation assessment produced for very diverse land use systems

Due to Ecuador's diversity of land use systems and landscapes, the national assessment, which was carried out based on an existing LUS and vegetation cover map from Ministry of Environment of Ecuador (MAE) Ministry of Agriculture and Livestock (MAG), was particularly challenging. Capacitated and supported by the Cuba Tropical Institute of Geography[14] through a mechanism of South–South cooperation, a final map with 43 LUS was created (Figure 19) and the national land degradation assessment developed for each province and each LUS, building up a national baseline. This was a very challenging process as Ecuador includes 23 provinces of which some comprise 30 to 40 different land use systems.

FIGURE 19
Land use systems in Ecuador

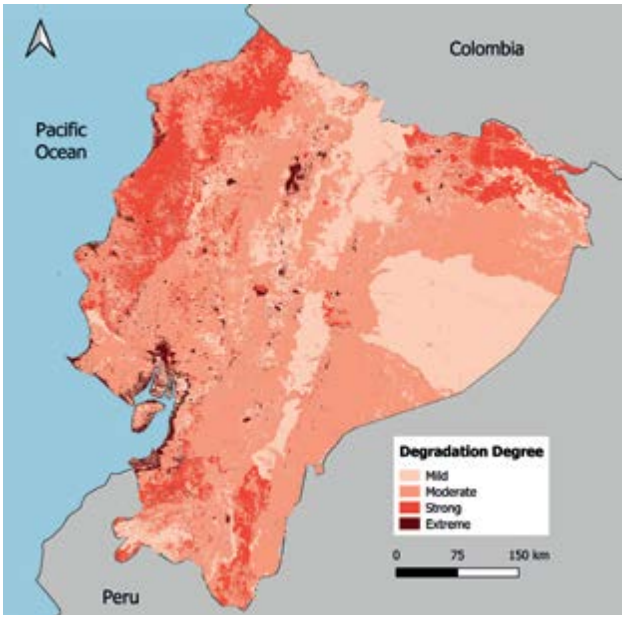


Source: FAO and Ministerio del Ambiente del Ecuador (MAE). 2018. *Evaluación nacional de la degradación de la tierra mediante la metodología LADA-WOCAT.* MAE, Quito. https://www.wocat.net/documents/1009/POLICY_BRIEF_CORREGIDO_FAO_DIC_2018.pdf

[14] For additional information, please see: http://www.geotech.cu

This process – for the first time – produced a series of national land degradation maps, covering the whole country and including all types of LD, not only erosion, as was the tradition (Figures 20 and 21). The national assessment, led by the MAATE, was guided by the ITCG and included a participatory expert assessment at subnational and national levels, coordinating with and involving both local and national organizations. The final national land degradation maps were validated by all stakeholders involved and approved by the MAATE and the ITCG. This participatory and consultative approach of the land degradation assessment process led to a wide recognition of the national land degradation evidence by all ministries as well as regional and local actors. Due to this buy-in, the evidence is now widely used as reference data in relevant decision-making processes as well as for the design of new SLM-related projects.

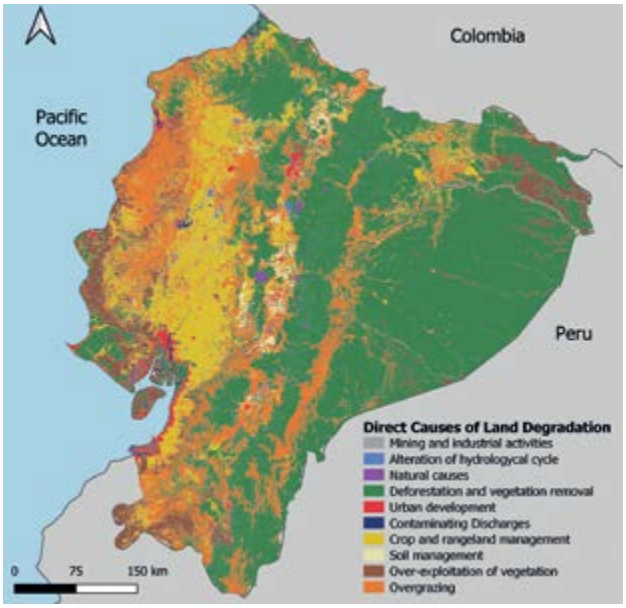
FIGURE 20
Degree of land degradation in Ecuador



Note: Natural LUS includes páramos, native forests,mangroves, amongst others; Transformed LUS includes pastures, short-cycle crops, fruit trees, forest plantations, amongst others

Source: FAO and Ministerio del Ambiente del Ecuador (MAE). 2018. Evaluación nacional de la degradación de la tierra mediante la metodología LADA-WOCAT. MAE, Quito. https://www.wocat.net/documents/1009/POLICY_BRIEF_CORREGIDO_FAO_DIC_2018.pdf

FIGURE 21
Direct causes of land degradation in Ecuador



Source: FAO and Ministerio del Ambiente del Ecuador (MAE). 2018. Evaluación nacional de la degradación de la tierra mediante la metodología LADA-WOCAT. MAE, Quito. https://www.wocat.net/documents/1009/POLICY_BRIEF_CORREGIDO_FAO_DIC_2018.pdf

MODULE 4

Setting priorities and assessing land degradation and SLM at provincial level

Based on the national land degradation assessment and resulting evidence, the province of Loja, located in south Ecuador, was selected as a priority landscape (Figure 22) based on the following criteria:

- existence of land degradation;
- considerable amount of people living in the area (as compared to vast areas where few people live in);
- dry forest and its vulnerability to drought;
- areas with different land use systems;
- areas with current, ongoing land degradation processes and evidence of SLM practices;
- presence of relevant projects, related to SLM.

Due to the diversity and complexity of landscapes in Ecuador, the national land degradation assessment was replicated at provincial level in Loja to generate further details on hot spots of degradation and to guide the selection of locations for: a) further assessments and b) SLM implementation in the framework of other SLM projects.

Thanks to the land degradation assessment in the province of Loja clear understanding about land degradation processes, causes, trends, impacts and responses emerged – supported by identifying their spatial distribution presented on maps. Additional detailed local level assessments included:

a) a livelihoods assessment which provided knowledge about the causes of land degradation at farm level and uncovered the reasons for low adoption of SLM practices.

   The assessment concluded that social capital is of utmost importance to meet the needs and income of the inhabitants. Migration to urban areas and weak dependence on agriculture for income limits SLM investments. Regarding natural and physical capital, one of the most important barriers is the availability of water. Both the economic capacity and the availability of natural resources are major problems for scaling out SLM. There are no easy answers to such challenges – but mainstreaming of SLM is going ahead in Ecuador and there is a strong foundation to build upon.

b) a the documentation and evaluation of SLM good practices with local communities using the WOCAT Questionnaire on SLM Technologies and sharing the good SLM Technologies in the WOCAT Database.

FIGURE 22
Type and severity land degradation map of Loja province

Source: FAO and Ministerio del Ambiente del Ecuador (MAE). 2018. *Documento de la evaluación subnacional de la degradación de la tierra en la provincia piloto de Loja mediante la metodología LADA-WOCAT.* FAO, Quito. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/ecuador/#module-2

Four different examples of documented SLM practices including water harvesting, home gardens, sylvopastoral systems and riparian zone protection:

Tajamar

It is a traditional Technology against drought and low spring water. 'Descending steps' are built in streams to capture moisture in the accumulating behind the small stone dams facilitating the infiltration of water for more water availability and to feed small springs and/or springs downstream. With the moisture retained in the sand and animal manure containing seeds deposited on the banks shrub and tree species can naturally regenerate.

©Leonardo Jaramillo

Tajamar, canton of Paltas, de Loja province.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3275/

Family gardens

In a home garden vegetables and short-cycle legumes are grown, combined in some cases with coffee, banana and fruit plants. They serve for self-sufficiency as well as selling of surplus at the local market. The family garden is managed by the women of the household. In rural communities, vegetable gardens are part of a rich tradition, which has been passed on from generation to generation.

©Leonardo Jaramillo

Home garden, Parish of Nambacola, Canton of Gonzanama, Province of Loja.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3273/
https://qcat.wocat.net/en/summary/3273/?as=html

Silvopastoral systems

Land users applying this Technology plant nitrogen fixing trees such as acacia in their pastures in order to improve soil properties and fertility. The combination of trees and forage species on the same land ensures improved and long-term productivity and hence higher livestock feed production both in quantity and quality. Silvopastoral systems can reduce the impact of climate change.

©Osmani López y Rosa Arias

Silvopastoral systems, Parish of Nambacola, Canton of Gonzanama, Province of Loja.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3269/
https://qcat.wocat.net/es/summary/3269/?as=html

Riparian vegetation

Riparian strips are located adjacent to rivers, lakes and reservoirs, wetlands and plains, and perform important ecological functions related to sedimentation control, water retention, flood control, runoff control, among others. The riparian strip is established on either side of rivers or streams, generally 1 km long and 10 m wide, with deep-rooted native forest species, shrubs or grasses.

©Luis Diaz

Franja Ribereña, Canton Celica, Loja Province.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3269/
https://qcat.wocat.net/es/summary/3269/?as=html

The methodology followed is relevant for identifying and understanding land degradation in any province of Ecuador, whatever the social and economic situation. The methodology and outputs (such as geodatabase, SLM good practices catalogue) generated through the subnational evaluation serve as important data and instruments to allow political decision-making bodies and entities to make informed choices regarding SLM, territorial planning, development policies and regulation. They permit to integrate SLM practices with proven potential into different programs and projects in other degraded areas of Ecuador and support the formulation of specific public policies to combat LD. Local information about good practices is clearly necessary to help in the spread of good practices nationwide.

MODULE 1

Mainstreaming SLM

National and subnational evaluations and studies served as a baseline/ starting point and have allowed the formulation of relevant SLM mainstreaming instruments as part of a SLM Mainstreaming Strategy which includes two key points with five objectives:

1. Integration of SLM into national decision-making processes
   a. SLM integrated into the national inter-sectoral dialogue
   b. SLM brought into financing mechanisms

2. Integration of SLM into local decision-making processes
   a. SLM integrated into local planning
   b. SLM included in the strengthening of capacities and knowledge exchange
   c. SLM prioritized actions to be financed by local governments

While defining the mainstreaming strategy, under the lead of MAE, four important policy instruments were identified: (i) the National Constitution (2008), (ii) the National Plan of "Buen Vivir" (2009–2013), (iii) the Environmental Code (2016), and (iv) the Agricultural Policy (2015–2025). It was also realised that the participation of international agencies was crucial for funding mainstreaming initiatives.

Together with the GEF/FAO Climate-Smart Livestock Project, the MAE has identified the importance of overcoming a key constraint to mainstreaming – finances – and has developed mechanisms that allow local actors to access funding to implement sustainable livestock practices (Box 10).

BOX 10: Financing sustainable livestock practices through subsidies/ incentives

As part of the Climate-Smart Livestock Project, a National Strategy of Financial Mechanisms and Incentives was developed, based on the approach of the SLM Microfinance Strategy of Ecuador developed by the Global Mechanism of the UNCCD in 2014. The main approach is the use of national financing mechanisms for practices addressing SLM, climate change, generating green financial products, promoting businesses that embrace climate-smart practices. This mechanism is developed in close coordination with the local authorities (Gobierno Autónomo Descentralizado), and includes training and financial technical assistance, as well as identification of certification systems. The strategy was developed to accelerate the rate of implementation of sustainable practices, which in the majority of cases cannot be scaled-out due to financial constraints that beneficiaries experience in rural areas.

The results of this strategy have been:

- creation of seven community funds (with associated capacity building);
- formation of two Centres of Agricultural Services;
- an agreement between FAO-EC and BanEcuador for development of a "green credit line" that supports the financing of climate-smart livestock practices.

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Press release in Spanish: FAO and BanEcuador sign agreement to create green credit line.
For more information please see: http://www.fao.org/ecuador/noticias/detail-events/en/c/1193298/

Ecuador: knowledge products, links and references

Ecuador country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/ecuador

Ecuador SLM practices documented under the DS-SLM project:
https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_ECU&filter__qg_funding_project__funding_project=1

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3.7 Lesotho

Implementing Partner: Ministry of Forestry and Land Reclamation

CONTEXT

Lesotho has long been known for severe problems of soil erosion and resource degradation. The root causes are commonly cited as overgrazing, continuous cultivation of maize, degradation of forests – and a landscape that is inherently vulnerable to erosion. In the 1970s, catchment land use planning was introduced, and various agencies became involved in projects and programmes. These interventions have evolved over the decades and currently the Government of Lesotho has a broad investment portfolio in sustainable land management. These include the benchmark integrated catchment management programme and agricultural development programmes also. There is support from the European Development Fund, IFAD and the World Bank amongst other agencies. Programmes focus on rehabilitation of forest resources, water conservation infrastructures, protection of wetlands, reseeding of degraded rangelands – and on resilient smallholder farm production.

MODULE 4

Agro-ecological zones and catchments at the centre

Lesotho can be divided into four agroecological zones, namely, mountains or highlands (59 percent of the country), foothills (15 percent), lowlands (17 percent) and the Senqu River Valley (9 percent) (CIAT and World Bank, 2018). A selection of target districts and watersheds for intervention was made per agroecological zone, based on available national land use maps and the local assessment[15] of already known hotpots.

A team made up of a national consultant, directors from the implementing ministry and other line ministries, NGOs, local authorities, and farmer representatives selected four target districts in the four agroecological zones. In each district, in a joint exercise with local stakeholders, a representative watershed was selected, based on the following criteria.

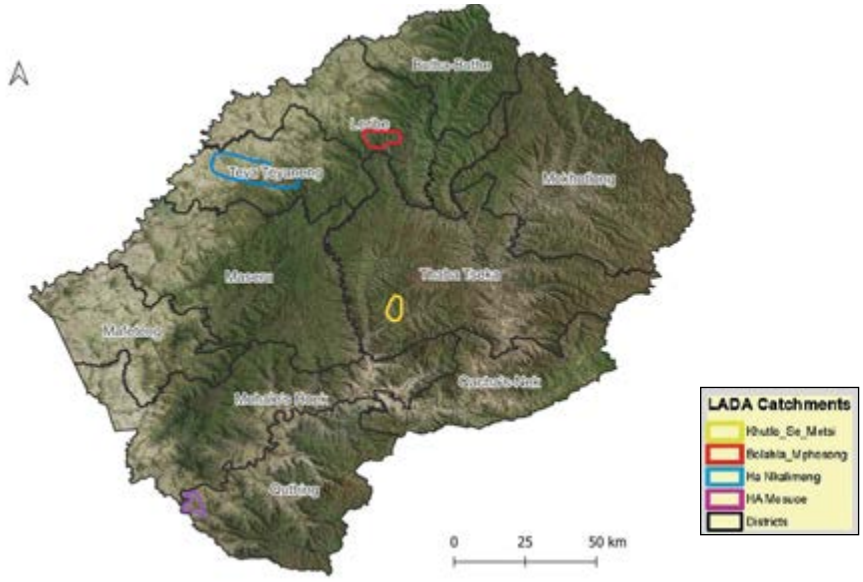
a) one or more of the land use systems, which are critical for sustainable livelihoods in the target physiographic zone;
b) a good mix of bright spots and hotspots;
c) a specific percentage of the land area under sustainable and efficient use;
d) sensitivity to the social context and governance issues;
e) presence and nature of conflicts, presence of farmer associations for the key land use systems (post-project sustainability); and
f) global significance in relation to national commitments in the multi-lateral environmental conventions.

The following watersheds were selected and served as demonstration sites for testing and disseminating SLM practices (Figure 23):

- Leribe – Foothills site: the Mphosong watershed from the confluence of Bolahla and Mphosong River to the north-eastern escarpment
- Berea – Lowlands site: the Tebetebeng river catchment below the Clarence escarpment to the confluence with the Phuthiatsana river
- Quthing – Senqu River Valley site: the watershed area of ha Mosuoe between Thaba-Ntšo and the area around Thaba-ea-Makoloane south of the Qomoqomong river to the confluence with the Senqu river
- Thaba-Tseka – Highland site: two sub-catchments of the Lesobeng river from Thaba-Kholo escarpment i.e. Khutlo-se-metsi and Methalaneng sub-catchments

To validate the final watershed selection, district technical officers and all other stakeholders were consulted. Thereafter, the district community councils were required to endorse the selections.

FIGURE 23
Location of selected priority watershed in identified districts of each of the four agro-ecological zones of Lesotho



Source: geoBoundaries, 2020, https://www.geoboundaries.org. modified by the contributor.

[15] For additional information, please see: https://www.fao.org/land-water/land/land-assessment/assessment-and-monitoring-impacts/en/

Some examples of Technologies selected from the Leribe catchment for up-scaling are presented below.

Focus group discussions

Focus group discussions were held to verify the watershed boundaries with the communities and allow them to draw land use maps depicting their resources. After the focus group discussions, a transect walk through the catchment helped to verify the results. The focus group discussion participants also discussed barriers and opportunities to potential SLM implementation and specific SLM interventions. The focus group discussions were perceived as very helpful by the community.

©Joseph Patrick Mensah

Participatory catchment delineation with community members in Mphosong catchment Mphosong catchment, Leribe.
https://qcat.wocat.net/en/wocat/approaches/edit/approaches_4266/
https://qcat.wocat.net/en/summary/4266/?as=html

Brush layering

An experiment - held jointly with extension workers and land users - demonstrated the importance of organic matter in the soil to reduce erodibility and improve production.

SLM demonstration plots were established in the Mphosong catchment in Leribe district representing foothills over the country and characterized by rangelands. Through a community-led natural resource management approach the community and specialists agreed on the best SLM activities for the rangelands. The activities included, among others, invasive species control, brush layering, stone lines, water harvesting and erosion control structures.

©Palesa Leoaneka

Branches cut from invasive species are laid on bare areas to slow down runoff and trap sediment, Mphorosane, Leribe.
https://qcat.wocat.net/en/wocat/technologies/edit/technologies_4594/
https://qcat.wocat.net/en/summary/4594/?as=html

In-field rain water harvesting

The highlands in Lesotho are mainly rangelands and suffer from invasive bush species that are not palatable. SLM practices that were put to scale were brush control and layering, and tree planting and range resting. The catchment in the lowlands suffers from deep gullies. SLM practices for scaling out were diversion furrows and infiltration pits, reshaping of gullies, tree planting and grass seeding.

©Koetlisi Koetlisi

Infiltration pits constructed on bare land to capture runoff and thereby improve land cover, land productivity and soil organic carbon. Leribe district.
https://qcat.wocat.net/en/wocat/technologies/edit/technologies_4591/
https://qcat.wocat.net/en/summary/4591/?as=html

Scaling out activities were conducted in one of the catchments representing the highlands (Mahlomola sub-catchment) and in one of the lowlands (Laitsoka catchment).

Extension officers were trained through "training of trainers" (ToT) to in turn train farmers on the site. For scaling out of the prioritized technologies the government of Lesotho provided the community with inputs such as grass seeds, trees, transport and tools. Workshops for experts and SLM specialists at local level helped to raise awareness about SLM and lobby for support in the country.

Scaling out was successful and was evidenced by change in attitude of the farmers within the catchments. For example, farmers used to remove the wood/ brush of invasive species from the fields. The brush is also used as a source of fuel by the rural communities. After the training farmers did brush layering to trap silt and reduce erosion.

Once a week on national television, the ministry has a half hour slot in the evening on land management activities, where the achievements of integrated catchment management in the four priority catchments can be shared with the broad public.

Multi-stakeholder cooperation: key to stepping-up dissemination of SLM and sustained action

At national level a rapid district consultation mission was conducted across all selected districts, where key stakeholders were engaged, especially the Ministry of Agriculture and Food Security, Ministry of Forestry, Range and Soil Conservation. Each ministry/ department shared key barriers and challenges for uptake and upscaling of SLM, lessons learnt and experiences, key projects implemented, on-going or planned, and confirmed their interest in scaling out SLM. In addition, an attempt was made to establish how Government mandates and related projects and programmes could work with the Decision Support for SLM project. Finally, recommendations were developed for how the project could build on lessons learned from previous experience in Lesotho to ensure sustained action. These lessons included the benefit of a "bottom-up" approach and people being part of the solution – and most of all, listening to land users to understand their priorities and concerns as a basis for improving their SLM options.

