

LDN in Mountain Regions: Existing tools and approaches to assess land degradation and support restoration

GEO Mountains General Meeting, 29 May 2026

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About WOCAT

The World Overview of Conservation Approaches and Technologies (WOCAT) is a **global Network established in 1992**.

WOCAT supports the compilation, documentation, evaluation, sharing, dissemination, and application of **sustainable land management (SLM) knowledge**.

In 2014, WOCAT's growth and ongoing improvement culminated in being **officially recognized by the UNCCD** as the primary recommended Global SLM Database for best SLM practices.

<https://www.wocat.net/en/about>



The Global Network on Sustainable Land Management

Consortium Partners



Funding Partners

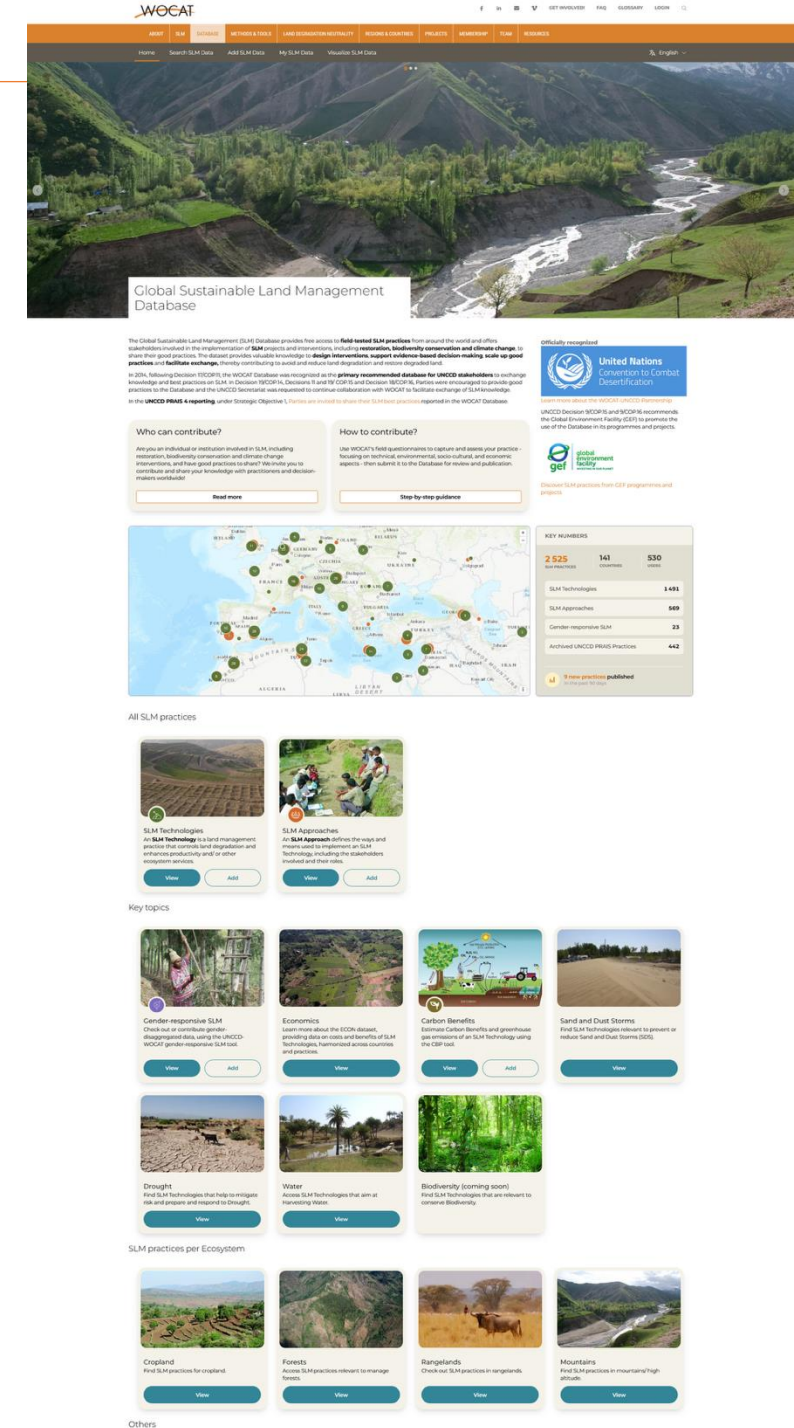


Global SLM Database

Facts

- **Large, standardized, multilingual, interoperable open access dataset** on Sustainable Land Management practices – **SLM Technologies and Approaches**
- With **more than 2000 field-tested SLM** solutions from **over 130 countries**, documented with land users and experts on the ground
- Providing **technical insights** on the functionalities, costs, and quantified impacts of SLM Technologies
- **Supporting replication** of SLM Technologies and Approaches in similar or diverse contexts or ecosystems
- **Facilitating the scaling** of SLM by informing policies or incentive mechanisms




... serving practice, policy and science!



WOCAT tools and methods

TOOL SPOTLIGHT

SLM Technology /Approach PDF Summary

-  Automatically generated from structured field data
-  Available in all official UN languages
-  Used for best-practices compilations and extension learning materials