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Ukaejiofo,Rex Uzonna; Mubanga,Ngao; Osiemo,Jamleck; Grey, Sebastian; Emenanjo,Ijeoma; Girvetz,Evan; Braimoh,Ademola. 2018. *Climate-smart agriculture in Lesotho* (English). Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/866541527750717859/Climate-smart-agriculture-in-Lesotho

3.8 Morocco

Implementing Partner: The High Commissioner for Water and Forests and the Fight against Desertification

CONTEXT

Data from 2015 shows that 19 percent of Morocco's total land area is degraded (UNDESA, 2021). Degradation is a result of several factors: the most important are increased population pressure on limited natural resources, overexploitation of forests, removal of natural vegetation from sloping lands, overgrazing of rangeland, cultivation of vulnerable lands in arid and desert regions leading to erosion, and inappropriate general land management (especially tillage) (Dahan *et al.*, 2012). Increasing pressure on the land and poor management are continuing to lead to wide-scale land degradation, depletion of water resources, loss of wildlife habitat, and increased susceptibility to droughts and climate change. The National Action Programme to Combat Desertification, updated between 2011 and 2013 by The High Commissioner for Water and Forests and the Fight against Desertification (HCEFLCD), has developed decision-making tools in line with the implementation strategy of the Convention to Combat Desertification (UNCCD) and the other Rio Conventions to address, simultaneously, effects of climate change and loss of biodiversity. These tools were designed to help answer the overarching question of where and how to intervene at national level, while the DS-SLM supported concrete planning and implementation at regional level.

MODULE 2

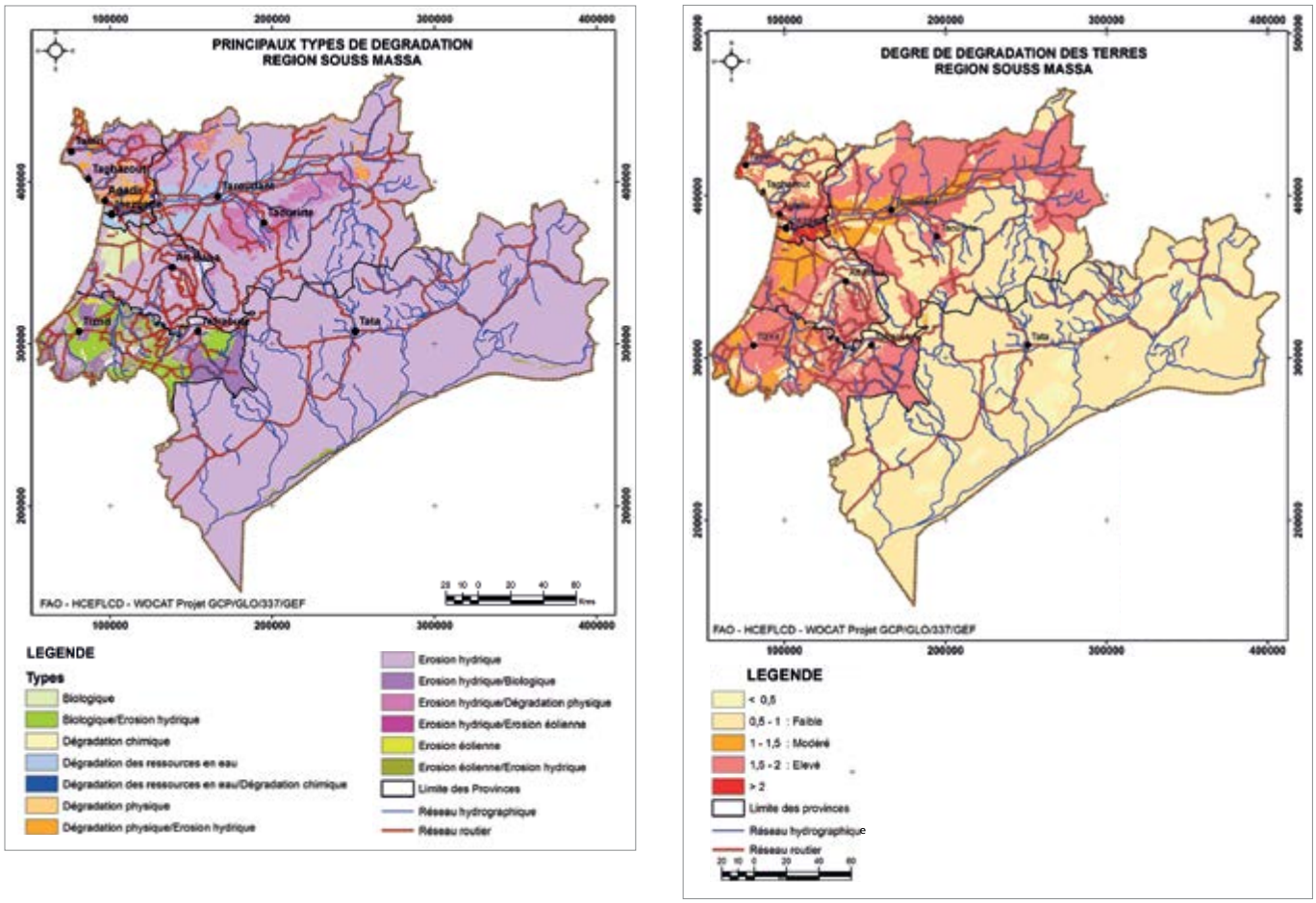
National and subnational land degradation assessment to support the selection of priority areas and communes

To assess land degradation and desertification, and to select SLM good practices, regional maps of bioclimatic types, soil types, level of grazing pressure, land cover types and land use systems (LUS) were developed – based on existing national maps. Guided by a national consultation, the Souss Massa Region was identified as priority area. In Souss Massa, the two main causes of desertification are grazing pressure (67 percent of the area) and water erosion (23 percent). Grazing pressure is due to the low productivity of the rangelands and is more intense in the corridors frequented by pastoralists. The region also experiences wind erosion, biodiversity loss and deforestation due to human pressure, unsustainable management practices and climate change. To identify the LUS of the Souss Massa Region, satellite images supported by field verification were utilised.

Types, drivers, pressures and impacts of land degradation as well as hot spots of land degradation (Figure 24) and bright spots – areas with SLM – and existing SLM solutions (Figure 25) in the Souss Massa region were identified based on the LUS map and the LADA– WOCAT Questionnaire (QM) for mapping land degradation and SLM. The LUS map was established using: (i) the land cover map produced by National Action Plan on Climate Change in 2011; (ii) the forest inventory map; (iii) field observations; and (iv) Google Earth map.

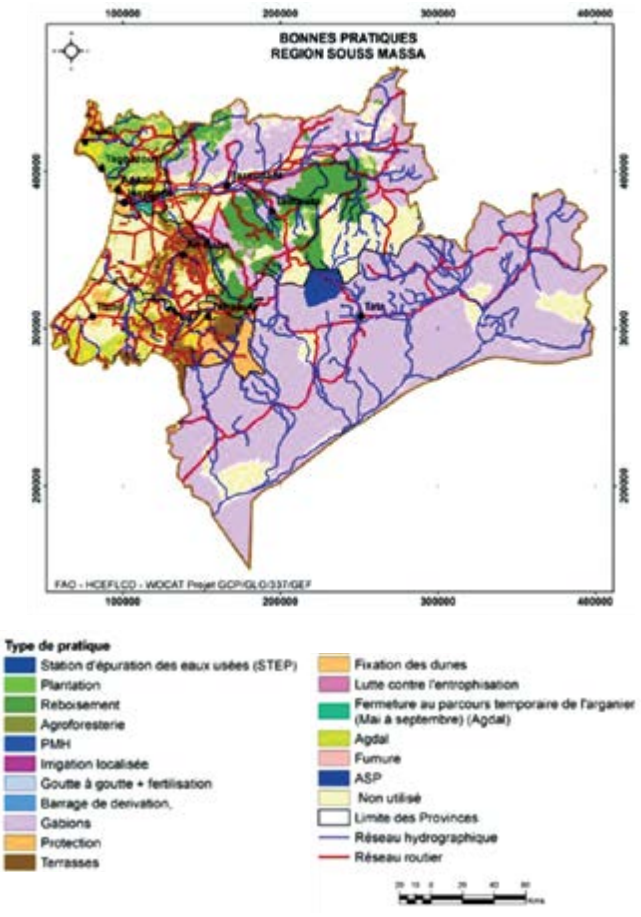
FIGURE 24

Main types of land degradation in the Souss Massa region (left) and degree of land degradation (right)



Source: Rouchdi M., M. Sabir and M. Qarro. 2019. *Assessing degradation at the regional scale (sub-national level.* FAO and HCEFLCD, Rabat.
https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/morocco/#module-2

FIGURE 25
Existing SLM technologies in the Souss Massa region



Source: Rouchdi M., M. Sabir and M. Qarro. 2019. *Assessing degradation at the regional scale (sub-national level.* FAO and HCEFLCD, Rabat. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/morocco/#module-2

TABLE 7
SLM technologies in the different provinces of the Souss Massa region

SLM technology	Provinces of Souss Massa region
Agdal (rest)	Agadir-Ida-Outanane and Tiznit Taroudant
Agroforestry	Tata
Sylvopastoral management Derivation dam	Tata
Rest of argan from grazing (May to September) (agdal)	Inezgane-Ait Melloul
Sand dune stabilization	Chtouka- Ait Baha, Inezgane-Ait Melloul and Tiznit
Use of organic fertilizer	Taroudant
Gabions	Taroudant, Tata
Drip irrigation and fertilizer Localized irrigation	Agadir-Ida-Outanane Inezgane- Ait Melloul and Tiznit Agadir-Ida-Outanane
Combating eutrophisation Plantation	Agadir-Ida-Outanane
Small and medium sized irrigation areas (PMH)	Tiznit
Protection from grazing	Agadir-Ida-Outanane, Chtouka- Ait Baha, Inezgane- Ait Melloul and Tiznit
Forest plantation	Agadir-Ida-Outanane Chtouka- Ait Baha, Inezgane- Ait Melloul, Taroudant, Tata and Tiznit
Sewage water treatment station (STEP)	Inezgane- Ait Melloul
Terraces	Agadir-Ida-Outanane Chtouka-Ait Baha and Tiznit

Source: Rouchdi M., M. Sabir and M. Qarro. 2019. *Assessing degradation at the regional scale (sub-national level.* FAO and HCEFLCD, Rabat. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/morocco/#module-2

Existing SLM Technologies were identified in the different provinces of the Souss Massa region (Table 7) and a selection of these documented in the Global SLM Database. A selection is presented below.

Enriched forestry plantations

Enriched forestry plantations are formed by planting local species, especially the oil-producing native argan (*Argania spinosa*), but also other species that are adapted to the ecological conditions (for example *Pinus halepensis*). Increasing the population density of trees in open and degraded argan stands through nursery-produced seedlings involves digging planting holes to achieve a population of 200 trees per hectare, planting the seedlings and refilling the holes. Then the seedlings are watered at least 15 times to ensure survival. Gap filling takes place in the second year together with weeding around the young trees. The area needs to be protected from use for 10–12 years until the trees are fully established.

©Mohamed Qarro

Reforestation closure with fence, municipality of Amskroud, Souss Massa region.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3232/
https://qcat.wocat.net/fr/summary/4872/?as=html
https://qcat.wocat.net/fr/wocat/approaches/view/approaches_3203/
https://qcat.wocat.net/fr/summary/3203/?as=html

Rehabilitation of vegetation through enclosure

Preventing access of livestock to grazing areas ensures development of vegetative cover. Protection of the area in question began after a forest fire. Over and above banning grazing, people were also not allowed to gather fuelwood or to cut vegetation. The vegetation then recovered by itself. Such measures can only work when people, themselves, adhere to the rules and agreements. In this situation, the land users formed an association and were compensated for their loss of access to resources. After five or six years of protection, the results are clearly visible and there has been a significant increase in tree cover.

©Mohamed Qarro

General view of burnt perimeter at the beginning of the enclosure, Amskroud commune/ municipality.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_3232/
https://qcat.wocat.net/fr/summary/4872/?as=html
https://qcat.wocat.net/fr/wocat/approaches/view/approaches_3203/
https://qcat.wocat.net/fr/summary/3203/?as=html

Improved yields of argan oil through protection from goats during the harvest

Argan oil is primarily a traditional product used for home consumption. Local people sell it occasionally in the market when there is a surplus. They could produce more to sell, but the profit isn't worth the effort of the extra labour involved. However, it's important in the subsistence economy and makes a significant contribution to the family budget. Other more lucrative routes include networks of cooperatives which produce argan oil by mechanical means. A third path is industrial production with a value-chain. Under traditional methods, women (exclusively) can produce a litre of oil in a week. The most labour intensive and slowest stage is crushing the nuts to obtain the kernel. All in all, one litre of oil requires 15 hours of work. Harvest of argan is managed sustainably through controlling the period when nuts are collected – after maturing naturally on the tree. The traditional "agdal" period of harvesting nuts begins in May and lasts until August-September. There is strict control of goats in the area and traditional rules are applied to penalise the trespassing of goats during the harvesting period.

©Mohamed Qarro

Producing argan oil, cooperative of Aziar.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_3209/
https://qcat.wocat.net/fr/summary/5168/?as=html
https://qcat.wocat.net/en/wocat/approaches/view/approaches_3201/
https://qcat.wocat.net/fr/summary/3201/?as=html

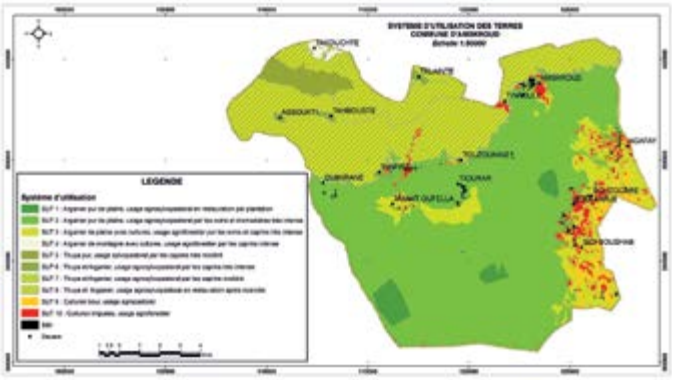
The hot spots assessed in the Souss Massa region were discussed with stakeholders at subnational level and they identified the province Agadir-Ida Outanane as a priority area. In Agadir-Ida Outanane, the three communes Ameskroud, Tamri and Aziar were selected, based on their land degradation severity and also in relation to the framework of the National Action Plan to combat desertification.

MODULE 4

Local level assessment of land use and degradation

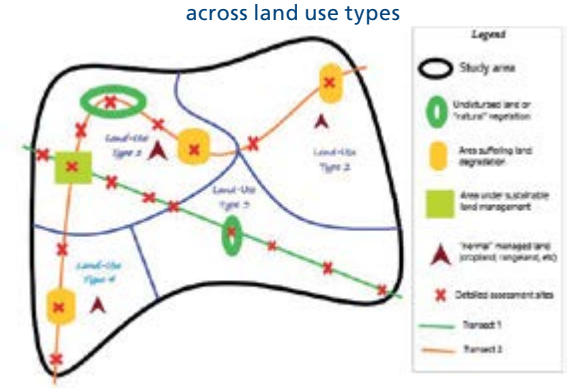
In the three communes, LUS maps of the community lands were developed based on vegetation types and major land use, population density, livestock type and pressure from livestock, reflecting perceptions of land users (Figure 26). In selected sites, transect lines were laid across different LUS for a detailed assessment of land degradation (Figure 27) (Bunning *et al.*, 2016). Through these transects, villages where selected, were focus group discussions were carried out and socioeconomic conditions of different social groups were assessed based on the livelihoods framework's five "capitals" (financial, human, physical, social and natural). Based on the results of this, refined land degradation assessment at commune level and in collaboration with local stakeholders and communities, hot spots of degradation and bright spots were identified.

FIGURE 26
Land use system map of Ameskroud



Source: Berkat,O., Ouchna, R., Touami, M., Rouchdi M., Sabir, M., and Qarro, M. 2019. *LADA assessment of LD and SLM within and through their land use system: landscape/local level assessment (three sites, Amskroud, Tamri and Aziar) – Module 4.* FAO and HCEFLCD, Rabat. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/morocco/#module-4

FIGURE 27
Detailed assessment sites along transect lines across land use types



Source: Berkat,O., Ouchna, R., Touami, M., Rouchdi M., Sabir, M., and Qarro, M. 2019. *LADA assessment of LD and SLM within and through their land use system: landscape/local level assessment (three sites, Amskroud, Tamri and Aziar) – Module 4.* FAO and HCEFLCD, Rabat. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/morocco/#module-4

MODULE 5

Development of a territorial planning pact for SLM mainstreaming

Territorial planning involves the selection and prioritisation of potential and promising SLM practices for the area under consideration and the development of an action plan for scaling out of these good SLM practices through a participatory and negotiated process (a "Territorial Planning Pact"). The Territorial Planning Pact is a result of a consultative process: process, a series of workshops bringing together key stakeholders of the three selected communes (Amskoud, Tamri, and Aziar) to negotiate, agree and adopt a plan for scaling out good land management practices, taking into account the priorities of each commune and facilitating inter-institutional coordination to identify responsibilities for supporting community implementation of the recommended practices, and securing financial and technical commitment from all stakeholders. The different land degradation and SLM assessment results (described above) were used as evidence to guide the territorial planning process and enable evidence-based decisions. In Table 8 the agreed activities under the Territorial Pact in Amskroud commune are presented.

TABLE 8
Agreed activities under the territorial planning pact in Amskroud commune

Good practices	Quantity	Responsible institution	Partners
Repair of stands	50 ha	Agriculture	Civil society and private associations
Setting up new terraces	50 ha	Agriculture	Civil society and private associations
Regeberation of argan trees with fencing	300 ha	Water forest	Civil society
Herding the pastures	100 ha	Water and forest	Civil society
Establishing protective berriers	30 000 m^3	Water and forest	Civil society and territarial communities
Untangle the isolation	Road opening of 18 km and maintenance of 4 km	Territorial Comunityies Water Forest	Civil society
Dug-out ponds (*iferd*)	3 units	Water and forest-Sousse-Massa Hydraulic Basin Agency (ABHSM)	Territorial communities and civil society
Local watering	9 villages	Regional Office for Agriculture Investment (ORMVA)	Civil society and the private sector

Source: Ziadat, F., Berkat, O., Ouchna, R., Touami, M., Fetsi, T., Harari, N., Studer, RM., & Schlingloff, S. 2022. Participatory land resources planning to promote sustainable landscape management in rainfed areas-Morocco. *Front. Sustain. Food Syst.* 6:848043. https://doi.org/DOI:10.3389/fsufs.2022.848043

A 3-year action plan was developed to integrate SLM at the provincial level and support scaling out of SLM beyond the communes. Six major areas of action were agreed upon (Ziadat *et al.*, 2022):

- capacity building and communication for SLM integration in territorial plans;
- promotion of SLM good practices;
- promotion of good practices for sustainable management of vegetation cover;
- access to roads;
- promotion of sustainable water management practices; and
- monitoring and evaluation.

The different activities highlight the importance of integrating the biophysical assessment with the socioeconomic needs. This is achieved through a multi-level participatory process, evaluating good practices and mainstreaming them into national and regional planning for scaling out, identifying the future actions and responsibilities of various stakeholders, and ensuring sustainability and ownership of the process for better management of natural resources.

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©FAO/ Feras Ziadat

Top and bottom: Field visits during the consultation workshop with stakeholders and communities to identify good practices for implementation.

Morocco: knowledge products, links and references

Morocco country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/morocco/

Morocco SLM practices documented under the DS-SLM project:
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3.9 Panama

Implementing Partner: Ministry of Environment

CONTEXT

In Panama 27 percent of the national territory is affected by land degradation and including loss of vegetation cover, deforestation, soil erosion, and loss of soil productivity. Main drivers are poverty, limited access to capital and markets, inadequate management practices (logging, burning), and overgrazing.

With the National Action Programme to Combat Drought and Desertification, the driving causes of degradation in critical areas have been verified. The Water Security Plan has highlighted the importance of ensuring the conservation of water as a vital resource. It characterized the hydrographic basins for the production of water for power generation, transportation and human consumption. The National Forest Reforestation Plan strengthens landscape restoration, focusing on increasing vegetation cover in 'neglected' basins. As part of the LDN TSP, degraded sites were identified, where SLM shall be implemented and scaled. The results of DS-SLM have been fundamental to provide information on land degradation and related impacts to orientate investment projects to avoid, reduce and land degradation in Panama.

MODULE 2

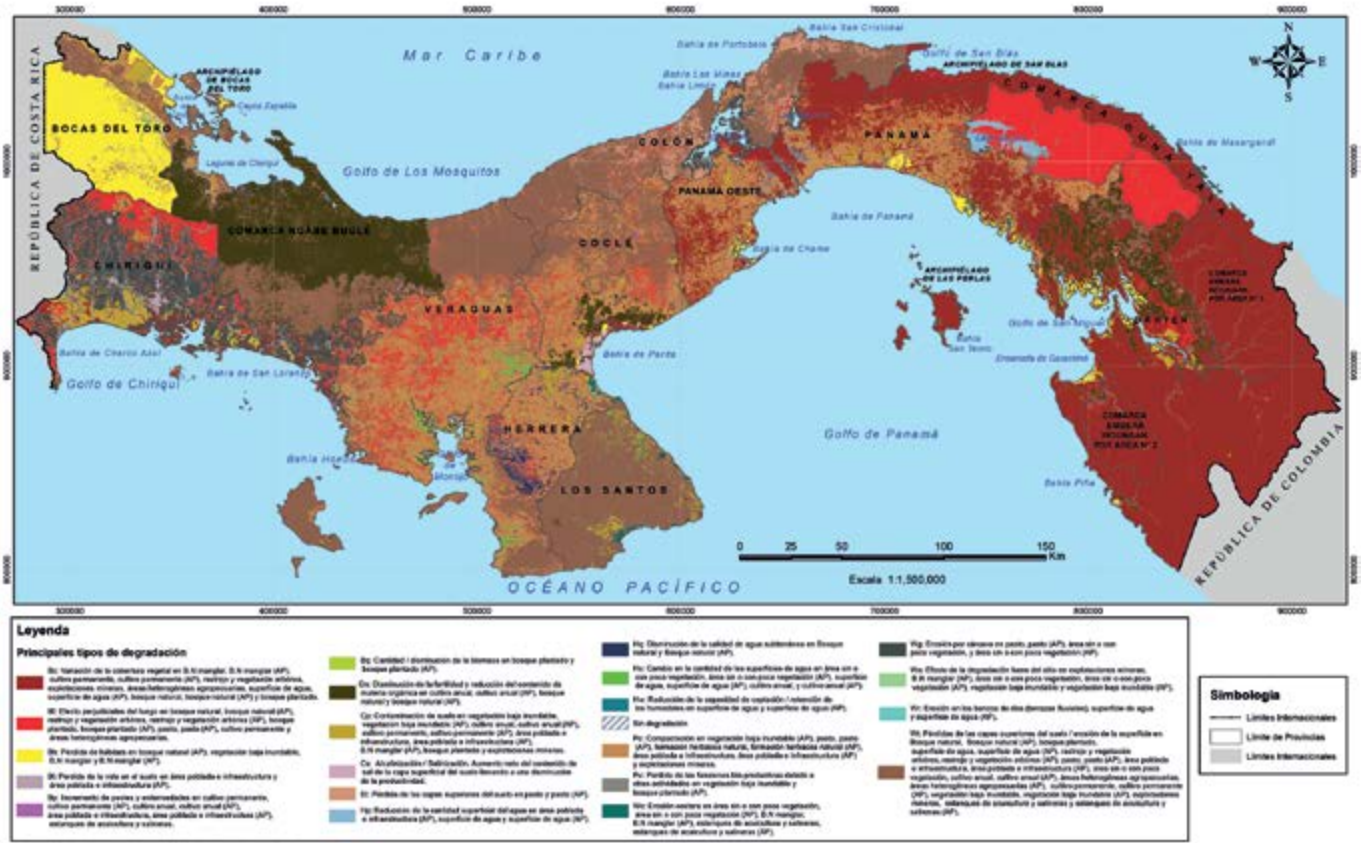
First map of land degradation

Panama produced its first national map of land degradation through a consultative process in its ten provinces and three provincial-level Indigenous regions (*comarcas indígenas*) (Figure 28). After in-depth training on the FAO–WOCAT Mapping methodology (QM) through scientist from the Geographic Tropical Institute Cuba – as part of Cuba–Panama South–South cooperation (Box 11) – an updated LUS map with 15 categories was produced and the QM participatory assessment realized with local experts from the public and private sector, civil society, land users and researchers.

Additional land degradation maps showing, amongst others, extent and degree of degradation, causes of degradation (Figure 28) and impacts on ecosystem services as well as SLM maps, showing existing SLM technologies in the different LUS were produced (Figure 29). All evidence will be included in the National Atlas of sustainable land management of Panama (forthcoming).

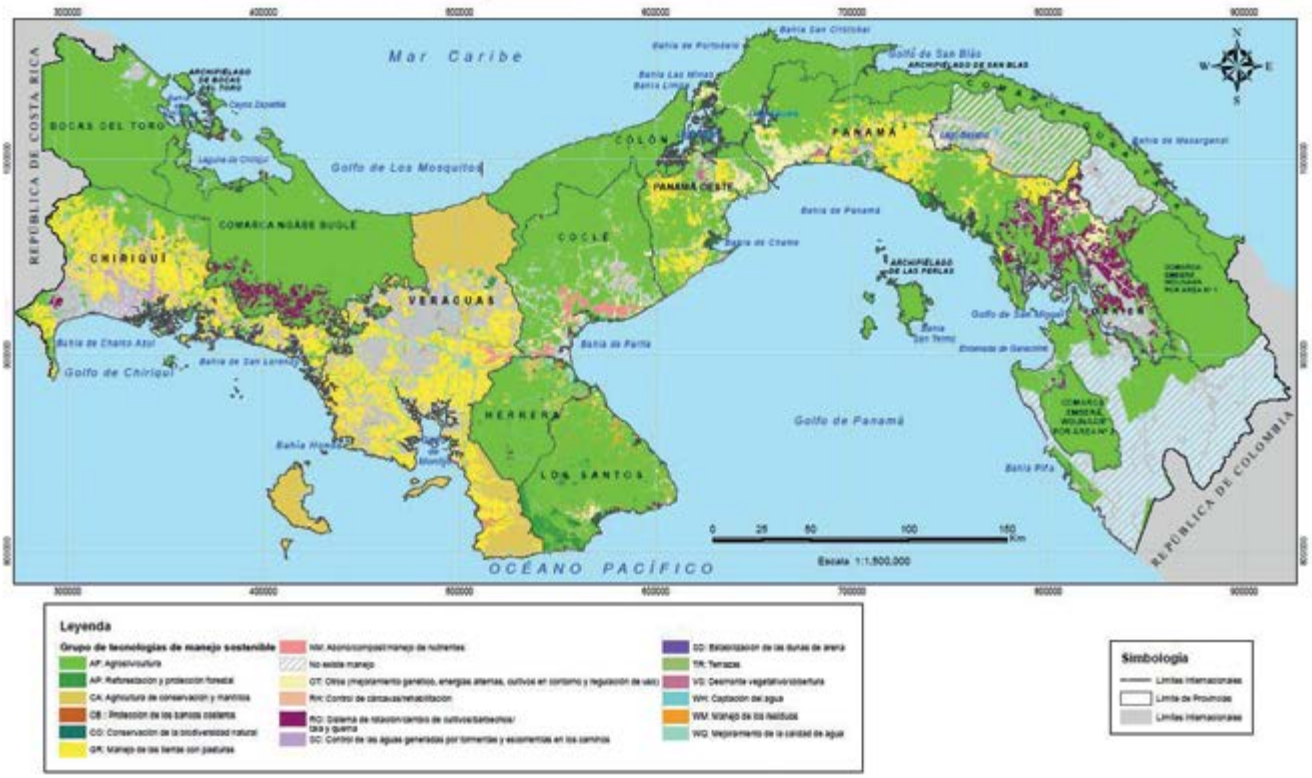
The Arco Seco region with 1 000–1 500mm of rain per year, in the South–West of the country was selected as priority region with high degradation problems due to extensive livestock farming and fires. In this region people are considered poor, unsustainable land management practices prevail, forest cover is reduced every year and wells are drying up. The two watersheds Parita and Tonosí were selected as priority landscapes.

FIGURE 28
National map of land degradation



Source: FAO. 2019. *Decision Support for Mainstreaming and Scaling Out Sustainable Land Management (DS-SLM) project,* Panama. Unpublished

FIGURE 29
Sustainable land management technologies according to land use system



Source: FAO. 2019. *Decision Support for Mainstreaming and Scaling Out Sustainable Land Management (DS-SLM) project,* Panama. Unpublished

BOX 11: South–South collaboration with Cuba supporting land degradation and SLM assessments and implementation

The Ministry of Environment (MiAMBIENTE) in Panama and the Ministry of Science, Technology and Environment (CITMA) of the Republic of Cuba signed a cooperation agreement (*convenio marco de cooperación*) for scientific, technical and academic cooperation in environmental matters in October 2018 which facilitated a series of land degradation and SLM capacity building and exchange events:

- **Training and capacity building:** Cuban experts train GIS staff from the Ministry of Environment Panama on the creation of an updated LUS map and the FAO–WOCAT QM methodology and provide ongoing support for the realization of the methodology and production of land degradation and SLM maps.
- **Learning routes:** A group of SLM experts from Argentina, Colombia and Panama visited Cuba to jointly reflect and exchange lessons learned on methodologies for land degradation assessment; identification and implementation of good SLM practices; organizational processes for SLM; as well as mainstreaming of SLM in decision-making and financing mechanisms.
- **Technical exchange:** Cuban SLM experts visiting SLM demonstration sites in Panama to provide technical support. Exchange with other programmes of the Ministry of Environment Panama to create linkages to SLM.
- **Technical assistance:** Cuban SLM experts provide technical assistance to technicians and land users in Panama in the pilot farms of the DS-SLM project on the topics of irrigation, drainage and soil and water conservation for the implementation of SLM technologies.

©MiAMBIENTE/ Karima Lince

Cuban experts explaining erosion reduction measures.

MODULE 4

SLM implementation in the priority watersheds

In the two prioritized watersheds, a watershed committee was established and internal regulations for the operation of the committees formulated. The committees are autonomous entities for the joint management of water resources that facilitate the integration of SLM in the Territorial Management Plan (*plan de ordenamiento territorial*) and in the Watershed Management Plan (*plan de manejo de la cuenca*).

In order to evaluate SLM technologies for implementation in the two watersheds, an inventory of existing SLM technologies and approaches on farms (*fincas*) with different land use systems (LUS) was carried out.

Based on the degradation maps produced in the national assessments and visible hot spots of degradation in the watersheds, 22 farms (fincas) were selected as demonstration farms to implement SLM technologies and facilitate replication by training and capacity building activities to both technicians and land users and the farm.

In order to support the implementation of SLM practices in the two watersheds, a local NGO was contracted. A maximum investment budget per farm was defined, depending on whether the farm functioned as pilot or satellite farm. The latter are technology dissemination farms to promote the results of the project. For each farm, a farm management plan was elaborated including: diagnosis, selection of suitable SLM technologies, considerations for the implementation of SLM, schedule of activities and budget. A letter of agreement was signed with each farmer to have the commitment to implement SLM and also follow the recommended maintenance plan.

Training was provided to land users on the following topics:

- Silvopastoral systems, principles of agribusiness, preparation of organic fertilisers, use of A level
- Sustainable management of soil and water resources
- Sustainable production

MODULE 1

SLM mainstreaming

A national mainstreaming strategy was formulated with the National Committee to Combat Drought and Desertification (CONALSED). DS-SLM contributed to create the basis for the realization of a draft soil law that is oriented to the sustainable management of soils in Panama, integrating SLM in the key decision-making processes of the country. The draft soil law intends to fill a legal vacuum with a law that integrates all the relevant subjects and parties interested in the use of soil resources. The general objective of the draft soil law is to guarantee the sustainable use and management of land, through its conservation and recovery in an orderly manner at the national level, develop mechanisms and alliances for integrated action with civil society, private companies and competent institutions.

Furthermore, a process of economic–ecological valorisation of the best SLM technologies was conducted and financing

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Livestock farm in the province of Herrera. Earth barriers made from old tires to heal a gully.

©MiAMBIENTE/ Karima Lince

Farm with SLM technologies which benefitted from the DS-SLM project in the province of Herrera.

©MiAMBIENTE/ Karima Lince

Livestock farm in the province of Los Santos. Gullies plugged with wooden barriers to retain sediments.

©MiAMBIENTE/ Karima Lince

Organic fertilizer from the remains of the cattle farm to improve pasture fertility in the province of Los Santos.

mechanisms (e.g. public payments; payments for investments in land conservation; eco labels) designed for their implementation in the priority watersheds of Parita and Furthermore, a process of economic–ecological valorisation of the best SLM technologies was conducted and financing mechanisms (e.g. public payments; payments for investments in land conservation; eco labels) designed for their implementation in the priority watersheds of Parita and Tonosí.

Environmental education and capacity building

In order to foster environmental education and capacity building to youth, an NGO was selected for the creation of two groups of "young agro-environmental leaders" comprised of students from agricultural colleges, one in each pilot watershed (Parita and Tonosí). The group of young environmental leaders were equipped with drones for the monitoring of their watershed (Box 12). They surveille and serve as informants for the watershed committee to provide evidence on the state of the watershed with drone information. It is necessary to include young agro-environmental leaders in the SLM, to achieve their appropriation as land users and thus contribute to the generational transformation of the productive systems in watersheds.

©Joshua Jaramillo

Young environmental leaders learning out to use the drones.

Panama: knowledge products, links and references

Panama country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/panama

Fernández, Joel Pérez. 2020. Plan Nacional de Sequía para Panamá. Ministerio de Ambiente (MiAMBIENTE)

Ministerio de Ambiente. 2018. *Proyecto apoyo en la toma de decisiones para la integración y ampliación del manejo sostenible de tierras, Panamá.* Presentation at 2nd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April, 2018, Rome, Italy. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/panama/#module-1

Video. 2020. *Apoyo a la toma de decisiones para el manejo sostenible de la tierra.* FAO, Panamá City. https://www.youtube.com/watch?v=VBBwNLD4-l0&t=110s.

3.10 Philippines

Implementing Partner: Bureau of Soils and Water Management, Department of Agriculture

CONTEXT

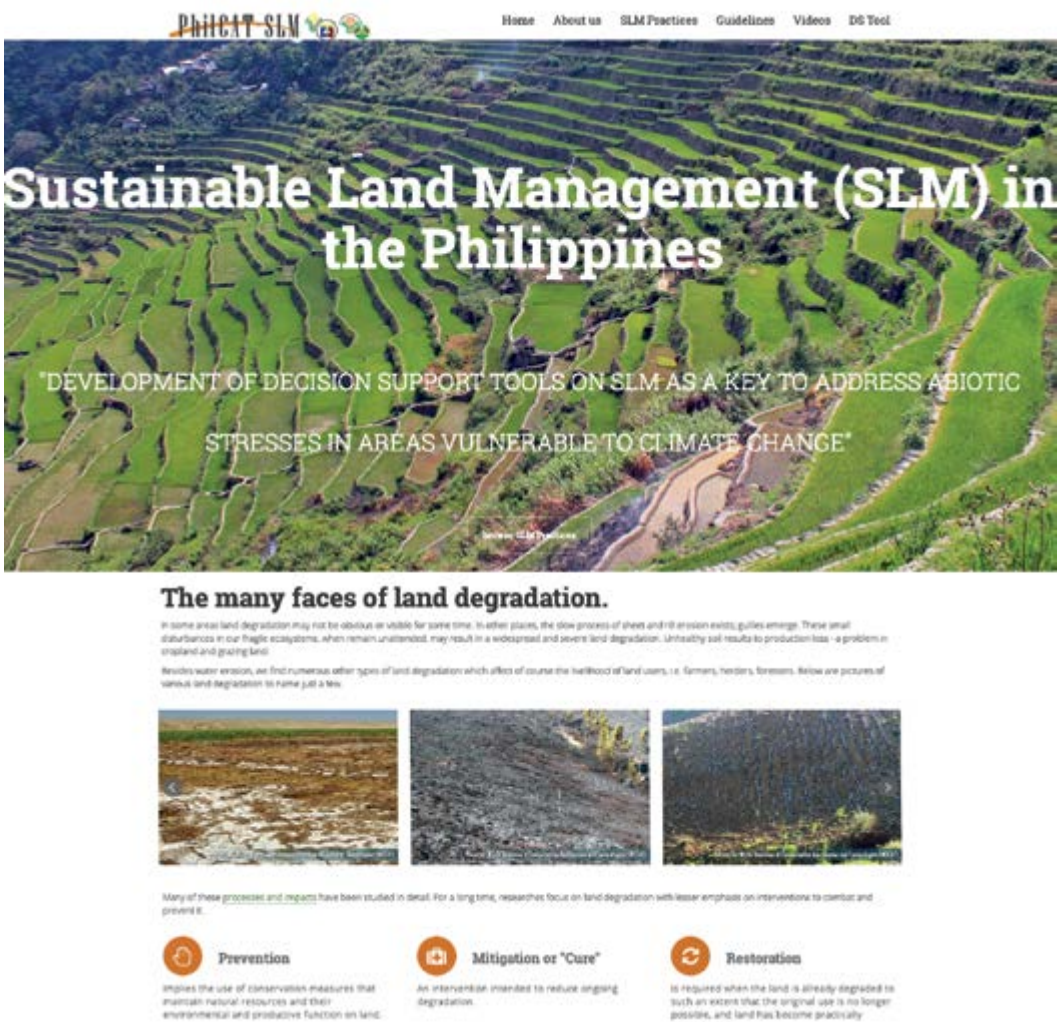
The Philippines is an agricultural country with steep slopes that has been largely cleared of forest – principally for food crops to support the rapidly increasing population. Approximately 27 percent of the country is vulnerable to drought, alternating with yearly floods and typhoons, causing serious land degradation and declining land productivity. About 45 percent of the arable lands have been moderately to severely eroded, triggering migration of subsistence farmers. Over time, soil loss by water, nutrient depletion and soil fertility decline have reduced the productivity of the land. Deforestation and unsustainable land management in the uplands make topsoil vulnerable to water erosion. Once the rich top soil is gone, this creates a cycle of poverty, resource exploitation, and under development. There is declining trend in productivity despite fertilizer applications under modern intensive farming methods (Gastro, 2013). Furthermore, there is a lack of rational and comprehensive national land use policy to ensure optimum use and management of land. One particular problem is the expansion of maize monoculture – using herbicide resistant genetically modified organism varieties – in sloping areas. However appropriate soil conservation measures are being developed and promoted for this situation.

MODULE 1

PhilCAT: a nationwide SLM network

The Philippine Conservation Approaches and Technologies (PhilCAT, is a nationwide SLM network which provides a platform for knowledge management and decision support in SLM. Led by the Bureau of Soils and Water Management (BSWM), it is a consortium of over ten mainly governmental institutions, including academia, applying FAO–WOCAT tools and tailoring them to the national context. It has been active for nearly 20 years. PhilCAT ensures an ongoing partnership among national agencies on land degradation and SLM, and a strong linkage between SLM-related projects, creating synergies, populating a national database with proven practices, and providing SLM solutions for different ecosystems through a decision support tool (Figure 30). Hence, PhilCAT, under the lead of BSWM, embedded decision support framework (DSF) in its procedures, and created synergies between the DSF Modules and ongoing activities in different SLM-related projects.