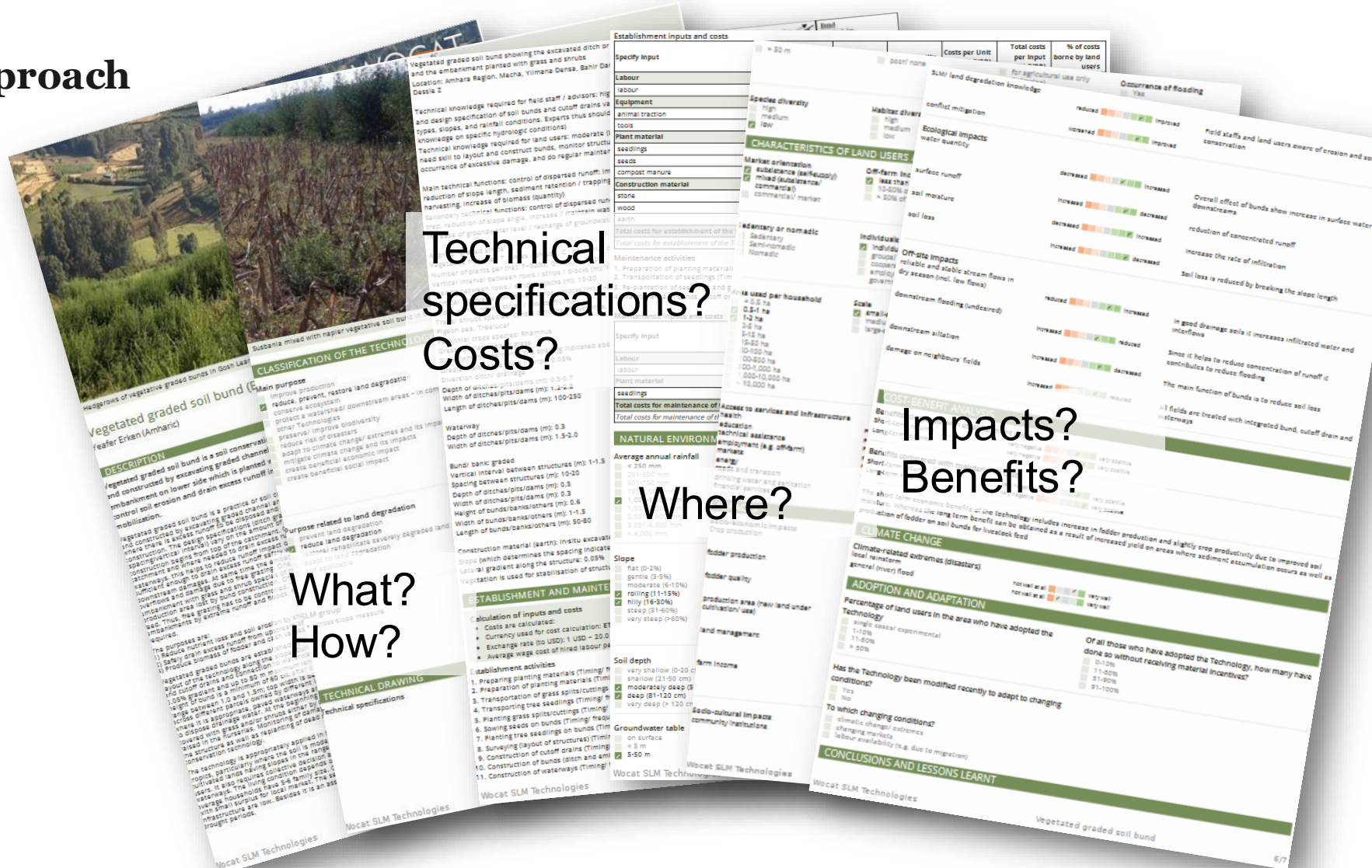


View sections

Expand all

- General Information
- Description of the SLM Technology
- Classification of the SLM Technology

Completeness: 90%



Technical specifications?
Costs?

Where?

Impacts?
Benefits?

What?
How?

Global SLM Database

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The screenshot displays the WOCCAT Global Sustainable Land Management Database website. The header includes navigation links for Home, SLM, About, Network & Tools, User Documentation, News & Events, Projects, Membership, and News. The main content area features a large hero image of a mountain landscape with a river. Below the hero image, there is a section titled 'Global Sustainable Land Management Database' with a brief description of the database's purpose and a call to action to 'Add SLM Data'. To the right, there is a section titled 'Officially recognized' with logos for the United Nations Convention to Combat Desertification (UNCCD) and the Global Environment Facility (GEF). Below this, there is a section titled 'Who can contribute?' and 'How to contribute?' with links to 'Read more' and 'Step-by-step guidance'. The central part of the page features a world map showing the distribution of SLM practices across various countries. To the right of the map is a 'KEY NUMBERS' table:

| KEY NUMBERS | 2 525 | 141 | 530 |
|--------------------------------|-------|-----|-----|
| SLM Technologies | 2 525 | | |
| SLM Approaches | | 141 | |
| Gender responsive SLM | | | 530 |
| Archived UNCCD PRADS Practices | | | 442 |

Below the map and table, there is a section titled 'All SLM practices' with a grid of practice cards. Each card includes a title, a brief description, and a 'View' button. The practices are categorized by 'Key topics' and 'SLM practices per Ecosystem'.

Key topics:

- SLM Technologies: An SLM Technology is a land management practice that controls and regulates and enhances productivity and/or other ecosystem services.
- SLM Approaches: An SLM Approach defines the way and manner used to implement an SLM Technology, including the stakeholders involved and their roles.
- Gender responsive SLM: Check out or contribute gender-disaggregated data, using the UNCCD-WOCCAT gender responsive SLM tool.
- Economics: Learn more about the ECON dataset, providing data on costs and benefits of SLM Technologies, harmonized across countries and practices.
- Carbon Benefits: Estimate Carbon Benefits and greenhouse gas emissions of an SLM Technology using the CBP tool.
- Sand and Dust Storms: Find SLM Technologies relevant to prevent or reduce Sand and Dust Storms (SDS).
- Drought: Find SLM Technologies that help to manage risk and prepare and respond to Drought.
- Water: Assess SLM Technologies that aim at harvesting water.
- Biodiversity (coming soon): Find SLM Technologies that are relevant to conserve Biodiversity.

SLM practices per Ecosystem:

- Cropland: Find SLM practices for cropland.
- Forests: Assess SLM practices relevant to manage forests.
- Rangelands: Check out SLM practices in rangelands.
- Mountains: Check out SLM practices in mountain/high altitude.

Global WOCAT SLM Database- mountains

WOCAT

Main purpose(s) of the Technology

Land use type(s)

Select Degradation type

Goal of the Technology with regards to land degradation

Select SLM group

Select SLM measures

Altitudinal zone

1,001-1,500 m a.s.l.

1,501-2,000 m a.s.l.

2,001-2,500 m a.s.l.

2,501-3,000 m a.s.l.

3,001-4,000 m a.s.l.

> 4,000 m a.s.l.

501-1,000 m a.s.l.

Annual rainfall

Slopes

gentle (3-5%)

hilly (16-30%)

moderate (6-10%)

rolling (11-15%)

steep (31-60%)

very steep (>60%)

Land use rights(s)