FIGURE 30
PhilCAT SLM platform



Source: Philippine Conservation Approaches and Technologies (PhilCAT) SLM platform. For more information please see: http://119.92.65.179/philcat-slm

MODULE 2

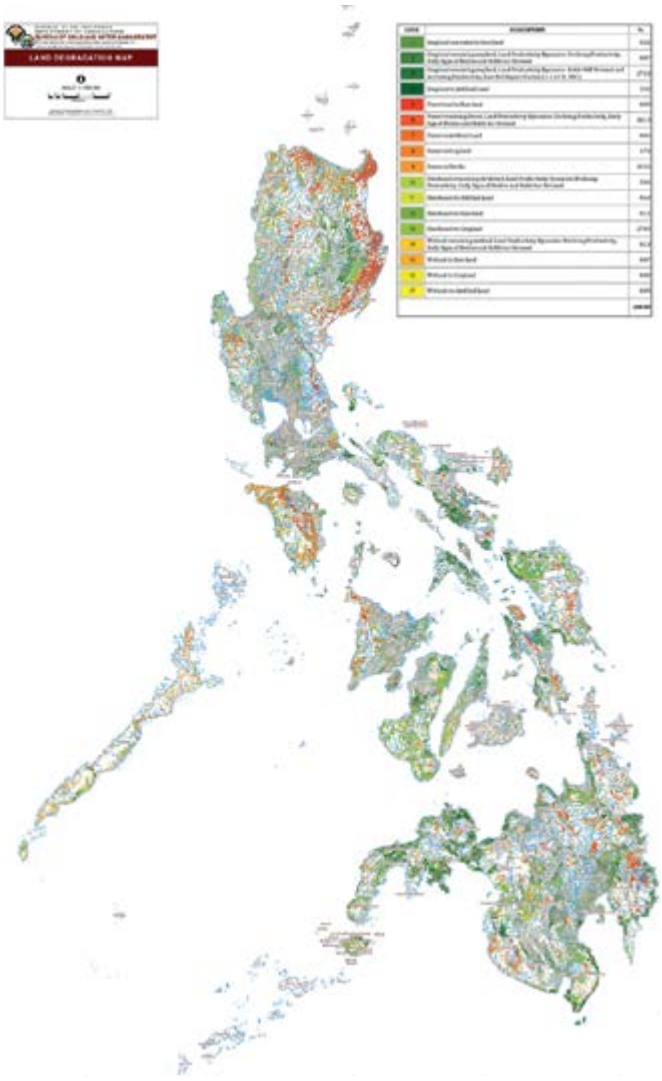
National land degradation assessment anchored in the LDN target setting programme for the prioritisation of landscapes

The national level assessment was based on activities within the UNCCD LDN target setting programme that mapped LDN baselines and priority targets for SLM implementation. Multistakeholder workshops were organised to present the results of the spatial analysis, obtain comments from experts, and identify drivers of land degradation. The results of the LDN target setting programme, including the PRAIS report, were further presented in three island-wide meetings and one national consultation.

In this process, a national land degradation map was developed based on the three LDN indicators (Figure 31):

- Trends in land cover change, using national datasets
- Land productivity dynamics, using UNCCD/ global datasets
- Soil Organic Carbon, using national datasets

FIGURE 31
National land degradation map developed under the land degradation neutrality target setting programme



Source: Bureau of Soils and Water Management (BSWM). 2018. DS-SLM final report. BSWM, Manila.
https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/philippines/#module-2

The land degradation map (Figure 31) and other maps were used as a baseline for a GEF 6 project (i.e. with the Biodiversity Management Bureau as executing agency) and development of the GEF 7 project (with BSWM as executing agency) and served as the baseline for the SDG Target 15.3 reporting to the UNCCD.[16]

As the Philippines adopted integrated landscape management in the implementation of LDN, the country's 18 major river basins are considered priority areas for development. The Cagayan de Oro River Basin in Mindanao was selected as the pilot area for ILM because of flash floods resulting in the loss of property and lives. There are plantations of pineapples and bananas in the basin and smallholder farmers planting maize on the slopes. There are also two Key Biodiversity Areas that need to be protected within the basin.

MODULE 5

SLM evidence for territorial planning at farm level

While the ILM approach is applied at the river basin level, the provincial land degradation map (with a 30 m resolution) serves as the baseline for identifying areas that need SLM intervention and planning at farm level. In Box 13 the different steps needed for territorial planning are presented:

BOX 12: Steps of territorial planning – from national to local level

Step 1. Initial target areas are identified based on Land Degradation Map and national priorities.

Step 2. Upon budget approval and release, liaising with the Regional Field Office of the DoA is conducted for the to identify maize growing areas, and with the local government units to identify farmer co-operators.

Step 3. A consultation meeting is conducted to select the final farmer cooperators based on the following criteria:

1. accessible and connected to nearest farm-to-market roads;
2. visible to other farmers/farming communities;
3. freedom from land tenure conflict;
4. preferably with potential water sources (e.g. small farm reservoir);
5. presence of local interest and involvement of local participants, particularly maize farmers; and
6. cooperators who are willing, receptive to new technologies, and have their own resources.

Step 4. Before formal start-up, a courtesy call and awareness campaign is conducted with village officials.

Step 5. Staff from BSWM provide technical assistance in the preliminary field investigation. After the field validation, biophysical characterisation and soil surveys, as well as socioeconomic surveys, are conducted.

Step 6. Another consultation/meeting with farmer cooperators and partner agencies is conducted to present the soil conservation farm (i.e. SLM) plan.

Step 7. Capacity building activities for farmer cooperators are undertaken by BSWM covering topics on practical approaches to SLM: that is the right mix of land use options and appropriate SLM measures.

[16] For additional information, please see: https://prais.unccd.int/unccd/reports?field_year_target_id=All&field_country_target_id=philippines&items_per_page=25

In the intervention areas, farmers were introduced to the concepts of land capability potential – the ability of land to support a given land use without causing damage, which is a step towards assessing its suitability for cultivation of specific crops. The land capability class of the farm (Table 1) is determined during field work with farmers.

As a final output of territorial planning, a soil conservation farm plan is produced and presented to the farmer cooperator. This becomes the basis for the establishment of the farmer-managed Soil Conservation Techno Demo Farm that features appropriate and recommended soil conservation measures, suitable crops correctly located, water resources development, if any, and other soil and water conservation strategies (Box 14). For the development of the soil conservation farm plan, together with the assessment of land capability potential, baseline data on soil, vegetation, metrology, hydrology and agro-socioeconomic data were collected through field surveys at farm level.

TABLE 9
Land capability classes

A	Very good land; can be cultivated safely; requires only simple but good farm management practices.
B	Good land; can be cultivated safely; requires easily applied conservation practices.
C	Moderately good land; must be cultivated with caution; requires careful management and intensive conservation practices.
D	Fairly good land; must be cultivated with extra caution; requires careful management and complex conservation practices. Best suited for pasture or forest.
L	Level to nearly level land; too stony or very wet for cultivation. Suited for pasture or forest with good soil management.
M	Steep, very severely to excessively eroded or shallow for cultivation. Suited for pasture or forest with careful management.
N	Very steep, excessively eroded, shallow, rough, or dry for cultivation. Suited for pasture with very careful management and definite restrictions. Best suited for forest with very careful management.
X	Level land, wet most of the time, cannot be economically drained. Suited for farm ponds or for recreation.
Y	Very hilly, mountainous, barren and rugged. Should be reserved for recreation and wildlife.

Note: Classes A, B, C, D, designate arable land and classes L, M, N, X and Y non-arable. Most of the hilly and sloping lands would fall under land capability classes D, M, N and Y. Very hilly and mountainous, barren, and rugged land would fall under class Y.

MODULE 4

Showcasing SLM solutions through techno-demo farms

Techno-demo farms were initiated by the Department of Agriculture – Regional Field Offices and the Provincial Agricultural Offices in close supervision/ assistance with the BSWM. These farmer-managed, techno-demo farms underpin farmer-to-farmer learning and have been established in different regions – especially where sloping uplands are cultivated with maize. They serve as SLM learning centres to support scaling out. Specific SLM technologies suitable for different zones are considered for implementation in the techno-demo farm planning (Figure 32).

Good SLM practices for the different zones are shared in PhilCAT's overview book "Philippine Case studies on SLM – Approaches and Technologies" and some examples are shown below. In addition, Information, Education and Communication materials were produced for land users and extension services.

BOX 13: Participatory soil conservation farm planning

Through participatory farm planning, the BSWM encourages land users to prepare their soil conservation farm plan which is a simple farm layout including a tentative schedule of activities and the steps needed to develop their farm.

Step 1: Establish objectives with the farmer
Objectives are set by land users themselves as they are fundamental to the success of the farming enterprise. Objectives must be based on land stewardship and economic values. Land users are then given the opportunity to decide what appropriate interventions (i.e. whether rehabilitation, mitigation or preventive measures) should be put in place.

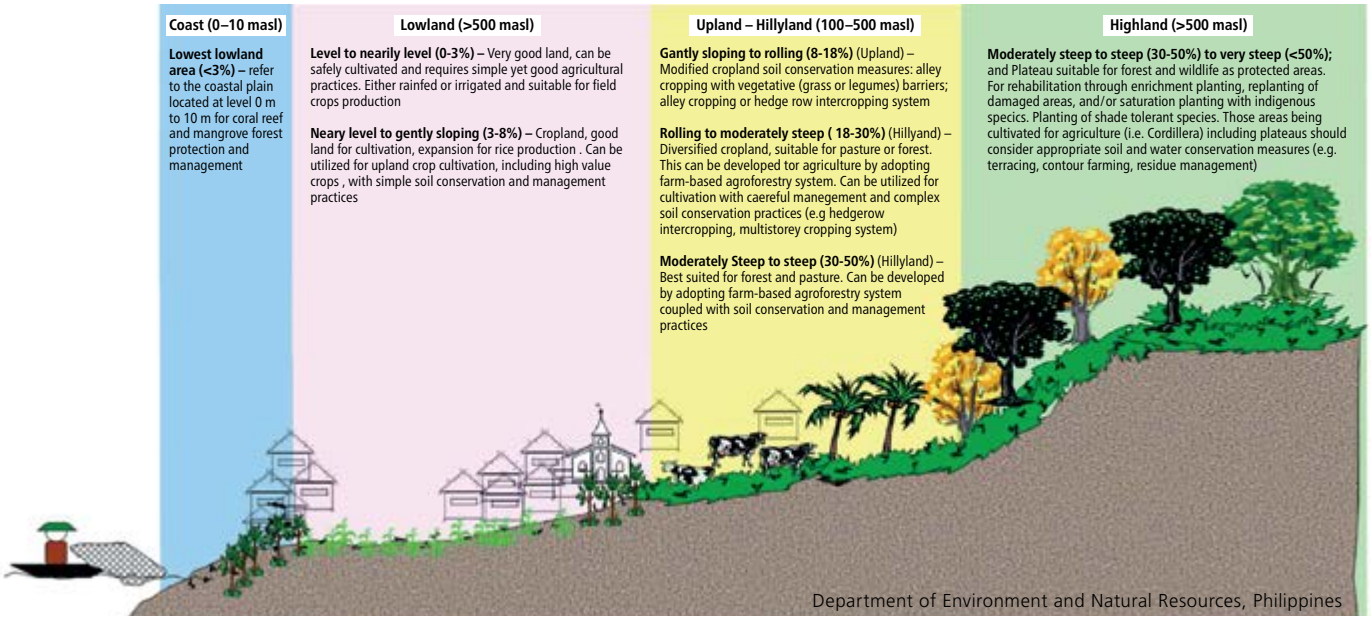
Step 2: Carry out farm resources inventory
This is to make sure there is a sound and do-able farm plan: the land user makes an inventory of the resources and situation in the farm. These include existing crops, water source, farm tools and signs of land degradation.

Step 3: Farm plan based on appropriate land use
A recommended land use management and conservation strategy for each land use is put in place. For example, where to plant annuals, mixes of annuals/ perennials, and perennials. Sometimes, the installation of a farm pond or reservoir is recommended.


©William Critchley

Cabbage planted on contour of vegetable terraces.

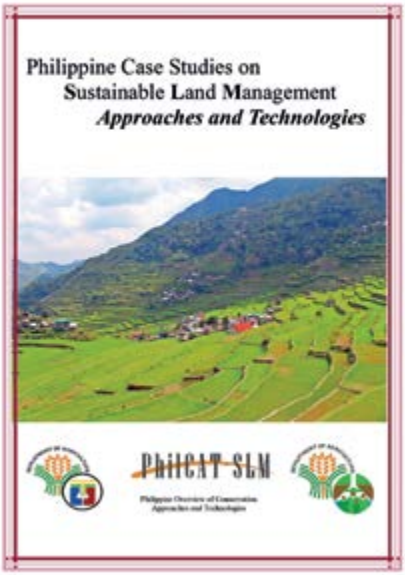
FIGURE 32
Specific SLM technologies suitable for different ecosystems/ zones



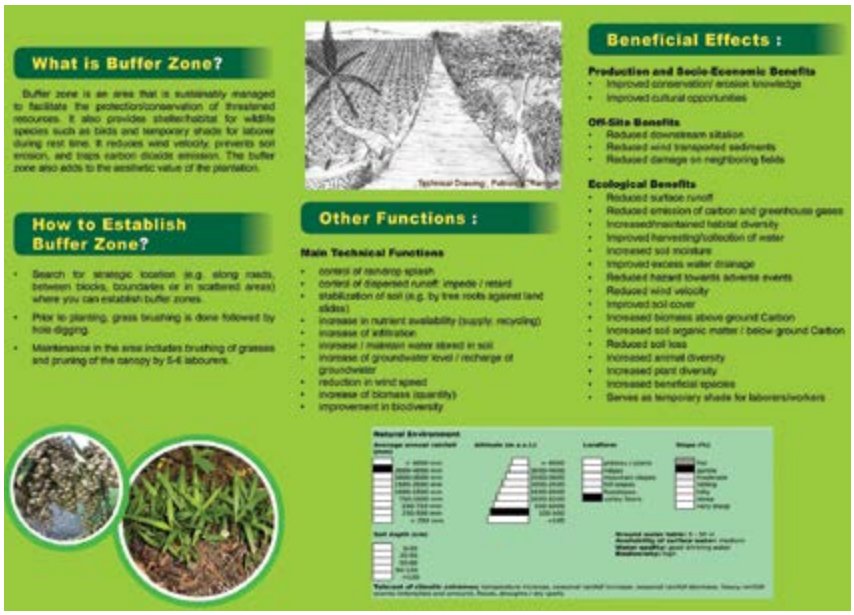
Coast	LOWLAND	LOWLAND-UPLAND	LOWLAND-UPLAND	UPLAND-HILLYLAND	UPLAND-HILLYLAND-HIGHLAND	HIGHLAND
1. Mangroves as a buffer against natural hazards	1. Alternate wetting and drying 2. In situ decomposition of banana stalk 3. Conservation tillage for core production 4. Ecological engineering for irrigated lowland rice 5. Modified rapid composting	1. Windbreaks 2. Planted vegetative strip 3. Small farm reservoir	1. Organic based system of rice intensification	1. Vetiver grass system 2. Multi-storey cropping 3. Small water impounding project 4. Pressing of cogon 5. Firebreaks/ greenbreaks 6. Sweet potato relay cropping 7. Improved pasture under citrus	1. Littuko growing for forest enhancement 2. Residue incorporation 3. Trees as bufferzone 4. Contour straight block layout 5. Sediment traps 6. Highly diversified cropping in live trellis 7. Sugar mill waste water re-use for irrigation	1. Natural vegetative strip 2. Rainfed paddy rice terraces 3. Contour farming using hedgerows 4. Rockwall terrassing 5. Stone bunds and small basin 6. Seed production of multi-purpose shrubs/ legumes 7. Vegetable terracing 8. Organic mulching 9. Composting using indigenous microorganisms 10. Compact farming for vegetable production

Source: PHILCAT. 2017. *Philippines Case Studies on SLM Approaches and Technologies* - Compendium PHILCAT. BSWM, Manila. https://www.wocat.net/library/media/145/

BOX 14: PhilCAT SLM good practices overview book (left) and an example of information, education and communication material for land users and extension (right)



Source: PHILCAT. 2017. *Philippines Case Studies on SLM Approaches and Technologies* - Compendium PHILCAT. BSWM, Manila. https://www.wocat.net/library/media/145/



Source: PHILCAT. 2017. *Information, Education and Communication (IEC) materials Philippines*. BSWM, Manila. https://www.wocat.net/library/media/167/

Coastal and Lowland Areas:

Mangroves as Buffer against natural hazards

Mangroves act as buffers against natural hazards. They perform an essential function in protecting coasts from storm surges and erosion of the coastline. Sediments are captured and a rich, unique ecosystem is established. Mangrove forests are highly biodiverse and act as breeding grounds for fish and other marine creatures. On the island of Banacon, the mangrove "Bakauan" (*Rhizophora* sp.) is highly appreciated. Replanting of degraded mangroves began in 1957. Mangroves are propagated through cigar-shaped "propagules" produced by mature plants. Results have been positive – but community-agreed rules are needed to protect the mangroves from being cut for poles and charcoal.

©Djolly Ma. Dinamling

Mangrove and beach forest Banacon Island, Getafe, Bohol.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_578/
https://qcat.wocat.net/en/summary/5060/?as=html

Ecological engineering for pest control

It is achieved primarily through the provision of habitats for their natural enemies. However, other ecosystem services, such as pollination and cultural services, may simultaneously be enhanced. In intensively managed tropical rice production systems, biological pest control, pollination and landscape aesthetics also benefit from flower strips on the bunds within irrigated fields. The specific aim is to increase biodiversity in rice fields and provide habitats for beneficial organisms such as predators of rice pests (e.g. spiders) or parasitoids (e.g. hymenopteran parasites), which in turn helps to minimise the use of pesticides.

©Leonardo V. Marquez

Rice field planted with strips of flowering plants along levees, Maligaya, Muñoz, Nueva Ecija.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1720/
https://qcat.wocat.net/en/summary/5055/?as=html

Upland / Hillyland / Highland:

The highly diversified cropping live trellis system

The Technology is a farmers' initiative used in rolling to hilly terrain where annual rainfall is between 1 000 and 2 000 mm."Kakawate" (*Gliricium sepium*), is a leguminous tree that is used as a living trellis or "balag" to support crops such as tomatoes, cucumbers and beans. The system is highly diversified and crops rotated regularly. Trees are planted in rows about 2–3 meters apart and pruned to 3 meters high: the trimmed leaves are very rich in nitrogen and serve as compost. The living trellis stabilizes sloping lands and reduces soil erosion.

©Baldwin Pine

Gliricidia sepium locally known as "kakawate" as live trellis "balag" or anchorage for annual crops and erosion control measure, Brgy. Bukal, Nagcarlan, Laguna.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1930/
https://qcat.wocat.net/en/summary/5059/?as=html

Littuko for forest enhancement

"**Littuko**" (*Calamus manilensis*) is a large rattan variety which is common in the Cordillera, Caraballo, and Sierra Madre mountain ranges. Its fruits are sweetish sour. Littuko grows naturally within forests and remains green throughout: in case of wildfires, it reinforces the forest's capacity to serve as a firebreak. It also attracts wildlife, ranging from insects to birds, bats, and cloud rats. The thorns of littuko help guard the forest area from people and animals – and it can be planted to enhance forest protection.

©Evangeline F. Dacumos

Littuko seedlings planted in rows for transplanting. Bayombong, Nueva Vizcaya.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1708/
https://qcat.wocat.net/en/summary/5052/?as=html l

Highlands:

Vegetable terracing

Vegetable terracing is extensively practiced in Benguet which is known as the "Salad Bowl of the Philippines". Potatoes, cabbages, Chinese cabbages, carrots, chayote, beans, lettuce and broccoli are grown. With an increase in population, this leads to the conversion of sloping areas for agricultural production. "Vegetable terracing" permits horticultural production on these steep slopes. Small bench terraces create narrow beds which makes it possible to cultivate vegetables. Soil is conserved simultaneously.

©Evangeline F. Dacumos

Terraced vegetable farm within a forest, Benguet, Atok, Benguet.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1289/
https://qcat.wocat.net/en/summary/5042/?as=html

MODULE 1

SLM mainstreaming and scaling out through the integrated land management framework

The Integrated Land Management Framework developed helps Local Government Units to systematically organise their multifaceted responsibilities in performing tasks on managing land resources sustainably, and to address the gaps and barriers in implementing and mainstreaming SLM at the national and local levels. Awareness raising and education were identified as key decision-making process as well as communication and communication material to further support mainstreaming and scaling out.The Philippines SLM platform underpins and strengthens PhilCAT in:

1) advocacy and activities related to SLM;
2) increasing capacity and awareness of local partners about SLM and climate change adaptation strategies; and
3) communicating and disseminating results to all stakeholders to stimulate adoption.

It also provides an online decision support tool for selecting SLM practices, based on their ecosystem zone, type of land degradation, type of measure or main function. It is a valuable tool for all SLM-related projects.