Marked orientation of production system

SLM specialists

From Date

To Date

Approaches

0

Countries

80

Institutions

450

SLM specialists

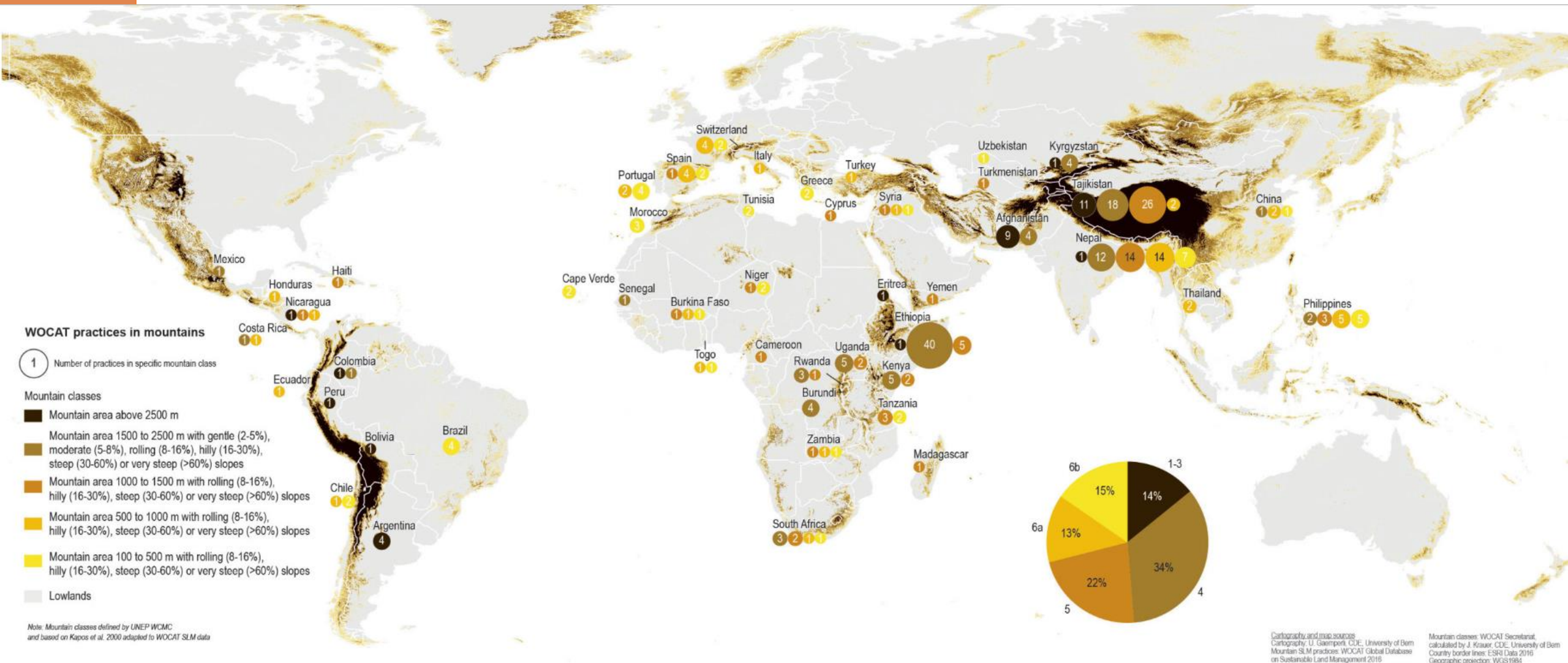
752

Location of documented SLM Practices

Land use types

| | | |
|----------------------------------|-----|--------|
| Cropland | 511 | 67.50% |
| Grazing land | 296 | 39.10% |
| Forest/ woodlands | 158 | 20.87% |
| Settlements, infrastructure | 45 | 5.94% |
| Waterways, waterbodies, wetlands | 34 | 4.49% |
| Unproductive land | 31 | 4.10% |

SLM technologies in Mountains



Degradation in mountains

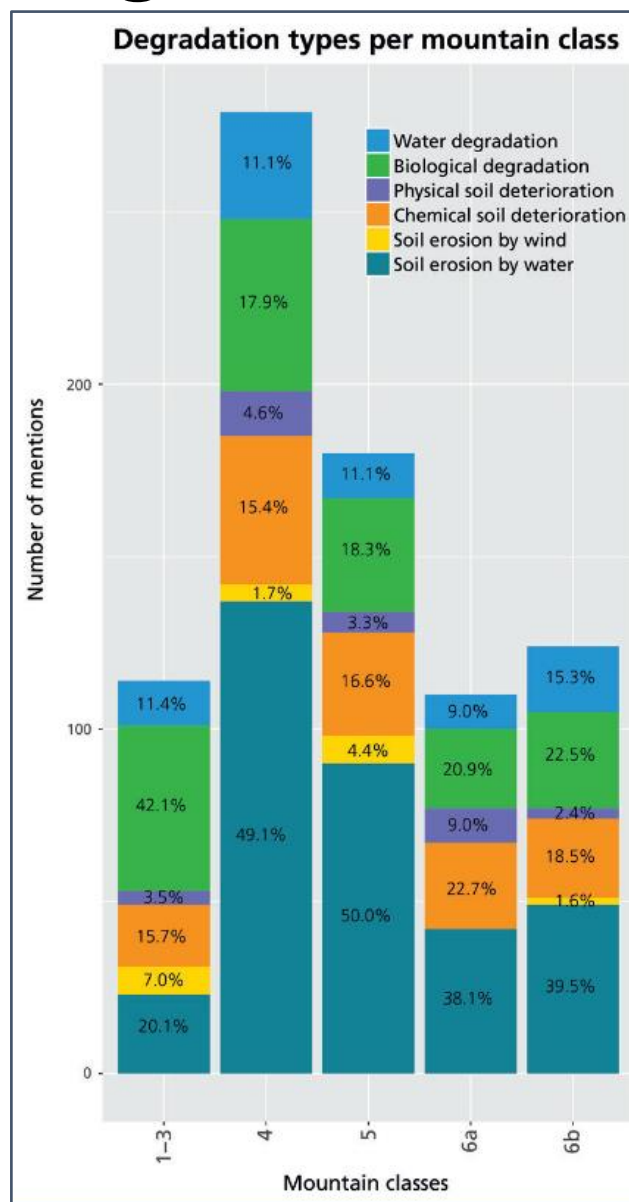


Photo: Hans Hurni

Mountain classes

- 1-3 Mountain area above 2500 m
- 4 Mountain area 1500 to 2500 m with gentle (2-5%), moderate (5-8%), rolling (8-16%), hilly (16-30%), steep (30-60%) or very steep (>60%) slopes
- 5 Mountain area 1000 to 1500 m with rolling (8-16%), hilly (16-30%), steep (30-60%) or very steep (>60%) slopes
- 6a Mountain area 500 to 1000 m with rolling (8-16%), hilly (16-30%), steep (30-60%) or very steep (>60%) slopes
- 6b Mountain area 100 to 500 m with rolling (8-16%), hilly (16-30%), steep (30-60%) or very steep (>60%) slopes

Source: Fleiner et al 2018: 47

Supporting partner of the UN Decade on Ecosystem Restoration

Joint publication with videos by **UNCCD** and **WOCAT** demonstrates how the implementation of SLM practices not only **directly contributes to ecosystem restoration**, but also brings forth various social, economic, and environmental benefits, **showcasing on-the-ground "good practices" as evidence.**



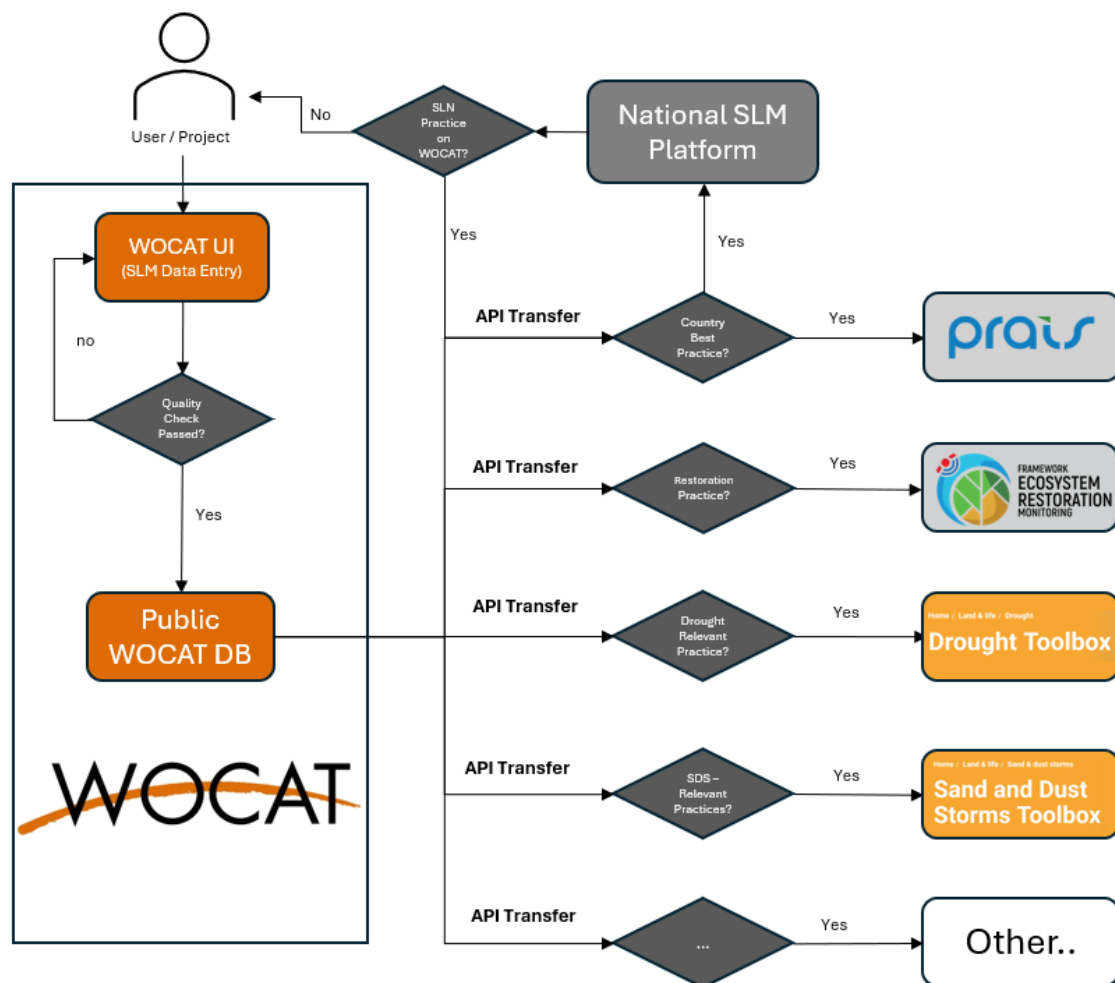
RESTORING LIFE TO THE LAND

The Role of Sustainable Land Management in Ecosystem Restoration



Interoperability (through API) for outreach and application of knowledge and data

Global to local

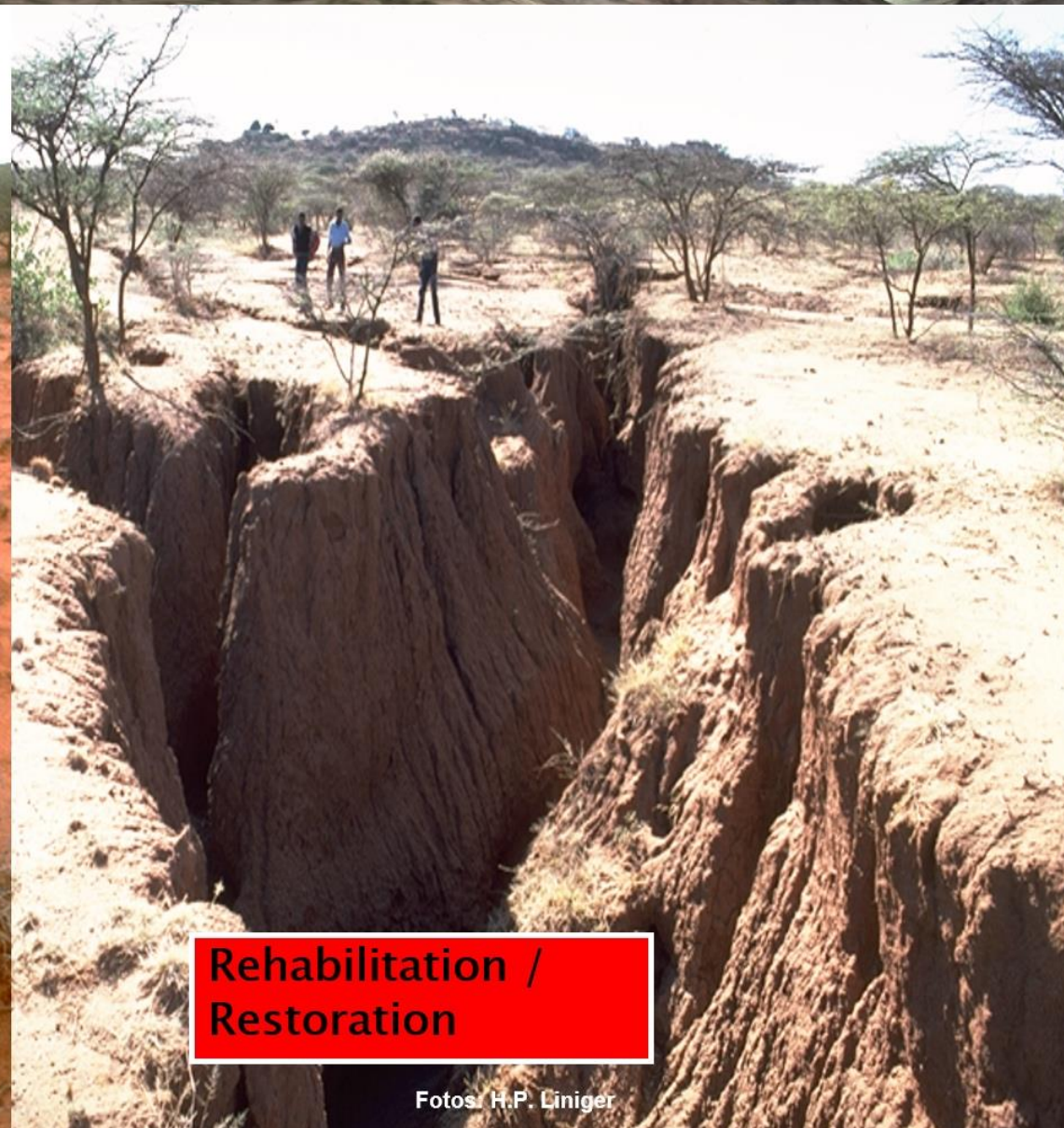




Prevention



Mitigation / „Cure“



**Rehabilitation /
Restoration**

Fotos: H.P. Liniger



I don't
think
so!