Philippines: knowledge products, links and references

Philippines country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/philippines

Philippines SLM practices documented under the DS-SLM project:
https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_PHL&filter__qg_funding_project__funding_project=1

PhilCAT SLM platform: http://www.bswm.da.gov.ph/philcat-slm/; http://119.92.65.179/philcat-slm

Bureau of Soils and Water Management (BSWM). 2019. DS-SLM final report. Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. BSWM Manila.
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https://link.springer.com/chapter/ 10.1007/978-94-007-6652-5_15

PHILCAT. 2017. *Philippines Case Studies on SLM Approaches and Technologies* - Compendium PHILCAT. BSWM, Manila. https://www.wocat.net/library/media/145/

PHILCAT. 2017. *Information, Education and Communication (IEC) materials Philippines.* BSWM, Manila. https://www.wocat.net/library/media/167/

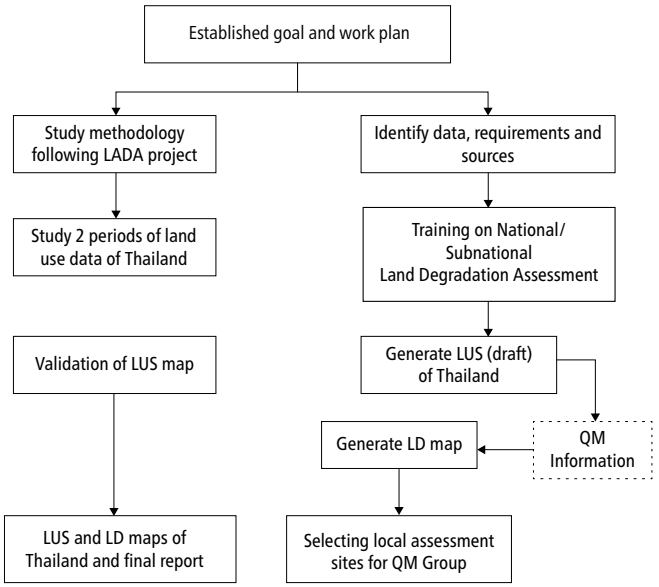
3.11 Thailand

Implementing Partner: Land Development Department, Ministry of Agriculture and Cooperatives

CONTEXT

Land degradation, leading to low soil productivity, can be found in all regions of Thailand and affects around 55 percent of the land area. Problems include soil erosion on steep slopes, acid sulphate soils, saline soils, shallow soils, sandy soils and low soil organic matter content. The cost of land degradation is estimated at over USD 12 000 million per year. Economic growth and population density exert pressure on land and water resources. Factors contributing to land degradation include deforestation, continuous cropping, adverse effects of agrochemicals and land fragmentation. With increased urbanisation, extreme climate vulnerability and a rising number of tourists there have been changes in government policies. In this context the DS-SLM project has been an opportunity to put in place a system that works in a collaborative manner within and across divisions, departments, ministries and with multi-stakeholders – particularly land users and farmers.

FIGURE 33
Flow chart of LUS and land degradation processes



Source: adapted from: Land Development Department (LDD). 2019. *Decision Support for Mainstreaming and Scaling up Sustainable Land Management (DS-SLM) Thailand.* 2nd progress report. FAO and LDD, Bangkok. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand/#module-2

MODULE 1

Cross-sectoral coordination and linking to national UNCCD processes

Land Development Department (LDD) engaged the UNCCD Technical Sub-Committee, an existing mechanism, with 25 permanent members, as the national steering committee for DS-SLM, ensuring cross-sectoral coordination and facilitating mainstreaming and scaling out activities. A capacity needs assessment with the members of the UNCCD National Committee showed existing planning tools used by government agencies for different thematic areas (e.g. remote sensing, land use/ cover, water use rights, climate) and baseline data available. However, there were not many responses regarding documentation of good practices in the surveyed organizations.

Working groups for project implementation were established where LDD's experts were supported by the Soil and Fertilizer Association of Thailand (SFST), Kasetsart University (KU) and national experts such as SLM specialists, economists and policy and institutional experts to facilitate data collection and analysis, validate the results, and facilitate mainstreaming and scaling up of SLM.

MODULE 2

National land degradation assessment and identification of priority areas

To attain a LUS and land degradation map at national level a "standardized" process was followed comprising a number of steps as shown in the flowchart below (Figure 33). Stakeholders at national/ subnational level were trained on the FAO–WOCAT mapping tool (QM) through a mechanism of South–South exchange by specialists from China.

The outcome of the training and follow-up work was a national LUS map (Figure 34) and maps showing the degree and rate of land degradation (Figure 35).

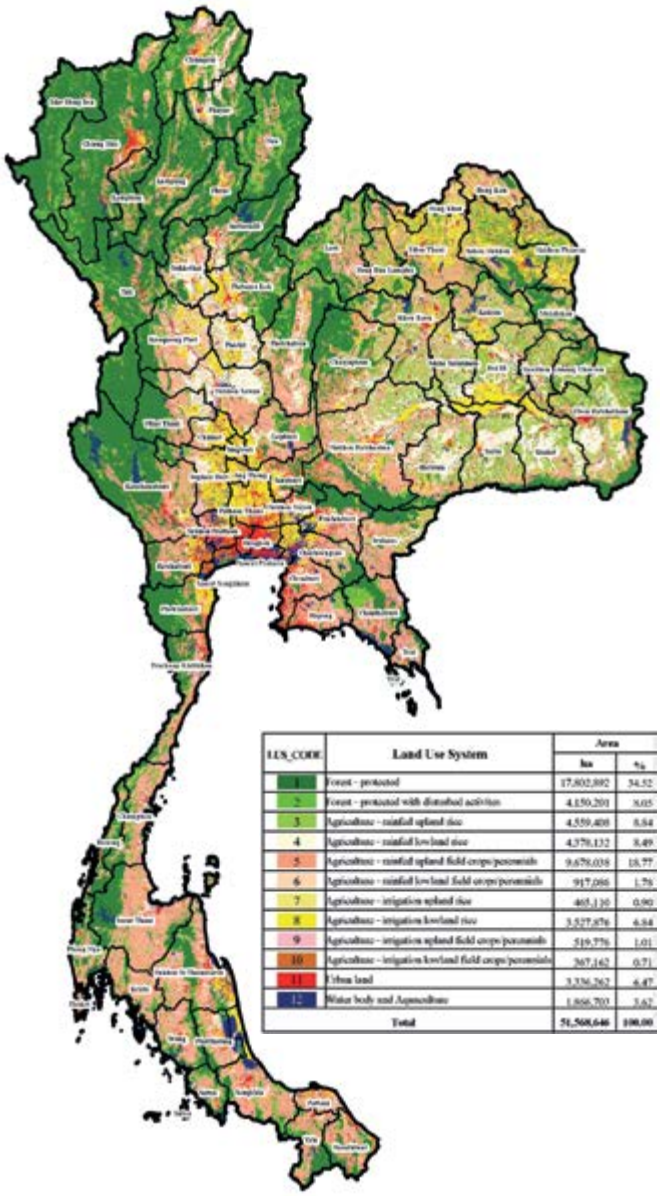
The LUS map was ground-truthed in four regions of the country, namely the North, the Northeast, Central region and the East, and the South. Randomly picked points in every land use system in these regions were taken for checking and verification. Findings revealed that the LUS map was accurate to a level of over 98 percent. Errors resulted from the fact that land utilisation had changed – for example through planting different crops.

©Land Development Department (LDD)

©Land Development Department (LDD)

Impressions from the training workshop on land use system mapping and LDN at national/ subnational level (top). Impressions from the training Workshop on Mapping LUS and LDN at national/ subnational level (bottom).

FIGURE 34
The land use systems map of Thailand



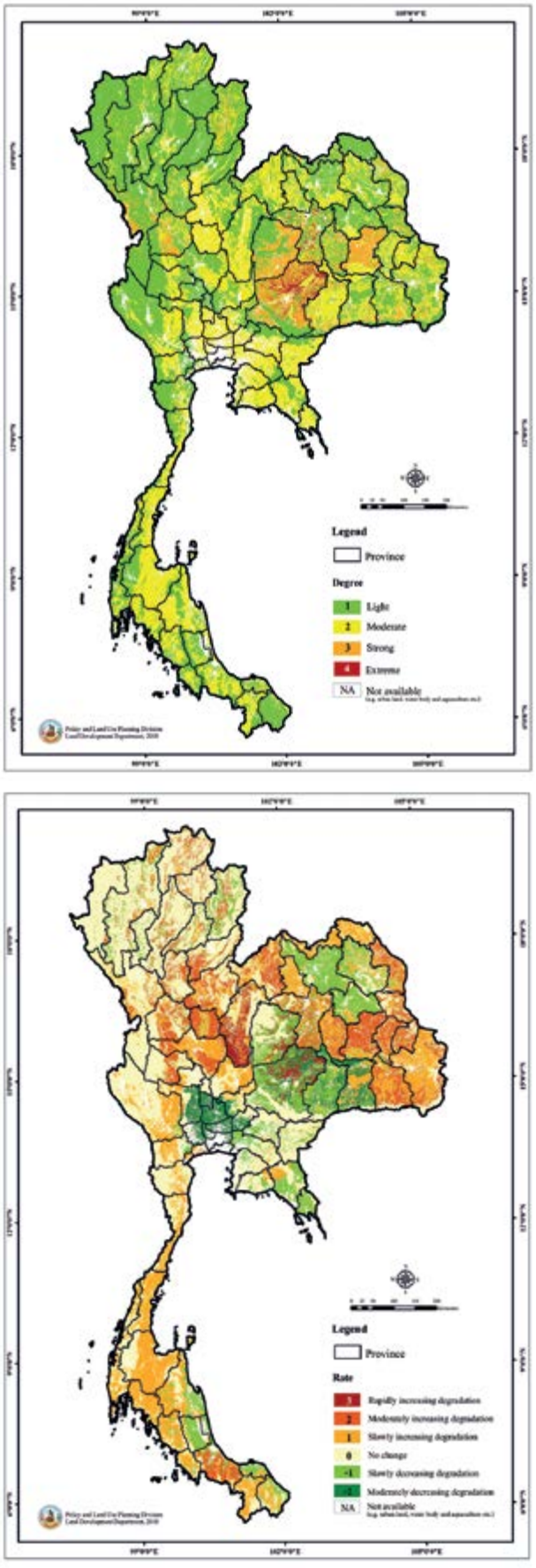
LUS_CODE	Land Use System	Area	
		ha	%
1	Forest - protected	17,802,892	34.52
2	Forest - protected with disturbed activities	4,150,203	8.05
3	Agriculture - rainfed upland rice	4,559,408	8.84
4	Agriculture - rainfed lowland rice	4,370,132	8.49
5	Agriculture - rainfed upland field crops/perennials	9,676,038	18.77
6	Agriculture - rainfed lowland field crops/perennials	917,066	1.78
7	Agriculture - irrigation upland rice	465,130	0.90
8	Agriculture - irrigation lowland rice	3,527,876	6.84
9	Agriculture - irrigation upland field crops/perennials	519,776	1.01
10	Agriculture - irrigation lowland field crops/perennials	367,162	0.71
11	Urban land	3,336,262	6.47
12	Water body and Aquaculture	1,866,703	3.62
	Total	51,560,646	100.00

Source: Land Development Department (LDD). 2019. *Decision Support for Mainstreaming and Scaling up Sustainable Land Management (DS-SLM) Thailand.* 2nd progress report. FAO and LDD, Bangkok. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand/#module-2

Results from the national level assessment showed that the main land degradation problems are: (a) soil erosion by water (loss of topsoil, collapse of riverbanks, mudslides, etc.); (b) chemical soil degradation (such as acid sulphate soil/acid soil, saline/alkaline soil); (c) decrease in organic matter and soil fertility; and (d) biological degradation (e.g. wildfires, increase of insect pests and disease, and decrease of biomass). Furthermore, soil compaction and a decrease in quality of surface water were also found.

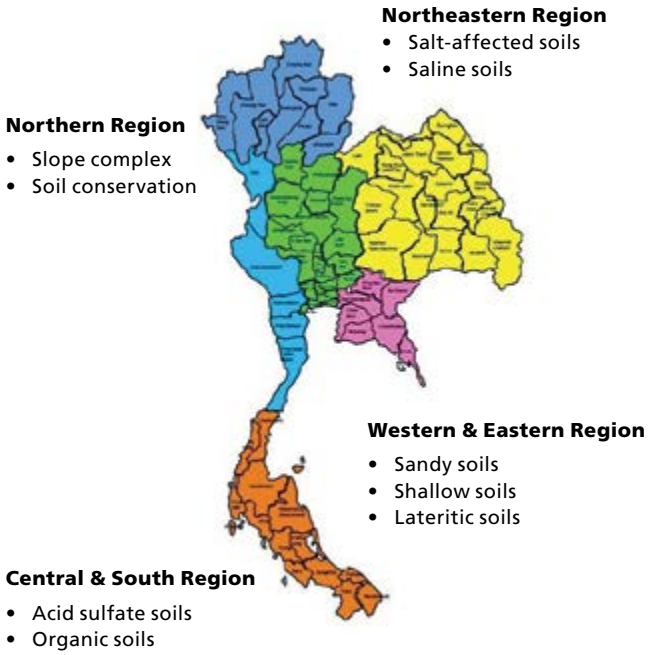
Soil and its problems were key for the selection of areas of intervention/ priority landscapes beside the assessed rate and degree of land degradation in each LUS. Four regions were identified for scaling up SLM, covering the salt-affected, acid sulphate and erosion-prone soils (Figure 36). Consequently, four teams were established, consisting of a consultant and the regional LDD officer, dedicated to implement activities in the respective region.

FIGURE 35
Map of degree (top) and rate (bottom) of land degradation in 2018



Source: Land Development Department (LDD). 2019. *Decision Support for Mainstreaming and Scaling up Sustainable Land Management (DS-SLM) Thailand.* 2nd progress report. FAO and LDD, Bangkok. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand/#module-2

FIGURE 36
Overview of four selected regions for intervention



Note: In the North, the highest degree of land degradation is in Tak province, Kamphaeng Phet province and Sukothai province. For the Northeast, the highest degree of land degradation is in Nakhon Ratchasima province, followed by Roi Et province. In the South, the highest degree of land degradation is in Yala province.

Source: Land Development Department (LDD). 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. LDD, Bangkok. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand

MODULE 4

Land degradation and SLM good practices evidence for local action

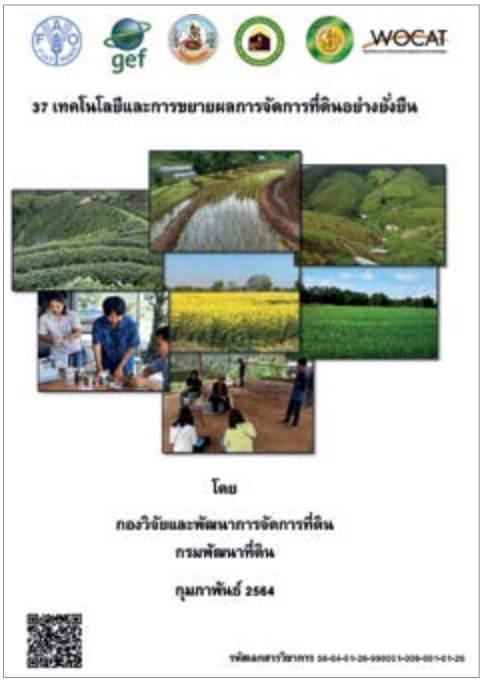
The participatory LADA local level assessment was conducted in the three regions showing problems of (1) soil erosion, (2) acid sulphate soils, and (3) saline soils. These were determined from the land degradation map. Local assessment included physical and chemical soil properties, topography, land use, land degradation and crop conditions, and the socioeconomic environment of the communities. To build awareness of the importance of land degradation, the principles of participatory stakeholder involvement were applied.

Transect walks were conducted in the **Northern part** affected by soil erosion in three agroecological zones: (1) lowland with irrigation (highly populated low plains with intensive farming), (2) upland rainfed, and (3) highland rainfed (long-term development projects supporting ethnic groups). In the **Central and Southern part** affected by acid sulphate soils transect walk were carried out in bright spots of good land management and hot spots of degradation as identified in the land degradation maps. In the **North–Eastern part** affected by saline soils the transect walk was done in a bright spot and a hot spot (rainfed agricultural areas in the highland and the plain).

Criteria for the selection of SLM Approaches and Technologies were agreed during LDD regional meetings in order to make an inventory and then to select at least 40 SLM good practices for documentation. These selection criteria were as follows:

1. **Relevance:** ability to cope with land degradation that is prevalent in the area or region
2. **Proof of endurance:** having withstood the test of time and proven to be applicable over a wide variety of conditions
3. **Replicability and transferability:** ability to be of value to a wide variety of land users in similar conditions
4. **Effectiveness:** in preventing, reducing, recovering or adapting to land degradation problems
5. **Efficiency:** cost-effective in addressing specific land degradation problems in the region (nevertheless, priority should be given to technologies or approaches that generate favourable social returns and incentivise stakeholders or public–private partnerships in achieving long-term sustainability outcome)
6. **Livelihoods:** applicable to livelihood activities that are prevalent in the area or region and can potentially contribute to household food security and sustainable livelihood enhancement
7. **Empowerment of local community:** enhance social equity in favour of the disadvantaged, i.e., the poor, the aged, and women and girls etc.
8. **Negative externality:** free from creating negative externalities or off-site impacts be it environmental, social or economic
9. **Sustainability:** sustainable in all three main aspects: social, economic and environmental

Based on this selection, SLM practices addressing soil erosion, saline and sodic soils were documented with the WOCAT Questionnaires on SLM Technologies and Approaches and shared in the WOCAT SLM Database in Thai and partly English language. A compendium was produced in Thai language with the aim to strengthen the contributions of SLM to solve DLDD problems, and support key decision-making processes and the uptake of national SLM best practices. Some examples from the four regions, addressing their specific problems, are shown on the next page.



Source: Land Development Department (LDD). 2021. *Compendium of Thailand's SLM Best Practices.* LDD Research and Development for Land Management Division, Soil and Fertilizer Association of Thailand (SFST), Kasetsart University (KU), FAO, WOCAT. Bangkok. https://www.wocat.net/library/media/249/

Northern region: soil erosion

Continuous bench terraces on steeply sloping land for tea plantation

Continuous bench terraces with three-meter-wide beds are a sustainable soil and water conservation measure for tea plantation in sloping areas of the northern region. In the past, the watershed areas in the northern region were affected by natural disasters, climate change, and human threats. Shifting cultivation was a serious problem in causing soil erosion: that is runoff with loss of topsoil and plant nutrients, which decreases soil fertility and productivity, and leads to extreme damage to upstream forest ecosystems.

©Tanomkwan Tipvong

Continuous bench terraces in a tea plantation, Chiang Mai Province.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4281/

Returning life to Mae Chaem watershed by integrated land and water management

The "Khok-Nong-Na" model, a new theory in agriculture, supports sustainable cultivation outside the protected forest area in the northern highlands. The model is based on the King Rama 9 initiative combined with local knowledge. This "new theory" Approach is based on a self-sufficiency economy dividing the area into portions as follows: 30 percent for water sources (farm ponds, small water channels), 30 percent for rice fields, 30 percent for trees, and 10 percent for housing and animals.

©Tanomkwan Tipvong

Integrated land and water management in highland landscape of northern Thailand, Mae Chaem District, Chiang Mai Province.
https://qcat.wocat.net/en/wocat/approaches/view/approaches_4280/
https://qcat.wocat.net/en/summary/4280/?as=html

Central & Southern region: acid sulphate soils

The application of marl to improve acid soils

Adding marl to soils helps to manage acidity. Acidity is a problem in soil caused by iron sulphate that becomes sulphuric acid upon oxidising when exposed to the air. Agricultural lime can neutralise or partly reduce the acidity, allowing plant production, and where rice is being grown – increasing its yields. Agricultural lime is available mainly in the forms of slaked lime, marl, or ground limestone. Before applying marl, the land should be well levelled so that marl can react with acid soil efficiently.

©Kanjaraj Lachidavong

Ploughing after marl application. Thung Rangsit area in the past was planted mainly to rice.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4312/
https://qcat.wocat.net/en/summary/4312/?as=html

Northeastern region: salt-affected and saline soils

Planting of *Acacia ampliceps* to control severely salt-affected land

Acacia ampliceps (salt wattle, a leguminous Australian shrub), has been introduced in salt-affected areas in the Northeast for the remediation of saline soils. Levelling the land and furnishing with ditches and dikes is needed first, and then the trees are planted in the affected area, along an east–west orientation on the dikes. The Technology is very well accepted by land users.