Defintelely,
Yes!

Well... it
depends...

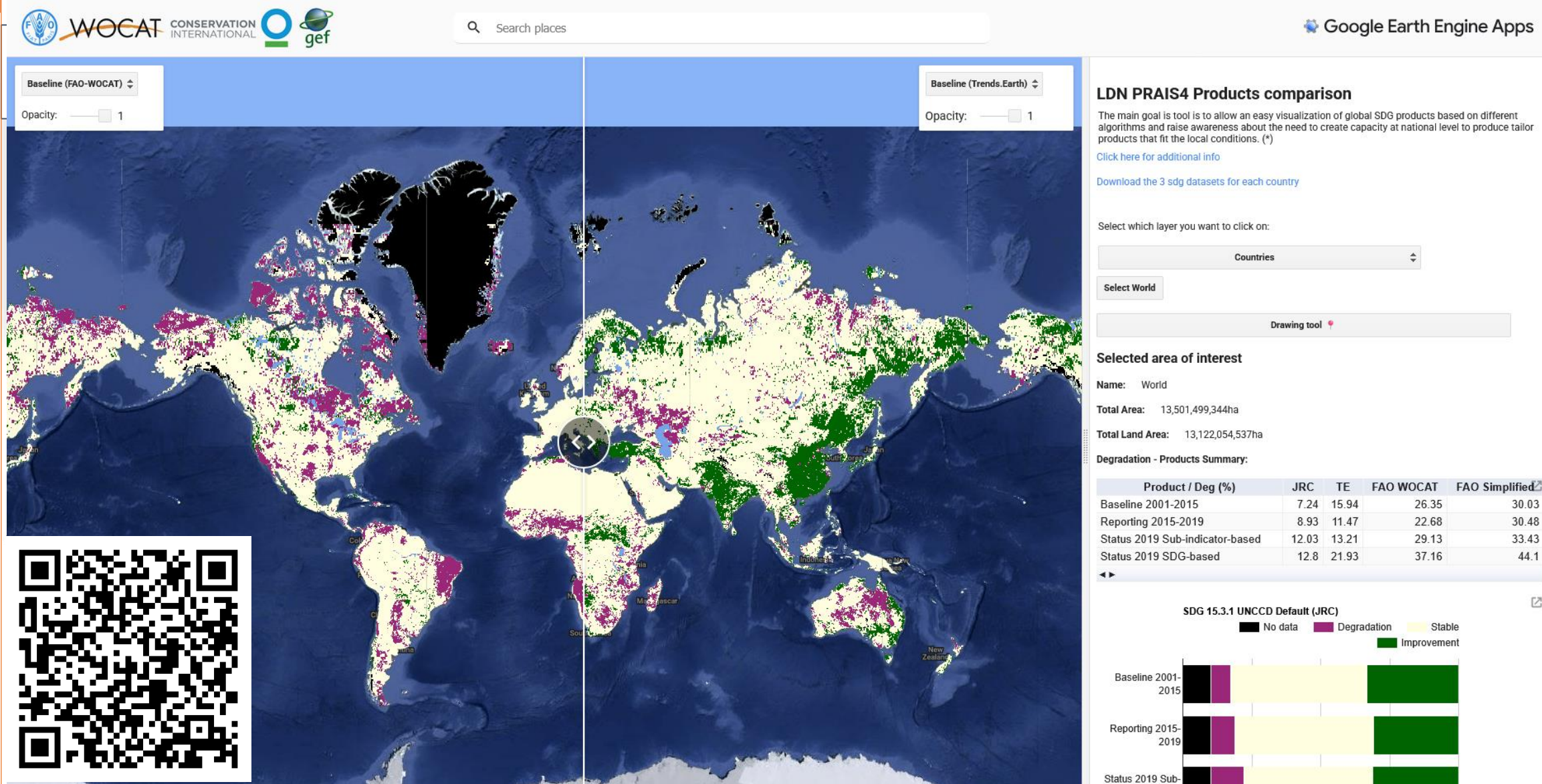
evidence-based discussion
participatory and inclusive
reach consensus to map land degradation

Challenges and Opportunities

- Mapping LD is not easy. Often **stakeholders disagree** on whether an area is degraded or not, depending on what factors they consider to make the decision: LD is a process; different types of LD; degree, causes and impacts vary
- Maps produced by single experts will not gain **ownership and trust** so they can be utilized for national planning and decision-making.
- **Participatory, multi-stakeholder and inclusive processes that integrate expert knowledge and data** can generate relevant, agreed LD maps and tools that help to **make decisions** on: what to do where? where to invest? what to prioritize?
- Strengthen capacities, **inter-institutional collaboration and knowledge exchange**

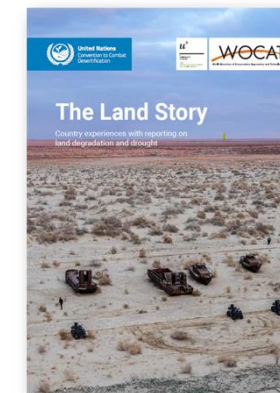
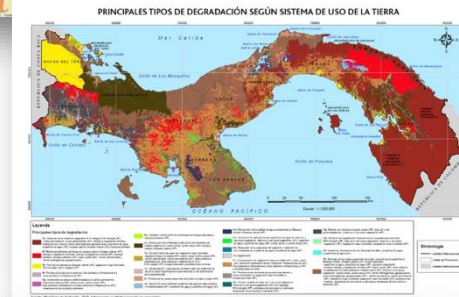
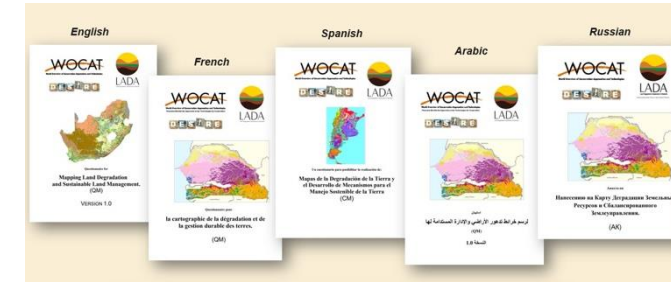


PRAIS 4 - Comparison of SDG 15.3.1



Participatory LD Monitoring – 3 Approaches History of Co-creation

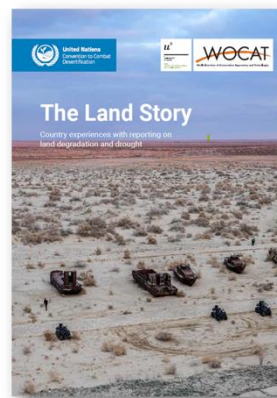
- 2006-2010: GEF / FAO Land Degradation Assessment in Drylands – **LADA**. **QM - Participatory Expert Assessment to map LD and SLM**
- Global interest: **Countries worldwide using the QM** to map LD, identify areas of intervention, and report to UNCCD
- 2015-2019: GEF / FAO Decision Support for Mainstreaming and Scaling out SLM – **DS-SLM**. **QM through South South training, combined with EO** and emerging tools
- Demand for replication of Argentina's innovative approach: **Countries request capacity development to replicate**
- WOCAT and Ministry of Environment Ecuador** pilot new approach
- Further **enhanced and implemented with countries** in 2022 UNCCD reporting process and **applied in GEF/ FAO DSL-IP**



Participatory LD Monitoring

Facilitation of participatory workshops with diverse stakeholders that were **NOT necessarily GIS experts**.

Use of cloud computing for co-development of tools and easy to use applications to explore, compare, integrate and validate maps.



Panama



Türkiye



Ecuador



Colombia



Bhutan



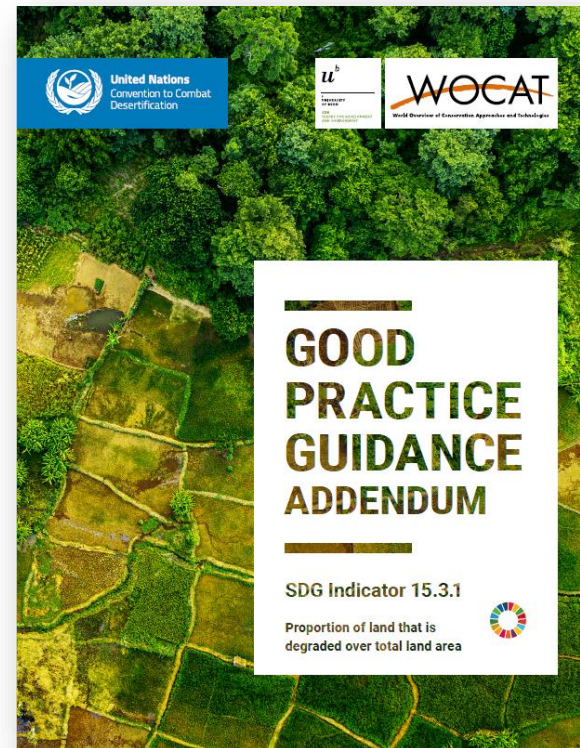
Bosnia and Herzegovina



Participatory LD Monitoring

PARTICIPATORY APPROACH FOR MAPPING LDN INDICATORS

A Collaborative Approach





United Nations

ICCD/CR



**Convention to Combat
Desertification**

Distr.: General
17 December 2025

Original: English

Committee for the Review of the Implementation of the Convention

**Report of the twenty-third session of the Committee for the
Review of the Implementation of the Convention, held in
Panama City, Panama, from 1 – 5 December 2025**

D. Development and promotion of activities for targeted capacity-building to further the implementation of the Convention

77. Some Parties emphasized the need for capacity-building approaches that are inclusive, context-specific and rooted in national and regional realities. They highlighted that different regions – such as LDCs, SIDS, mountainous countries, hyperarid zones, and communities with limited in-country expertise – require tailored support, including hands-on training, mentoring schemes and locally relevant technical backstopping.

E. Improving the procedures for communication of information as well as the quality and formats of reports to be submitted to the Conference of the Parties

90. Some Parties emphasized persistent gaps in default datasets – especially for LDCs, SIDS, hyperarid zones, countries with mountainous terrain and communities with limited in-country expertise – and called for high-resolution, continuous and regularly updated data and improved coverage.



LDN and Mountains: SDG targets 15.3 and 15.4

The use of land-cover data in SDG Indicator 15.3.1

SDG indicator 15.3.1 monitors the proportion of land degraded over total land area within a country. There are **three subindicators for the calculation of SDG Indicator 15.3.1**:



The use of land-cover data in SDG Indicator 15.4.2

SDG Indicator 15.4.2 monitors progress towards the conservation of mountain ecosystems through two subindicators.

Subindicator 15.4.2a

Mountain Green Cover Index (MGCI), measures the extent and changes of green cover in mountain areas.

Subindicator 15.4.2b

Proportion of degraded mountain land, monitors the extent of degraded mountain land as a result of land-cover change.

Subindicator 15.4.2b


In Subindicator 15.4.2b, similarly to subindicator **trends in land cover** under SDG Indicator 15.3.1, land cover is used to identify areas where changes in the type of land cover (land-cover transitions) may indicate a decline or loss of biodiversity, mountain ecosystem functions, or services that are considered desirable in a local or national context.

Indicator

15.3.1: Proportion of land that is degraded over total land area.

15.4.2: (a) Mountain Green Cover Index and (b) Proportion of degraded mountain land.

Custodianship

UNCCD is the custodian agency  for this indicator.

FAO is the custodian agency for this indicator.

Custodian agencies

Custodian agencies are United Nations bodies (and in some cases, other international organizations) responsible for compiling and verifying country data and metadata, and for submitting the data, along with regional and global aggregates, to the United Nations Statistics Division.

As the custodian agencies of, among others, SDG indicators 15.3.1 and 15.4.2, UNCCD and FAO play a critical role in explaining the theoretical and methodological basis for the SDG indicators for which they are responsible, as well as in disseminating best practices and technical guidance to countries on how these should be monitored and reported.