©Chakkaphan Phaosrakhu

Shading and native grasses returned after 3 years of planting *Acacia ampliceps*.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_4149/
https://qcat.wocat.net/en/summary/5776/?as=html

Promoting the network for integrated management on salt-affected soils

The multi-agency Approach for promoting the network of integrated management on salt-affected soils has been conducted in Ban Hua Nong, Hua Nong subdistrict, Ban Phai district, Khon Kaen province since 2007. For this Approach to succeed there must be a strong and selfless group leader. In addition, members of the group must have unity and share knowledge themselves, and also among other groups of farmers.

©Supranee Sritumboon

A farmer's group in saline soils.

https://qcat.wocat.net/en/wocat/approaches/view/approaches_4294/
https://qcat.wocat.net/en/summary/4294/?as=html

Western & Eastern region: Sandy, shallow and lateritic soils

Organic farming on as moderate hillside slope

Farming on sandy and gravelly sloping hillsides without soil and water conservation measures causes erosion and thus reduces soil fertility. Organic farming on moderate hillside slopes protects the land, soil and water to produce sustainable, safe and natural farm products without the use of chemicals. A farm should be divided by slope gradient for appropriate management of each zone.

©Daoyos Ninlanon

Vetiver grass in the organic farm, Kanchanaburi Province.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_4242/
https://qcat.wocat.net/en/summary/4242/?as=html

Natural agriculture club

The natural agriculture club brings together farmers who practice organic farming on sloping land, by setting up a forum for knowledge exchange and then sharing through the Organic Agriculture Technology Transfer Centre. This enables farmers to gain knowledge and better understanding about organic agriculture production, and then increase their management capability from farm to market.

©Kulwadee Sutthawas

Meeting of the natural agricultural club to share experience and knowledge.
https://qcat.wocat.net/en/wocat/approaches/view/approaches_4243/
https://qcat.wocat.net/en/summary/4243/?as=html

It was concluded that the following elements are required for developing the data and knowledge for making decisions in solving problems of land degradation and promoting the mainstreaming and scaling up of SLM:

1. reliable assessment of land degradation and SLM, and SLM best practices suitable for introducing into national related plans;
2. results of land degradation and SLM assessment as part of the planning process at the national and the regional level;
3. capacity development in regions and among regions in developing potentials, and sharing experiences regarding land degradation (Box 15);
4. strengthening the mechanism of demonstration, creating awareness and organising training with respect to SLM;
5. implementing best practices for acceptance and scaling up best practices, to bring about efficiency in practices (cost-effectiveness);
6. building strength domestically and regionally in scaling up SLM and land degradation through FAO–WOCAT or through regional cooperation and cooperation among regions, including sharing experiences.

In a national workshop on 'mainstreaming SLM into policies, strategies and institutions at national level', participants addressed barriers, opportunities, and entry points (decision-making processes) for mainstreaming SLM in Thailand (Figure 37). In addition, they suggested how farmers and stakeholders could participate, engage, and collaborate to decide and apply SLM practices.

BOX 15: South–South cooperation for knowledge sharing and training

A number of South–South activities were carried out to support mapping land degradation and SLM and facilitate knowledge exchange:

- training on national and subnational land degradation and SLM mapping by resource persons from China;
- technical exchange visits on biochar technologies with Indonesia;
- technical exchange visit to the Philippines;
- organization of the Asian Regional Forum in Thailand with the attendance of Bangladesh, Cambodia, China, Lao PDR, Philippines, and Sri Lanka. The forum showed the contribution of DS-SLM to the Voluntary Guidelines for Sustainable Soil Management (VGSSM) through capacity building and establishing an SLM database in Thailand. It also facilitated discussion on SLM mainstreaming and scaling out.

FIGURE 37
Barriers, opportunities, and entry points (decision-making processes) for mainstreaming SLM in Thailand and formulating a mainstreaming strategy.

Source: Land Development Department (LDD). 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. LDD, Bangkok.
https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand

The mainstreaming strategy that was formulated, focused on:

1. promotion and facilitation of innovative financing mechanisms and incentives to support farmers and land users to apply SLM practices;
2. integration of SLM best practices into land use planning at sub-district, local and farm scales (territorial development);
3. promotion of inter-institutional dialogue on SLM to integrate SLM into policies and programmes, in synergy with other sectors; and
4. building partnerships between and among government, private sector, and farmer groups for knowledge transfer, knowledge management, training and demonstration of SLM.

At the policy level and intervention levels, the linkage to the UNCCD – utilizing existing mechanisms such as the Technical Committee of the UNCCD – allowed for wider engagement both at the national and local levels on land degradation and SLM assessment, awareness-raising and capacity building activities.

Thailand: knowledge products, links and references

Thailand country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand/

Thailand SLM practices documented under the DS-SLM project: https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_THA

Land Development Department (LDD). 2021. *Compendium of Thailand's SLM Best Practices.* Research and Development for Land Management Division, LDD, Soil and Fertilizer Association of Thailand (SFST), Kasetsart University (KU), FAO, WOCAT. https://www.wocat.net/library/media/249/

Land Development Department (LDD). 2021. ***Compendium of Thailand's SLM Best Practices.*** LDD Research and Development for Land Management Division, Soil and Fertilizer Association of Thailand (SFST), Kasetsart University (KU), FAO, WOCAT. Bangkok. https://www.wocat.net/library/media/249/

Land Development Department (LDD). 2019. *Decision Support for Mainstreaming and Scaling up Sustainable Land Management (DS-SLM) Thailand.* 2nd progress report. FAO and LDD, Bangkok. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand/#module-2

Land Development Department (LDD). 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. LDD, Bangkok. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/thailand

3.12 Tunisia

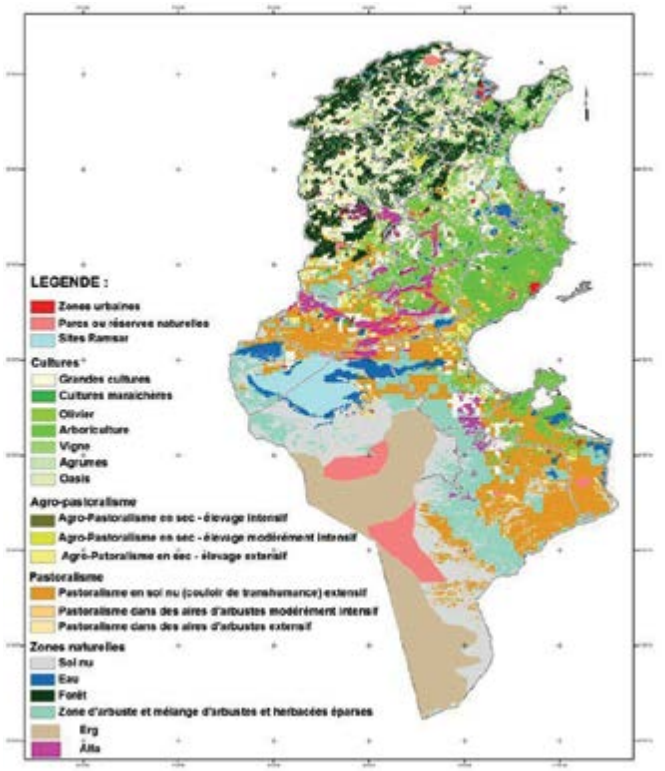
Implementing Partner: General Directorate for the Management and Conservation of Agricultural Land (DG-ACTA), Ministry of Agriculture

CONTEXT

Tunisia is a land degradation-vulnerable country affected by soil, water, and biodiversity degradation in a context of socioeconomic difficulties of the producers and increased impact of climate change. Most pressing issues are degradation of soil, water and biodiversity, socioeconomic difficulties of producers and the impacts of climate change. Only 33 percent of the land is exploitable, 33 percent is forest and rangeland, and 34 percent is non-agricultural land. A total of 92 percent of agriculture is rainfed and 8 percent is irrigated. Efforts to address land degradation by enabling widespread adoption of SLM practices are more and more critical, as land productivity needs to be enhanced and resilience of agricultural systems improved. On the other hand, SLM is not new to Tunisia: for centuries farmers have applied agroforestry and water harvesting systems such as jessour or tabia to manage their land sustainably.

Some of the main challenges to be addressed are improving soil productivity in rainfed or irrigated systems, identifying suitable SLM good practices within the larger land use systems, as well as understanding barriers to adoption, while promoting SLM implementation, enhancing coordination between different sectors, and making soil more accountable in different policies, projects and programs of agricultural, environmental and rural actions.

FIGURE 38
Land use map in Tunisia



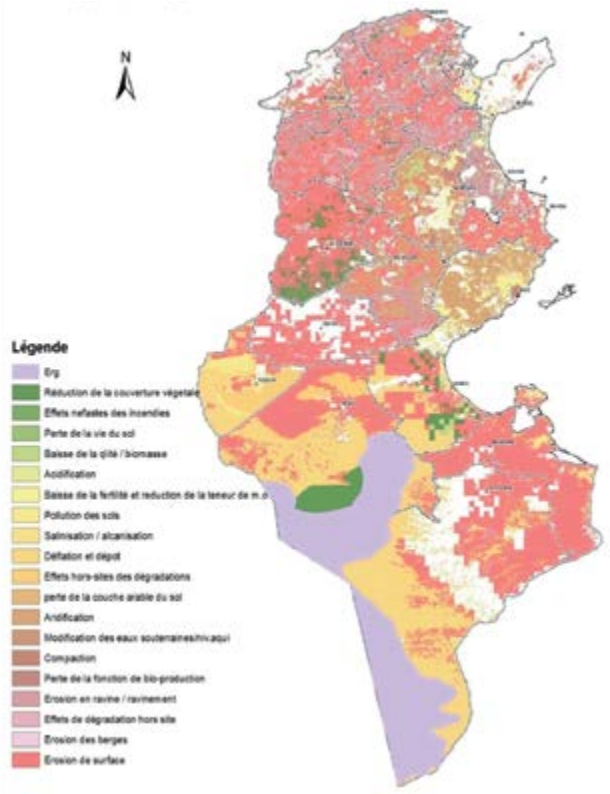
Source: Attia, R. 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. DGACTA, Tunis. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/tunisia

MODULE 3

Selection of landscapes and prioritization of SLM technologies using existing evidence

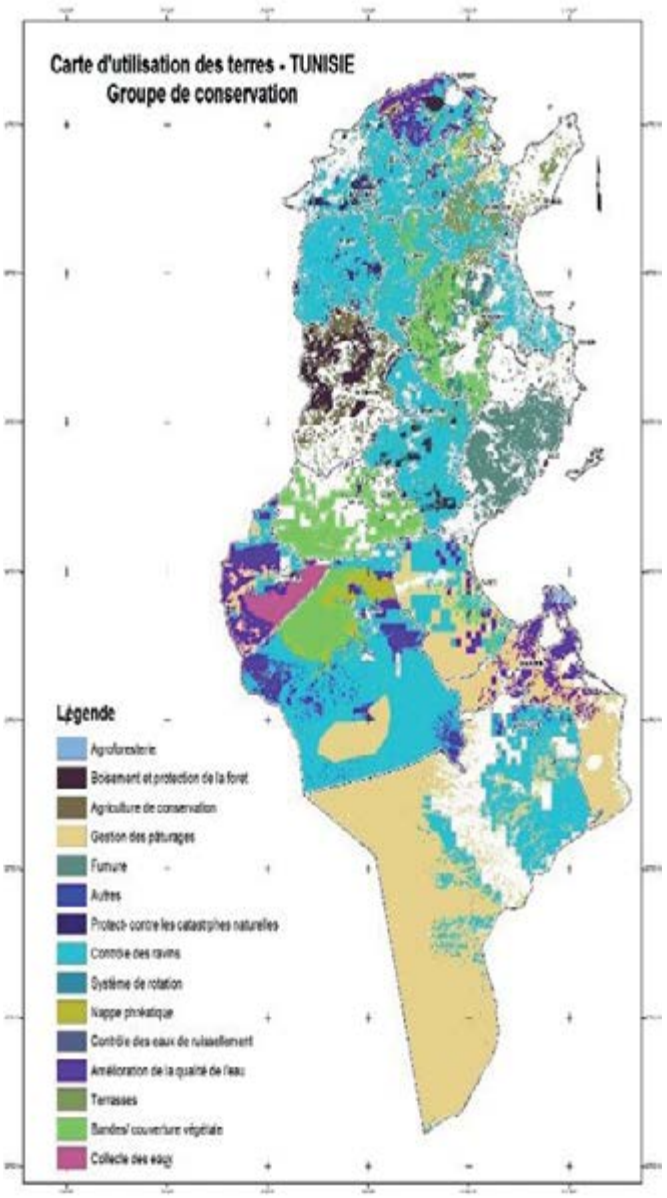
In the year 2010, as part of the GEF/ FAO LADA project and using the LADA–WOCAT QM, the Soil Directorate of the General Directorate for the management and Conservation of Agricultural Land (DG–ACTA) procuded a national LUS map with 21 LUSs (1:50 000–scale). Land degradation maps, demonstrating the type and degree of degradation (Figure 38 and 39) and conservation maps, showing existing SLM practices, their scale and effectiveness (Figure 40) were developed. Four main types of land degradation were identified: erosion by water, reduction of vegetation cover, salinization, and fertility decline.

FIGURE 39
Land degradation map in Tunisia



Source: Attia, R. 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. DGACTA, Tunis. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/tunisia

FIGURE 40
SLM practiced in Tunisia based on a national assessment.



Source: Attia, R. 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. DGACTA, Tunis. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/tunisia

MODULE 4

Selection of priority landscapes and technologies for implementation

In a participatory stakeholder workshop with different interest groups, priority landscapes were selected based on the existing national evidence on types and degree of degradation as well as discussions around hots spots of degradation and bright spots of conservation and their impacts on the different landscapes.

Finally, participants selected four SLM Technologies to be scaled out in the priority landscapes in a number of governorates as shown in the Table 10 below. The criteria for selecting the governorates were the following:

- same natural conditions (soils; land use; climate; land degradation types etc.) as where the good practice has already been applied;
- availability of machinery;
- work area and mandates of partners
- existing interest of farmers.

Partners for implementing the scaling out activities were also identified.

Examples of the selected SLM Technologies as well as other relevant Technologies and Approaches for Tunisia were documented using the WOCAT Questionnaires and Database. A national overview of good practices '*Vers une Gestion Durable des Terres – Une collection des bonnes pratiques en Tunisie*' was produced by DG–ACTA and widely disseminated (DG–ACTA, 2019). A choice of good SLM practices is presented below.

TABLE 10
Selected Technologies, governorates and partners for implementation

SLM technology	Conservation agriculture	Agroforestry	Organic soil management and composting	Sandy amendment
Main goal	prevent and reduce erosion of hilly agricultural soils	prevent and reduce erosion and improve livelihoods in poor regions	reduce fertility decline in agricultural soils	to treat salinity and fertility decline in oases
Selected governorate to scale out the Technology	Kef, Béja and sud Tataouine	Tataouine and Nabeul	Tataouine, Kébil and Nabeul	Gabes and Gafsa
Selected partner for implementation	Centre Technique des Dates (CTD) Comissariat Régional de Développement Agricole (CRDA) Institute des Régions Arides (IRA) Medenine	Institute National des Grandes Cultures (INGC)	Office de Dévélopement sylvopastoral du Nord–Ouest (ODESYPANO)	Centre technique de l'agriculture biologique (CTAB)

Conservation agriculture, Krib, Siliana

Water erosion and declining chemical and biological soil fertility, had led to declining yields of field crops. In a meeting with representatives of the Ministry of Agriculture, land users became convinced of the usefulness of conservation agriculture and tested its application. Conservation agriculture integrates minimum soil disturbance, permanent soil cover and plant diversification.

Tunisia has only a small area under conservation agriculture – based on minimum soil disturbance, permanent soil cover and plant diversification – but leads the way in North Africa. A key constraint to conservation agriculture is the competing demand for crop residues – between use as mulch and for livestock feed. In this pioneering case, grazing of stubble by smallstock is allowed – but for just 30 days each year, post-harvest. Benefits include better soil structure, more soil biodiversity, increased carbon in the land, reduced erosion and a more climate resilient system.

©Donia Jendoubi

Difference between zero tillage farm and tilled farm (in the back). CA has reduced erosion and improved the soil.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_3727/
https://qcat.wocat.net/en/summary/5457/?as=html
https://qcat.wocat.net/en/wocat/approaches/view/approaches_3725/
https://qcat.wocat.net/en/summary/3725/?as=html

Agroforestry, Thibar, Béja

An agroforestry system is generally implemented to improve and diversify agricultural production and income of small farms, enhancing the value of land on slopes and highlands that have low profitability in cereal cultivation, protect the soil against erosion and contribute to ecological balance.

This system in the North–Western regions of Tunisia, especially in mountainous areas is characterised by plantations of tree species dominated by the olive tree in association with field crops and vegetables (maraichage) integrated with livestock husbandry.

©Office de Dévélopement sylvopastoral du Nord–Ouest

Agroforestry system in the mountainous areas of Beja, North West Tunisia.

https://qcat.wocat.net/fr/wocat/technologies/view/technologies_3722/
https://qcat.wocat.net/fr/summary/5456/?as=html
https://qcat.wocat.net/fr/wocat/approaches/view/approaches_3723/
https://qcat.wocat.net/en/summary/3847/?as=html

Sand amendment, Douz, Kébili

The most important quality of the soil in a palm grove is its permeability for water, whether it is irrigated or rainfed. The intensive cultivation of land for the production of annual crops below the palm trees leads to soil erosion and decrease of soil fertility. Over time the roots of the palm trees become bare and unprotected.

The Technology consists of bringing sand "Safi" from the nearest dunes place it at the foot of the date palm tree to protect its roots. The sand amendment is a means of counteracting the decline in soil fertility, increasing the productivity of plantations, and finally diversifying the exploitation of plots to ensure an acceptable income technique.

©Donia Jendoubi

Sand amended palm grove in the Oasis of Douz, Kebili.

https://qcat.wocat.net/fr/wocat/technologies/view/technologies_3732/
https://qcat.wocat.net/fr/summary/5458/?as=html
https://qcat.wocat.net/fr/wocat/approaches/view/approaches_3733/

Organic soil management and composting, Chott Meriem, Sousse

Composting is a process of decomposition and recycling of fermentable organic waste under controlled conditions producing an organic fertilizer rich in organic matter, which improves both the structure and fertility of the soil. It is essentially based on the action of micro-organisms and is regulated by temperature, humidity, C/N ratio, etc.).

Waste is collected, shredded, piled, turned, and watered until mature. Then it is sieved and packaged for sale and use.

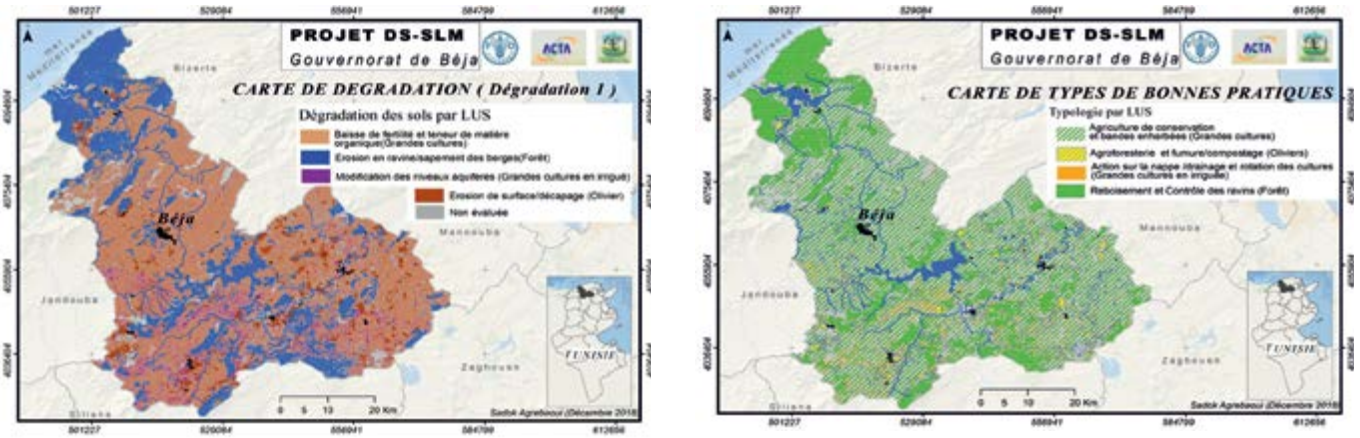
Major inputs: organic waste available locally from farmers of agricultural (plant, animal), municipal, forestry, agri-food, marine origin.