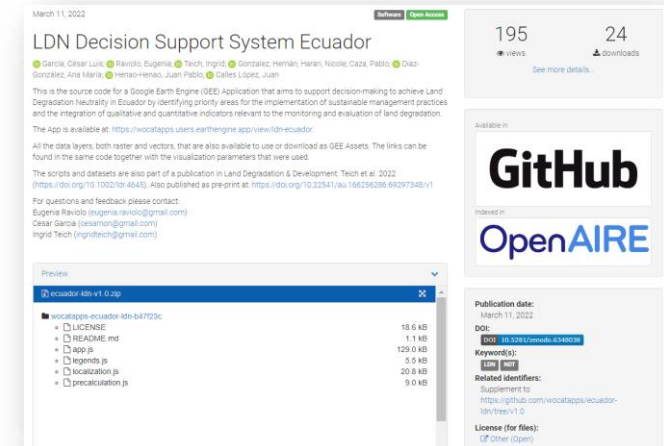
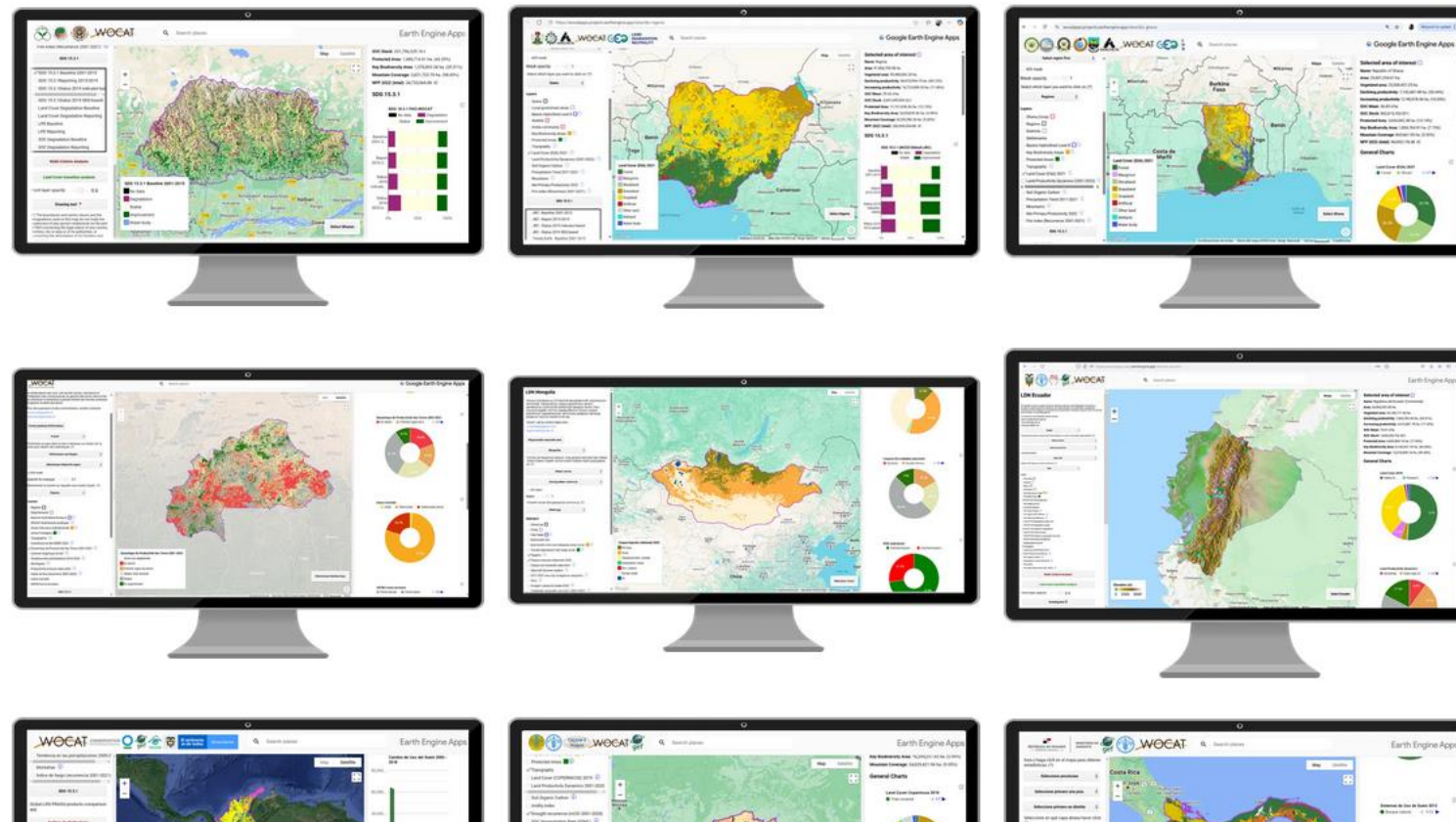
Source: FAO e-learning course

LDN DECISION SUPPORT SYSTEMS

<https://wocat.net/en/ldn/wocatapps/>

LDN Decision Support Systems

These apps, also used as LDN Decision Support Systems (LDN DSS) by different countries, include the results of participatory processes for mapping Land degradation and estimating SDG15.3.1, including the 3 LDN sub indicators and final degradation map. They also include additional indicators and maps selected by each country experts, including national, regional and global maps of land degradation, soil properties, protected areas, key biodiversity areas, precipitation trends, fire intensities, sustainable land management practices, etc. The LDN DSS allows decision makers to easily compare results and obtain statistics across spatial scales and landscapes, including a multi-criteria module to identify areas with specific characteristics to prioritise different types of interventions to achieve the country's LDN targets. The principle of convergence of evidence can be applied to identify hotspots of degradation as well as areas of false positives/negatives.



<https://doi.org/10.5281/zenodo.6348037>



Search places

Multi-Criteria Analysis

Land Cover

- ☐ Forest
- ☐ Shrubland
- ☐ Grassland
- ☐ Cropland
- ☐ Artificial
- ☐ Other land
- ☐ Water body

Land Productivity Dynamics (2001-2022)

- ☐ Declining
- ☐ Early sign of decline
- ☐ Stable but stressed
- ☐ Stable
- ☐ Increasing

Mountains

- ☒ $\geq 4500\text{m}$
- ☒ 3500-4500m
- ☒ 2500-3500m
- ☒ 1500-2500m slope $\geq 2^\circ$
- ☒ 1000-1500m slope $\geq 5^\circ$
- ☐ 300-1000m LER $> 300\text{m}$
- ☐ Inner plateau $< 25\text{km}^2$

Soil Organic Carbon

- ☐ < 40
- ☐ 40 - 60
- ☐ 60 - 80
- ☐ 80 - 100
- ☐ 100 - 120
- ☐ 120 - 140
- ☐ 140 - ∞

Soil Class

- ☐ Anthraquic Cambisols
- ☐ Dystric Cambisols
- ☐ Eutric Cambisols
- ☐ Haplic Acrisols
- ☐ Haplic Alisols
- ☐ Haplic Lixisols
- ☐ Skeletic Cambisols

Key Biodiversity Areas (Global Layer)

- ☐ Non KBA
- ☐ KBA

Protected Areas

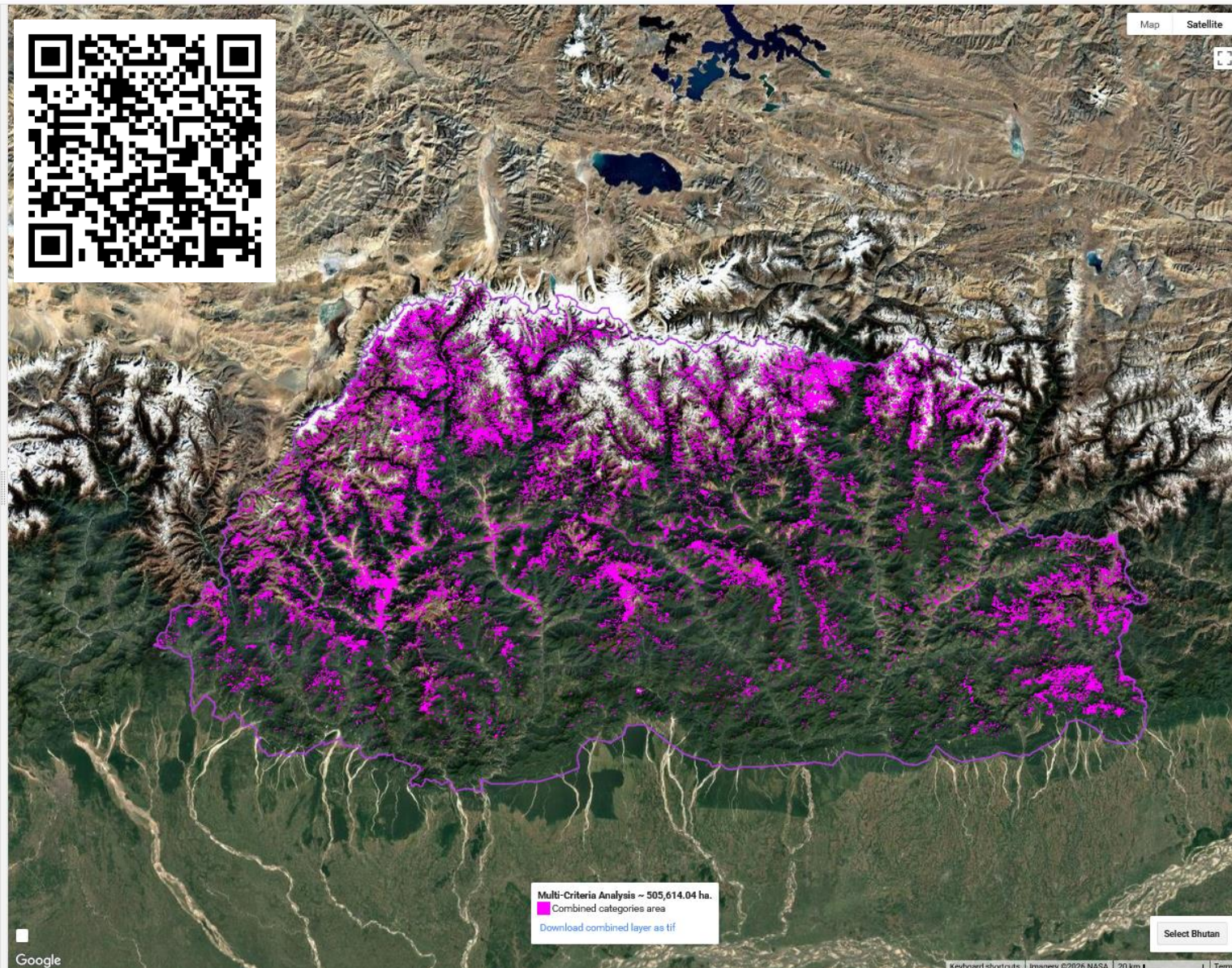
- ☐ Non Protected Areas
- ☐ Protected Areas

SDG 15.3.1 Baseline 2001-2015

- ☐ No data
- ☐ Degradation
- ☐ Stable
- ☐ Improvement

SDG 15.3.1 Reporting 2015-2019

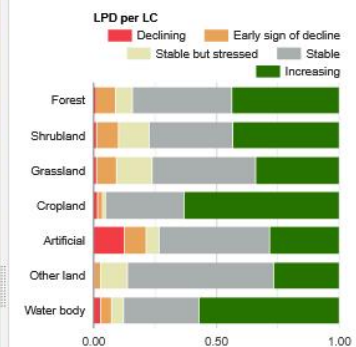
- ☐ No data
- ☐ Degradation



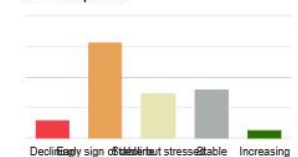
Selected area of interest

Name: Kingdom of Bhutan
Area: 3,882,654.04 ha.
Vegetated area: 3,874,516.81 ha.
Declining productivity: 323,472.63 ha. (8.35%)
Increasing productivity: 1,648,065.54 ha. (42.54%)
SOC Mean: 91.22 t/ha
SOC Stock: 353,066,469.67 t
Protected Area: 1,978,635.38 ha. (50.96%)
Key Biodiversity Area: 1,379,000.13 ha. (35.52%)
Mountain Coverage: 3,831,662.07 ha. (98.69%)
NPP 2022 (total): 34,733,202.74 tC

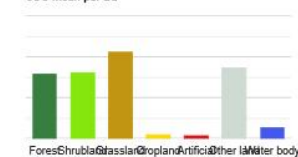
Combined LC/LPD/SOC Charts



SOC mean per LPD



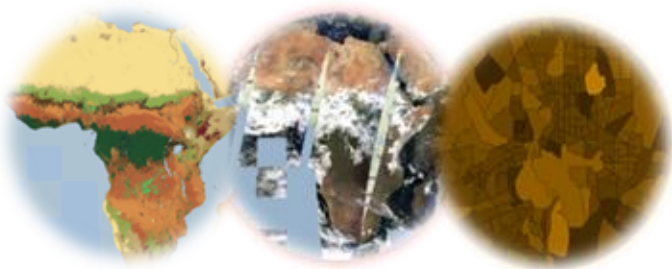
SOC mean per LC



A time of opportunities for informed decisions

AVAILABLE EO DATA

Growing daily, real time, climate & weather, geophysical data sets with high spatial, temporal and spectral resolution



CLOUD COMPUTING

Easy access to high-performance computing resources for processing very large geospatial datasets



WOCAT Principles

Democratization of knowledge through open access and easy to use data and knowledge

Co-development and **inclusiveness** in the creation of knowledge



DATA MINING

New technologies and algorithms, such as machine learning methods to effectively extract information from available data, including the hidden relationships of high dimensional spaces



USER FRIENDLY TOOLS & INTERFACES

Facilitate access to explore, compare, download and produce spatial explicit information for experts and non experts alike



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