©Hanem Grissa

Manual turning of a green waste compost heap.
https://qcat.wocat.net/fr/wocat/technologies/view/technologies_3726/
https://qcat.wocat.net/fr/summary/5463/?as=html
https://qcat.wocat.net/en/wocat/approaches/view/approaches_3724/
https://qcat.wocat.net/fr/summary/4061/?as=html 201

In the selected governorates the land degradation and SLM mapping was repeated in order to identify hot spots of land degradation where SLM technologies/ good practices should be scaled out. Figure 41 shows an example from the governate of Béja.

FIGURE 41
Béja governate: Land degradation map per land use system (left) and appropriate SLM practices for different land use systems (right)



Source: Attia, R. 2019. *DS-SLM final report.* Presentation at 3rd Global Meeting: DS-SLM Project for Mainstreaming and Scaling up of Sustainable Land Management April 24-27, 2019, Ankara Turkey. DGACTA, Tunis. https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/tunisia

MODULE 6

Scaling out SLM good practices in priority landscape

For each of the four selected SLM Technologies, i.e. conservation agriculture, agroforestry, organic soil management and composting and sandy amendment, the selected partners developed a technical guide to facilitate the implementation of SLM technologies. The guides to investigate each technology according to different types of land use, determine the current status of the use of the technology, assess its contribution to improving production, farmer income, and conservation of natural resources, and highlight the barriers to adoption and dissemination.

©DG-ACTA

Evaluation studies of selected SLM good practices and technical guide for implementation.

In order to facilitate scaling out at regional level, demonstration plots were established at model farms and a series of training sessions organized as well as educational material developed.

Other activities included awarding grants to oases farmers to support the implementation of sandy amendment on their farms.

©DG-ACTA

Training session for technicians and land users of the northern governorates.

MODULE 1

SLM mainstreaming and the new strategy DG–ACTA 2030

A workshop helped to formulate a mainstreaming strategy with multiple stakeholders and identify institutional, policy, economic and financial barriers to scaling out. Key recommendations were developed to influence the integration of SLM into national strategies and decentralized plans and budgets. These include:

- field visits for national policymakers help increase awareness and stimulate support for the integration of SLM;
- promotion of SLM in national and regional development programs for better awareness raising and adoption;
- association of Technologies and appropriate SLM Approaches by linking multiple sectors, actors and scales;
- creation of a shared understanding of concepts between the different actors is important;
- provision of subsidies to farmers;
- support to social organization and creation of ownership which lead to autonomy.

The concept of SLM was integrated in the new 2030 strategy of DG–ACTA, Ministry of Agriculture as well an action plan for SLM mainstreaming and scaling out was developed. Government subsidies for the implementation of sandy amendment were approved and included in the 2030 strategy.

Tunisia: knowledge products, links and references

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3.13 Türkiye

Implementing Partner: General Directorate of Combating Desertification and Erosion (ÇEM), Ministry of Agriculture and Forestry

CONTEXT

Türkiye is prone to desertification, land degradation and drought due to its location, climate, topography and soil conditions. Sixty five percent of the national territory is arid, semi-arid or sub-humid; 59 percent of agricultural land, 64 percent of pastures and 54 percent of forest land are prone to soil erosion due to unsustainable land use, overgrazing, and fuelwood collection.

The Great Konya Basin is one of the largest basins of Türkiye, and is situated at an altitude of about 1000 m.a.s.l. It has a semi – arid climate with cold wet winters and hot dry summers – and very limited water resources. The Great Konya Basin is a closed basin, with an internal drainage system, and its sub-basins drain into saline lakes or onto salt flats. Unsustainable land use, overgrazing, climate variability and change, including more frequent and severe droughts, and limited access to capital and modern technology are the principal drivers of land degradation. SLM is crucial for the region to reduce land degradation, improve ecosystem services and biodiversity and increase resilience to climate change and drought.

Türkiye has been putting into effect a number of actions related to the rehabilitation and restoration of degraded lands and has undertaken various projects, programmes and has established mechanisms to enhance the sustainable use of natural resources in vulnerable areas, and to improve the livelihoods of people.

MODULE 3

Selection of priority landscapes

There are already well-established assessment tools and risk maps in Türkiye, based on models for drought and desertification at different scales, ranging from small watersheds up to large river basins and regions for national evaluation of desertification, land degradation and drought. To monitor soil erosion, desertification, land degradation and soil organic carbon stocks, various projects have been launched, including the following methods and models: Soil Organic Carbon Model and Map, National Land Cover Use Classification and Monitoring System, Desertification Model and Vulnerability Map, Dynamic Erosion Model and Monitoring System. In accordance with nationally determined criteria and using the above data, Karaman district, located in in the Great Konya Basin has been selected as a pilot area.

Prevailing problems in the Karapinar basin and Akgöl sub-basin in Karaman district are:

- problems of salinity;
- wind erosion in dry periods;
- situated at an altitude of about 1000 m.a.s.l, the climate is semi-arid with cold wet winters and hot dry summers;
- water supply is limited and the area has no external drainage, so salinization occurs readily in the lowest spots. But topography and most soils are favourable for agriculture so attempts have been made over the last 60 years to improve agricultural conditions by irrigation and introduction of new methods;
- in areas dependent on natural rainfall, aridity and drought force farmers to carry out rainfed agriculture. Fertilizers are rarely used and yields are unreliable and poor;
- the choice of crops is limited by the short growing season; and
- irrigated land has more possibilities but inadequate drainage systems and over-irrigation has salinized much land so conditions have become worse than under rainfed farming.

The main reason why Karaman was selected as the focus for the DS-SLM project is to showcase how the partnership between the private sector and government institutions on SLM practices helped catalyse a remunerative farming system in an unproductive land affected by drought. Large-scale producers (public and private) provided small-scale farmers with knowledge and experience on SLM through field demonstrations and indoor training.

The private enterprise named UNSPED Agriculture and Livestock Company, with the government's support, has invested in the region using government subsidies to overcome land productivity challenges and contribute to economic and environmental development. The farm covers an area of nearly 1 200 ha, with 800 ha allocated to agricultural production and the rest used for horticulture and orchards combined with livestock production. UNSPED managed to successfully restore the unproductive area using activities including modern irrigation, and appropriate cultivation methodologies such as rotation-based production to improve soil health. The farm was chosen as a demonstration site to show how SLM Technologies and Approaches successfully could address land degradation and desertification issues.

MODULE 4

Selecting SLM solutions for scaling out

A central concern for selecting SLM solutions for scaling out is to examine how costly it would be to implement SLM effectively in such a fragile ecosystem as is found in UNSPED show case farm.

The showcase farm demonstrates a wide range of SLM Technologies and Approaches. These include:

- Sustainable Drainage System for Saline Soils

©ÇEM

Drainage channels (surface and subsurface) connected to a main ditch were constructed by the government in order to discharge salty water from the area.

- Barley cultivation in salt-affected soils of ancient saline lake bottom

©ÇEM

Barley, a salt-resistant crop, was used as a pioneer species in the reclamation of saline lands within the UNSPED farm.

- Drip irrigation in orchards and crops

©ÇEM

Drip irrigation is used in the UNSPED farm to grow dwarf or scrub apple species, to cope with saline subsoil, as well as maize. This provides for the most economical use of water and labour in this arid/ semi-arid climate of the Akgöl subbasin of the Central Anatolia.

- Integrated crop–livestock production systems

©ÇEM

Sheep have the opportunity to graze wheat regrowth after harvest in the rotation where summer corn follows wheat. Farmyard manure is collected to fertilise field crops and orchards.

- Crop rotation with cereals/ fodder legumes to improve soil health and to support animal production in the farm

©ÇEM

Crop rotation with legumes (e.g. alfalfa), subsequently planted with wheat, corn and sunflower. N-fixing legumes help improve soils of the Akgöl Lake Depression in terms of organic matter and infiltration capacity. Furthermore, planting into residues (direct seeding, no-till planting) supports soil aggregate establishment and helps prevent wind erosion.

Due to a its high level of engagement in various agriculture and livestock activities, the private sector is able to make use of more widespread opportunities and different incentives for planning and implementing SLM practices. Smallholders, on the other hand, have limited access to incentives to support sustainable agricultural practices. Setting up implementation plans for private sector companies and smallholders require different considerations in terms of policy tools and approaches. It is recommended that smallholders are provided with more suitable incentives to help them implement their SLM practices.

MODULE 1

SLM mainstreaming strategy

Opportunities for establishing a SLM mainstreaming strategy were assessed through consultations with local, regional and national stakeholders: a one-day workshop with local stakeholders in Karaman and one-day with national stakeholders in Ankara. Local farmers, regional and national institutions, and international organizations attended these workshops. Opportunities for mainstreaming SLM into regional and national policies, financing mechanisms and technical assistance processes were explored.

Policies, programmes, incentives and financial mechanisms related to SLM in Türkiye

Türkiye has a number of incentive mechanisms and programmes to support the agricultural sector. These include the Direct Income Support Scheme, premium payments for cereals, oil seed crops and cotton, livestock premium payments, agricultural insurance payments, rural development grants and a farmer transition programme, which promotes the cultivation of alternative crops such as tobacco and hazelnuts in specific areas.

Based on consultations and workshops conducted by the DS-SLM projects with local, regional and national stakeholders the following preliminary mainstreaming objectives were proposed to the General Directorate to Combat Desertification and Erosion (ÇEM):

1. to establish an inter-sectoral round table or working group with the different directorates and ministries (desertification, agriculture, forestry, etc.);
2. to conduct mapping and analysis of existing incentive programmes related to SLM;
3. to analyse the inclusion of SLM into provincial planning and to formulate a strategy to fill the gaps and to strengthen SLM under a watershed or basin approach;
4. to sign a general protocol for SLM, including policies, plans and incentives relevant for SLM;
5. to formulate national criteria and indicators of SLM as a first activity of the inter-sectorila group;
6. to formulate a national project proposal including the establishment of a fund or investment programme; and
7. to strengthen the Farmer Field School (FFS) programme in Türkiye.

Türkiye: knowledge products, links and references

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ÇATAK: https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Tarla-Ve-Bahce-Bitkileri/CATAK

General Directorate of Forestry: https://www.ogm.gov.tr/SitePages/OGM/OGMDefault.aspx

General Directorate of Agricultural Reform: https://www.tarimorman.gov.tr/TRGM

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3.14 Uzbekistan

Implementing Partner: UZGIP Institute, Ministry of Agriculture and Water Resources, together with Uzhydromet

CONTEXT

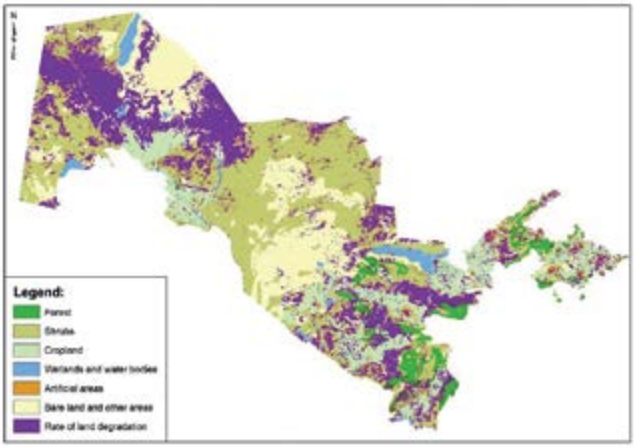
Uzbekistan is very vulnerable to climate change due to the high sensitivity of its arid arable lands. Almost 80 percent of the country is desert or semi-desert, including the Kyzylkum, the largest desert in Central Asia, with soils that are low in fertility and soil organic carbon (0–20 tonnes/ha). Land degradation covers 28.6 percent of its surface area, and is mainly caused by inappropriate land use and water management, especially poor farming practices. The most pressing issues are secondary salinisation and waterlogging in irrigated land, loss of organic matter and fertility, water erosion of cropland, loss of vegetation cover and biodiversity in grazing land, and wind erosion in the desert lands – including transport of salt and dust from the dry bed of the Aral Sea to irrigated areas. About 49 percent of irrigated lands are affected by secondary salinization: more than 17 percent are moderately or highly saline.

Government policy aims at expanding innovation, investment, and developing institutional transformation to create a favourable environment for scaling out SLM – as well as mitigating drought and adopting climate-smart agriculture. There are substantial funds being allocated for measures aimed at improvement of land and water resources. These are termed Innovative Financial Mechanisms, and include payments for emissions or discharge of pollutants, as well as payments for the use of natural resources.

FIGURE 42
National land use system map 2009

Source: CACILM SLM-Information project. 2009 based on Nachtergaele, F. & M. Petri. 2008. Mapping Land Use Systems at global and regional scales for Land Degradation assessment analysis: version 1.0. FAO, Rome. https://www.researchgate.net/publication/265754296

FIGURE 43
Land degradation map updated 2018



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MODULE 2

Land degradation and SLM assessment at subnational level, and selection of priority landscapes

In the framework of the multi-country CACILM SLM-Information System project (SLM-IS, 2009) various maps were produced and integrated into a national database: these included a national LUS map (Figure 42), a land degradation map, a soil type and a soil salinity map. In 2018, and in accordance with the UNCCD land degradation neutrality target setting programme guidance, beside developing maps on land productivity dynamics and soil organic carbon based on the national database and GSP guidelines (FAO & GSP, 2017) the land degradation map at national level was updated (Figure 43).

Consultative meetings and discussions with stakeholders at the national level, including representatives of ministries, scientific and public institutions, used the existing evidence to select two priority regions due to their economic importance and a combination of factors causing degradation, including water scarcity, drought, salt affected soils and salinity risks, dense population, primary dependency on agriculture and widespread environmental degradation. These were:

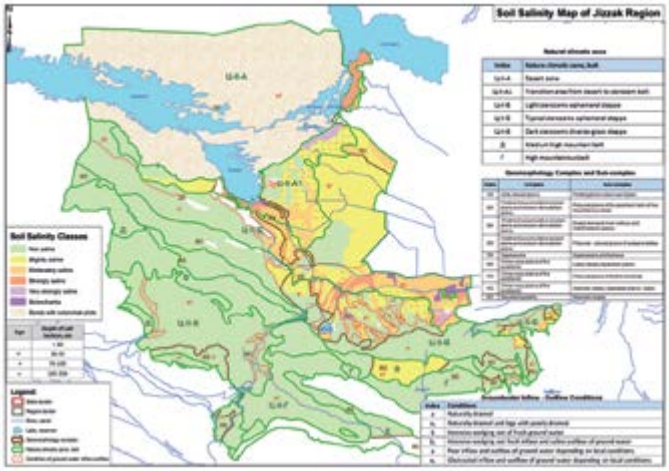
- irrigated salt-affected landscapes/ croplands in **Jizzakh region**, central semi-desert, northeast of Samarkand; and
- rainfed drought-prone landscapes in **Kashkadarya region**, southern semi-desert in the basin of the river Qashqadaryo and on the western slopes of the Pamir–Alay mountains.

Using different tools and evidence, including the LADA–WOCAT mapping tool, LADA local, FAO's Farmer Field Schools, Participatory Land Use Development as well as the LUS map, these two regions were assessed in terms of the needs for, and potential of, SLM adoption.

The three prevailing LUS in **Jizzakh region** are grassland with moderately intensive pastoralism (23 percent), rainfed agriculture (21 percent) and irrigated agriculture (15 percent). About 82 percent of irrigated lands are subjected to soil salinisation (Arnasay, Dustlik, Mirzachul, Zarbdar and Farish districts) (Figure 44).

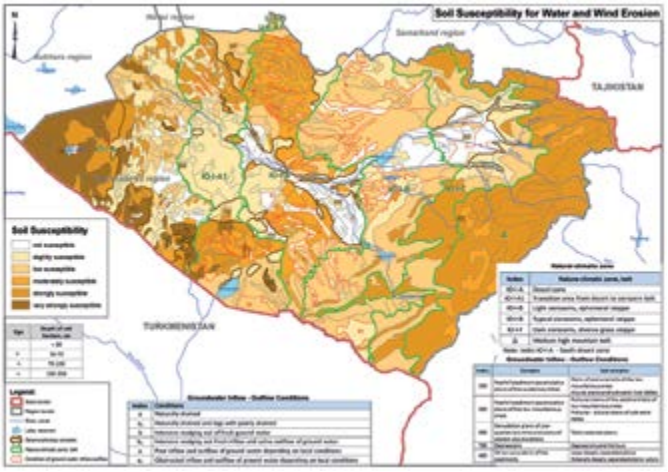
In **Kashkadarya region** most of the western part is occupied by extensive plains, which gradually merge into the foothills and mountains to the east and the northeast. Prevailing LUS are: shrubs – extensive pastoralism (21 percent), grasslands – moderate intensive pastoralism (17 percent), agropastoralism with large-scale irrigation (14 percent), and rainfed agriculture (13 percent). More than 67 percent of the irrigated area is subject to soil salinisation and soil pollution; about 67 percent of the rainfed land is subject to erosion (Figure 45). The river flow probability is only 66 percent of the overall water demand for irrigation.

FIGURE 44
Map of soil salinity, Jizzakh region.



Source: geoBoundaries, 2020, https://www.geoboundaries.org. modified by the contributor.

FIGURE 45
Map of soil erosion susceptibility, Kashkadarya region.



geoBoundaries, 2020, https://www.geoboundaries.org. modified by the contributor.

Districts/ landscapes within the two regions were selected to establish demonstration sites for sharing good practices and capacity building: namely Zarbdar and Kamashi. These cover two agricultural areas of the highest priority: irrigated salt-affected soils in Zarbdar and rainfed drought-prone croplands in Kamashi, respectively. These landscapes were selected on the basis of national priorities and the need to increase the productivity of agricultural land, while improving the livelihoods of the population. They represent the most densely populated and valuable categories of land use – as they produce large quantities of agricultural products and play a dominant role in ensuring food security.

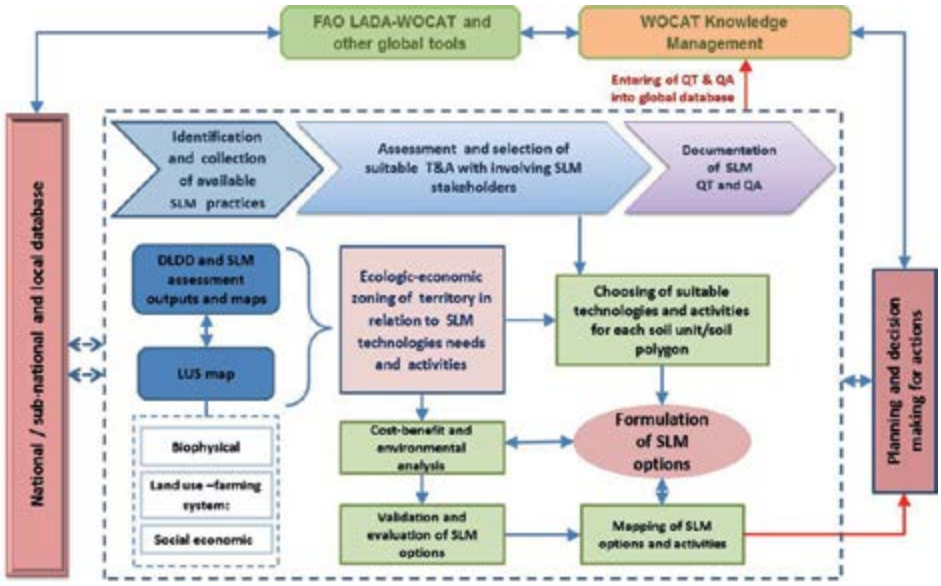
MODULE 4

Identifying SLM practices for scaling out

Review and selection of appropriate and suitable SLM practices, as well as land use planning, were based on a participatory approach involving multi-stakeholders through stakeholder workshops, expert meetings, and consultations at local, national and regional levels (Figure 46).

First an inventory of 60 SLM Technologies and five Approaches to address major land degradation issues was compiled in the target areas. After consultations, discussions and multi-criteria analysis (e.g. environmental friendliness, economic and financial viability, technical appropriateness, social and cultural acceptance) 26 Technologies and Approaches

FIGURE 46
Flow diagram showing the selection of suitable SLM options and their integration in planning and decision-making processes.



Source: Contributor's own compilation, 2018

were selected as the most appropriate and suitable options for the project areas. As a next step, 11 most appropriate/reliable technologies for scaling out were selected through a national SLM capacity building workshop with representation from national research and environmental institutions, SLM projects, communities, local authorities and land users. These were then documented in WOCAT's Global SLM Database. A selection of the documented technologies is presented below. Fine-tuning of the selection continued down to regional and local levels through stakeholder workshops.

Rainfed agriculture

Drought-resistant crops to enhance forage production and prevent erosion in desert areas

Animal husbandry is the main source of livelihoods and well-being for the population living in the rainfed zones. Cultivation of desert fodder plants, such as forage kochia and atriplex, under rainfed conditions provides adaptation to drought, creates feed reserves for livestock, ensures balanced nutrition of animals and prevents soil erosion. Furthermore, the Technology provides environmental benefits, contributes to climate change mitigation by sequestering CO_2 in plant biomass and soil and contributes to overall environmental health.

©T. Mukimov

Atriplex planted for forage production, Kamashi, Kashkadarya region.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_3650/
https://qcat.wocat.net/en/summary/5655/?as=html

Almond planting to increase the efficiency of rainfed lands and to prevent erosion

Drylands are located in the foothills, poor in rainfall and with low and unstable annual crops yield. The slopes are prone to soil erosion and require special methods of tillage and special measures to reduce erosion in order to improve the water regime and preserve the fertile topsoil. Almonds and other drought-tolerant tree species are planted on shallow terraces on gentle slopes to prevent soil erosion on the slopes and provide local land users with additional income.

©T. Mukimov

Almond planting on shallow terraces, Kamashi district, Kashkadarya region.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_3654/
https://qcat.wocat.net/en/summary/5653/?as=html

Irrigated agriculture

Furrow irrigation with alternating dry and watered (wet) furrows

Irrigated agriculture is the basis of agricultural production in Uzbekistan. However, water scarcity is a limiting factor, especially in dry years. To prevent large crop losses, the Technology recommends to water row crops through alternate furrows. Dry and watered furrows are rotated. Watering is carried out only during periods of water scarcity. The water demand for irrigation and the total water consumption (evaporation and transpiration) could be reduced by 20–25 percent.

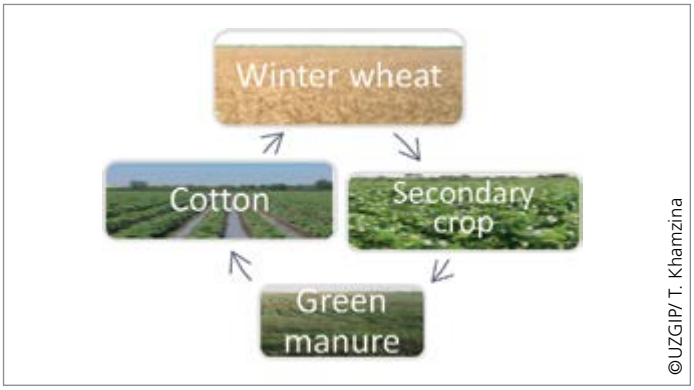
©UZGIP

Watering every alternate furrow.

https://qcat.wocat.net/en/wocat/technologies/view/technologies_3646/
https://qcat.wocat.net/en/summary/5657/?as=html

Diversification of crops in salinized soils by introducing legumes and green manure

Secondary salinization and decrease in soil organic matter as well as plant nutrients are the main indicators of degradation in irrigated arable lands. Poor crop rotation is one of the major causes of degradation. For several years in a row cotton has been cultivated after cotton, or wheat after wheat. By introducing legumes after harvesting winter wheat and green manure crops in the crop rotation reduced land degradation and increased the productivity of irrigated lands.



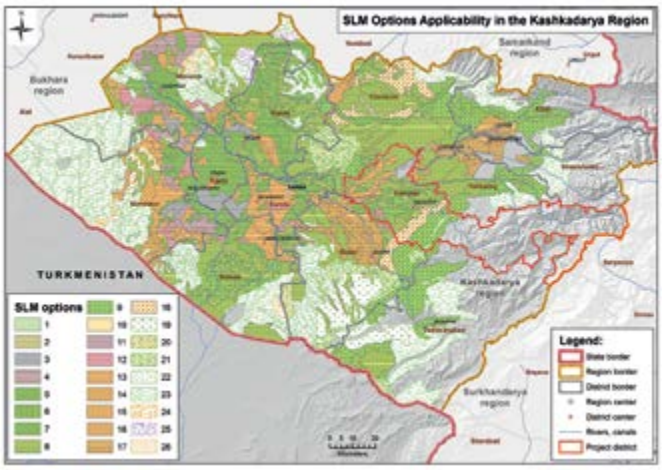
Crop rotation including winter wheat, legumes green manure and cotton.
https://qcat.wocat.net/en/wocat/technologies/view/technologies_3632/
https://qcat.wocat.net/en/summary/5654/?as=html

An SLM option mapping exercise was conducted with land users, and maps were produced at subnational level to demonstrate different options for different areas (Figure 47). The key indicators for selection of SLM options were: (1) natural & climatic conditions (climate, relief, hydrogeology, slope, water table, etc.), (2) soil texture, salinity, erosion, soil organic matter, etc. (3) land use and land use system, and (4) specific SLM technologies (Table 11).

The participatory assessment and mapping of SLM options included the following steps:

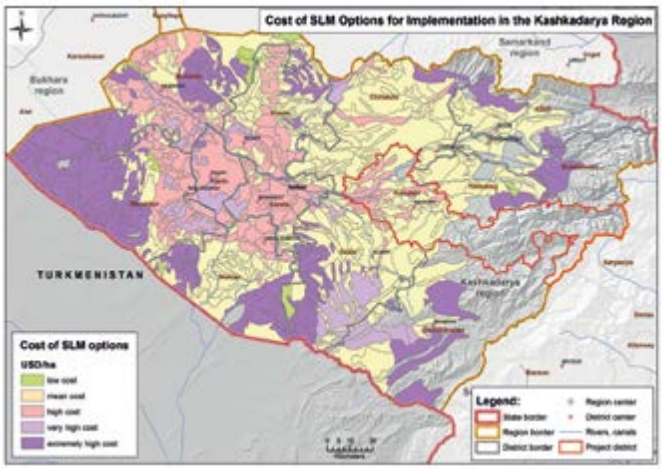
- Technology needs assessment, and zoning of project areas in relation to SLM;
- Cost estimation of selected SLM options (Figure 48, Table 11);
- GIS mapping of suitable SLM options for each soil unit/ soil polygon for planning of interventions and investments flow at local and subnational level (Figure 47, Table 11).

FIGURE 47
Mapping of SLM options applicability in the Kashkadarya region



Source: geoBoundaries, 2020, https://www.geoboundaries.org. modified by the contributor.

FIGURE 48
Cost of SLM options for implementation in the Kashkadarya region



Source: geoBoundaries, 2020, https://www.geoboundaries.org. modified by the contributor.

The SLM options mentioned in legend of Figure 47 consistonsist of single or different combinations of the following SLM practices: laser land leveling, crops diversification, use of biogas production wastes, afforestation, counter furrow irrigation, watering every second furrow, mulching end of irrigation furrows, salt-tolerant and drought-resistant cotton, cultivation of Indigofera tinctoria, desert drought-resistant crops, almonds on small terraces, pistachio varietal plantations and instead of autumn–winter pastures.

Demonstration sites were established for testing, sharing and capacity building purposes. The following four SLM technologies were implemented in the demonstration sites:

(i) Crop diversification and rotation with introduction of legumes and green manure on salt affected soils (Zarbdar district), see also https://qcat.wocat.net/en/summary/5654/?as=html

TABLE 11
Overview of 26 technologies based on identified (using above mentioned indicators) and mapped SLM options in different regions.

SLM Technology	Description of SLM Technology based on mapped options	Finance needs/ costs	
		$US/ ha	Cost Rate
1	Bio saline technology	250	Low-cost
2	Planting almonds on small terraces	311	
3	New salt tolerant varieties + diversification of crops + improved furrow irrigation	500	Mean-cost
4	Diversification of crops + improved furrow irrigation	400	
5	Sowing of desert drought-resistant grasses on the mountain + planting almonds on small terraces	411	
6	Irrigation with straw mulching of ends furrows + diversification of crops + improved furrow irrigation	420	
7	New salt tolerant varieties + diversification of crops with deep loosening of soils + improved furrow irrigation	550	
8	Diversification of crops with deep loosening of soils + improved furrow irrigation	450	
9	Diversification of crops with deep loosening of soils + Irrigation with straw mulching of ends furrows	470	
10	Laser planning + new salt tolerant varieties + improved furrow irrigation + diversification of crops	850	High-cost
11	Laser planning + improved furrow irrigation + diversification of crops	750	
12	Diversification of crops with deep loosening of soils + laser planning + new salt tolerant varieties + improved furrow irrigation	900	
13	Laser planning + improved furrow irrigation + diversification of crops with deep ripping of soils	800	
14	New salt tolerant varieties + improved furrow irrigation + diversification of crops + biodrainage	1100	
15	Biodrainage + improved furrow irrigation + diversification of crops	1100	
16	Diversification of crops with deep loosening of soils + biodrainage + new salt tolerant varieties + improved furrow irrigation	1150	Very high-cost
17	Improved furrow irrigation + diversification of crops with +deep ripping of soils + biodrainage	1150	
18	Creation of pistachio varietal plantations	1230	
19	Diversification of crops + laser planning + biodrainage + new salt tolerant varieties + improved furrow irrigation	1450	
20	Laser planning + biodrainage + improved furrow irrigation + diversification of crops	1450	
21	Diversification of crops with deep loosening of soils + laser planning + biodrainage + new salt tolerant varieties + improved furrow irrigation	1500	
22	Diversification of crops with deep loosening of soils + laser planning + biodrainage + improved furrow irrigation	1500	
23	Creation of pistachio varietal plantations + planting almonds on small terraces	1541	
24	Fixing of movable sands	2150	Extremely high-cost
25	Rotation of pastures + pasture enrichment	3700	
26	Rotation of pastures + pasture enrichment + bio desalinization	3950	

(ii) Planting of almonds on small terraces to prevent erosion and increase efficiency of rainfed landscapes (Kamashi district) see also https://qcat.wocat.net/en/summary/5653/?as=html

(iii) Introduction of the new drought and salt tolerant cotton variety "Gulistan" (Zarbdar district)

(iv) Drought and salinity tolerant Atriplex sp. for forage in desert areas (Kamashi district) see also https://qcat.wocat.net/en/summary/5655/?as=html

SLM technologies promoted at the four demonstration sites led to the adoption and out-scaling of cost-effective and innovative SLM technologies in salt affected and drought-prone landscapes. The area under SLM during two cropping seasons increased from 2 350 ha in 2017 to 4 725 ha in 2018.

MODULE 1

Developing a SLM mainstreaming strategy and action plan with focus on innovative financial mechanisms

A strategy and related action plan were developed through a consultative process with stakeholders, analysis and evaluation of available documents including regulations of key departments and agencies, and considering research results on gaps in SLM decision-making processes at the national and local levels. The draft strategy was discussed during the National Coordination Council meeting by involving the main target groups and local partners from the project areas.

In summary, the expected outputs of the strategy are:

- integration of SLM scaling out model into integrated crop production and integrated water management planning in line with Agricultural Programme 2030;
- integration of SLM practices and related tools into the national programmes, initiatives and projects;
- ensure SLM coordination, capacity building and resource mobilisation;
- scale out SLM and share knowledge and experience.

Uzbekistan: knowledge products, links and references

Uzbekistan country page: https://www.wocat.net/en/projects-and-countries/projects/ds-slm/countries/uzbekistan

Uzbekistan SLM practices documented under the DS-SLM project:
https://qcat.wocat.net/en/wocat/list/?type=wocat&filter__qg_location__country=country_UZB&filter__qg_funding_project__funding_project=1

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Conclusions and outlook

Conclusions

Take-home messages: some new, others reconfirmed

- SLM mainstreaming and scaling out can only be achieved with political, institutional, social and financial support. That requires its key roles to be recognised: SLM is crucial in sustainable development and maintaining livelihoods, while also fundamental to achieving the SDGs and objectives of the three Rio Conventions.

- SLM mainstreaming and scaling out must be must be embedded in an interinstitutional and participatory process, and simultaneously capacities need to be developed to understand land degradation and SLM. Effective partnerships and communication are essential to underpin success and durability.

- A conducive institutional and political environment is required, otherwise SLM interventions will remain geographically isolated and limited to short-term projects. A process to mainstream and institutionalise SLM should be country-led, and tailored to specific needs and challenges. Long-term initiatives nurture such processes.

- To achieve land degradation neutrality, producing data on land degradation and SLM is a vital step to feed into participatory processes that stimulate evidence-based policies and practices. It is essential that the key institutions and stakeholders – with land users at the centre – participate to integrate existing knowledge at all levels.

Decision support framework: evidence for joint decision-making

- Continuous generation and use of evidence, especially of SLM impact, nourishes interinstitutional, multisectoral dialogue, throughout the decision support framework (DSF) its modules. This is fundamental for coordinating and mainstreaming SLM. The DSF provides a space to facilitate dialogue and interaction between a wide range of stakeholders and specialists. It provides them with tools, methods, and evidence to reach joint solutions.

- The results of the land degradation and SLM assessments (Modules 2 and 4) can be used to guide participatory SLM planning (Module 5) in target areas. Both biophysical and socioeconomic assessments are important to guide the sustainable use and management of resources to enhance food security.

- Interinstitutional, multisectoral, and multistakeholder interaction creates ownership and trust in the whole process. Only the buy-in of all the most important stakeholders can guarantee that ownership and trust, and ensure that the evidence will be used to inform and guide land degradation, SLM and LDN interventions.

- The DSF is a flexible framework that can be applied by different countries and in different contexts to facilitate the embedding of land degradation and SLM evidence into decision-making processes to reach LDN. It helps to break down barriers between those who generate land degradation and SLM evidence and those who make decisions to reach LDN targets.

Mainstreaming strategies for scaling out: concrete and effective

- Implementing SLM mainstreaming strategies requires commitment of multiple stakeholders, financial resources and time. Thus, design must begin at the start-up of any initiative and in parallel with the generation of evidence. Simultaneously, the necessary resources must be identified.

- Decisions needed for SLM are taken at different levels and implemented through various instruments, not only at high policy level involving legal and regulatory frameworks. Indeed, high-level decisions often do not reach or influence land management at local level. Therefore, mainstreaming strategies must also address local initiatives and decision-making processes to encourage scaling out.

- Mainstreaming SLM into financing mechanisms is innovative and promising and one of the key elements of the mainstreaming strategies. Innovative financing mechanisms are a key to successful mainstreaming of SLM: these can be stimulated through stronger liaison between the agriculture, environment and finance sectors.

- Land use planning processes should fully integrate SLM concerns and priorities. In this way their capacity to achieve multiple objectives can be reinforced. The importance and effectiveness of land use planning processes to promote SLM depends on, and is influenced by, the governance setting of each country. In some countries land use planning is a governmental process undertaken by several institutions and sectors, while in other countries external projects facilitate the formulation of management plans.

- Activities for mainstreaming SLM are diverse and context-specific. These differ from country to country and context to context (Table 12). However, everywhere the objectives and related action lines of the mainstreaming strategies need to be concrete and detailed. The issue of scale/ level is crucial: depending on the country context, decision-making processes are dealt with at different levels.

TABLE 12
Examples of mainstreaming strategies according to country and decision-making processes

SLM mainstreaming strategies		
DECISION-MAKING Processes components/ categories	**Instruments**	**Examples of MAINSTREAMING STRATEGIES**
POLICIES AND REGULATIONS	Intersectoral dialogue	**Colombia** created an interinstitutional dialogue table on SLM with representatives from different sectors.
	Legislation	**Panama** formulated a draft law on soil management.
PROGRAMMES AND PROJECTS	Sectoral programmes	**Bosnia & Herzegovina** (Bosnia & Herzegovina Federation) integrated SLM into cantonal development plans.
	SLM into sectoral plans	**Bangladesh** proposed to integrate SLM into the climate change strategy.
FINANCING Mechanisms and INCENTIVES	SLM into financing mechanisms	**Bosnia & Herzegovina** (the Republic of Srpska) amended the existing Rule of Fund for environment protection and energy efficiency to include SLM in the financial scheme.
		China proposed to establish a multisource funding mechanism for prevention and control of sandification.
		Türkiye explored the potential to integrate selected SLM practices into the national incentive programme.
	SLM into microfinance programmes	**Uzbekistan** proposed a specific SLM financing capacity building programme to sustain the financing flow for SLM scaling out.
		Ecuador included SLM into the national microfinance programme to support climate-smart agriculture.
		Thailand proposed to integrate SLM into the National Agriculture Microcredit Programme.
LAND USE / TERRITORIAL PLANNING AT ALL SCALES (national, subnational, landscape and local)	Land use planning processes at subnational and catchment level	**Colombia** integrated SLM into land use planning processes at different scales (department, municipality, etc.).
		Morocco focused the mainstreaming strategy for supporting land use planning on regional and provincial levels.
		Uzbekistan proposed the integration of the SLM scaling out model into the Integrated Catchment Planning in the Upper Kashkadarya.
EDUCATION and awareness-raising	Communication at national and local level	**Argentina** developed a community communication strategy supporting the scaling out of SLM technologies.
		Lesotho developed an information and advocacy campaign.
	SLM into educational curricula	**Argentina** promoted the integration of a module on SLM into local community schools.
	Extension services	**Philippines** provided training-of-trainers on SLM practices to extension officers from the Local Government Units as an assistance to complete the Comprehensive Land-Use Plans.

Outlook

Reaching land degradation neutrality: can a decision support framework help?

In 2015, the UNCCD COP12 that took place in Ankara that SDG target 15.3 "is a strong vehicle for driving implementation of the UNCCD.'' At COP12, parties endorsed the definition of LDN and the Global Environment Facility (GEF) announced that it would make funding available for the setting of national voluntary LDN targets. This led to the establishment of the land degradation neutrality target setting programme by the Global Mechanism and the Secretariat of the UNCCD to assist countries to achieve LDN by 2030.

So far, more than 100 countries have already set their LDN targets. In 2017, the UNCCD Gender Action Plan was adopted, laying emphasis on gender-responsive actions. Both COP14 (2019) and COP15 (2022) emphasised the importance of the enabling environment with decisions related to land tenure and key items related to gender equality and youth empowerment. In addition, the achievement of LDN through land restoration moved into focus and, in relation to this, the implementation of the UN Decade on Ecosystem Restoration (2021–2023) was highlighted – and the importance of land use planning processes to support restoration was recognised.

The decision support framework (DSF) with its modules and suggested tools presented here can support the achievement of LDN by facilitating the scaling out of good land management solutions in the context of land restoration. This publication provides and overview of how the DSF has supported DS-SLM countries to concretise their activities towards achieving LDN. Any effort by a country, programme or project to monitor and reach LDN can make use of the DSF, tailor it to its own needs, and can benefit from lessons learned from countries who have applied it.

The DSF underlines the importance of building on and integrating evidence into programmes and projects and of addressing the identified barriers at different levels to combat land degradation and enhance the implementation of SLM and restoration efforts.

Enabling environment: tenure and gender

Since the DSF's application in 15 countries between 2015–2020 new tools have beenin line with the different UNCCD COP decisions to strengthen the LDN enabling environment. FAO has developed the Technical Guide on the Integration of the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security into the Implementation of the United Nations Convention to Combat Desertification and land degradation neutrality' (FAO & UNCCD, 2022) while FAO and WOCAT are currently testing a new tool, "tenure4SLM", which will allow better understanding of resource tenure in relation to SLM and LDN.

WOCAT and the UNCCD have tested and published a new tool on gender-responsive SLM[21] to support the UNCCD Gender Action Plan and to enhance promotion and scaling out gender-responsive SLM practices in LDN and restoration efforts.

South–South collaboration: a joint way forward

Countries have prioritized and targeted different key decision-making processes for mainstreaming and scaling out SLM: an exchange on experiences through South–South cooperation is a powerful tool to support mutual learning. South–South cooperation supports the sharing of tools and methods, joint exchange and learning from one another. Furthermore, it facilitates the exchange of good practices to embed evidence in decision-making processes. Cooperation among countries can be strengthened further and institutionalised by setting up Communities of Practice to ensure continuity.

[21] For additional information, please see: Gender-responsive Sustainable Land Management https://www.wocat.net/en/projects-and-countries/projects/gender

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ISBN 978-92-5-137884-7

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CC6118EN/1/10.23