LDN response hierarchy and land use planning – tools and approaches

LDN training, CRIC Guyana
25 January 2019, 14:30 – 16:00
Contents

A. LDN Response Hierarchy - Hanspeter Liniger WOCAT

B. LDN / SLM Implementation strategy? Sally Bunning & Vera Boerger FAO
   1. Assessment LD and SM (national to landscape)
   2. Land planning
   3. Integrated landscape management (ILM)
   4. Integrate climate change and biodiversity
   5. Mainstreaming in policy and financing
   6. Monitoring and communicating

C. Country Experiences
   1. Argentina - Latin America - Pablo Viegas
   2. Bosnia & Herzegovina – Europe - Hamid Custovic
   3. Ecuador - Latin America – Rosa Ana Gonzalez
   4. Thailand – Asia – Wisit Ngamson

D. Plenary session
| Step 6: Mainstream LDN in land use planning | • Integrate LDN into national land-use planning models to predict “gains” and “losses” |
| Step 7: Identify measures to achieve LDN targets | • Identify measures to address the drivers of land degradation  
• Promote implementation of the LDN response hierarchy: Avoid, minimize and reverse land degradation  
• Plan to balance unavoidable land degradation with restoration efforts |
| Step 8: Facilitate action towards LDN | • Communicate the multiple benefits of LDN  
• Mainstream LDN in national policies and plans  
• Increase investments to achieve LDN  
• Establish/strengthen LDN-related partnerships |
| Step 9: Monitor progress towards LDN | • Monitor changes in the values of LDN indicators to quantify “gains” and “losses”  
• Assess the achievement of LDN targets |
| Step 10: LDN Reporting | • Communicate progress towards LDN at all levels |
Land Degradation Neutrality Response Hierarchy

Prevention: AVOID
Reduction: REDUCE
Restoration: REVERT
Global WOCAT SLM Database (field experiences)

**Participants:**
- Who knows WOCAT?
- Who uses WOCAT tools?
LDN response hierarchy

Source: Liniger et al. 2019

Avoid / prevent degradation
Reduce degradation
Reverse / restore degradation

Source: Orr et al. 2017

WOCAT Db Technologies and LDN response hierarchy

Source: Liniger et al. 2019
Avoid / Prevent degradation (462)

- **Goal of the Technology with regard to land d**
  - Prevent land degradation (462)
  - Reduce land degradation (611)
  - Restore / rehabilitate severely degraded land (214)
  - Adapt to land degradation (23)
  - Not applicable (20)

- **SLM group**
  - Natural and semi-natural forest management (19)
  - Forest plantation management (12)
  - Agroforestry (55)
  - Windbreak / shelterbelt (17)
  - Area closure (stop use, support restoration) (16)
  - Rotational systems (crop rotation, fallows, shifting cultivation) (38)
  - Pastoralism and grazing land management (31)
  - Integrated crop-livestock management (15)
  - Improved ground / vegetation cover (107)
  - Minimal soil disturbance (42)
  - Integrated soil fertility management (67)
  - Cross-slope measure (75)
  - Integrated pest and disease management (incl. organic agriculture) (26)
  - Improved plant varieties / animal breeds (21)
  - Water harvesting (45)
  - Irrigation management (incl. water supply, drainage) (49)
  - Water diversion and drainage (25)
  - Surface water management (springs, rivers, lakes, sea) (28)
  - Ground water management (6)
  - Wetland protection / management (4)
  - Waste management / waste water management (4)
  - Energy efficiency technologies (10)
  - Beekeeping, aquaculture, poultry, rabbit farming, silk worm farming, etc (12)
  - Home gardens (15)
  - Ecosystem-based disaster risk reduction (14)
  - Post-harvest measures (3)

**Technologies**
- Dynamic agroforestry systems [Bolivia, Plurinational State of]
- Improved green manures [Plurinational State of Bolivia]
- Grazing with Holistic Management Principles [Plurinational State of Bolivia]
- Annual green manure with Phacelia [Syria]
- Stone Wall Bench Terraces [Syria]
Reduce degradation (618)

Goal of the Technology with regard to land

- prevent land degradation (462)
- **reduce land degradation** (618)
- restore/ rehabilitate severely degraded land (298)
- adapt to land degradation (23)
- not applicable (20)

SLM group

- natural and semi-natural forest management (18)
- forest plantation management (9)
- agroforestry (54)
- windbreak/ shelterbelt (17)
- area closure (stop use, support restoration) (27)
- rotational systems (crop rotation, fallows, shifting cultivation) (48)
- pastoralism and grazing land management (55)
- integrated crop-livestock management (20)
- **improved ground/ vegetation cover** (154)
- minimal soil disturbance (52)
- integrated soil fertility management (89)
- cross-slope measure (129)
- integrated pest and disease management (incl. organic agriculture) (25)
- improved plant varieties/ animal breeds (23)
- water harvesting (69)
- irrigation management (incl. water supply, drainage) (69)
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- waste management/ waste water management (9)
- energy efficiency technologies (12)
- beekeeping, aquaculture, poultry, rabbit farming, silkworm farming, etc. (5)
- home gardens (19)
- ecosystem-based disaster risk reduction (17)
- post-harvest measures (1)

Improved cover

- Cross-slope measure
- Int. soil fertility mgt.

Water harvesting

Water suppl. Irrig.

Agroforestry

Min soil disturb.
Revert / restore degradation (298)

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Improved cover

Cross-slope measure

WH & Irrigation

Water supply

Pastoralism & Grazing LM

Grass reseeding [Kenya]

Gully erosion management [Ethiopia]
SLM measures and LDN response hierarchy

Countries are already implementing SLM
What more is needed?
Report → Evidence of Impact and Value
→ Recognise Importance → Expand $$$$$$$
Use of WOCAT Database for LDN reporting

Figure 6: Impact of the SLM technology on LDN related indicators: productivity, food security, carbon below ground, and other key indicators including water availability, off-site water (quantity and quality) and biodiversity (Number of SLM technologies: 926. Note: the same technology may occur in different LUs). (Source: WOCAT 2018b)

Achieving land degradation neutrality: The role of SLM knowledge in evidence-based decision-making

Hanspeter Liniger*, Nicole Harari†, Godert van Lynden‡, Renate Fleiner*, Jan de Leeuw*, Zhanguo Bai†, William Critchley†

*Center for Development and Environment (CDE), University of Zürich, Switzerland
†MKEE, Wageningen University, Netherlands
‡Sustainable Land Management Associates, UK

LDN indicator 'land productivity' corresponds to WOCAT categories 'crop, fodder and wood production':

- crop production: decreased increased
- Quantity before SLM: 5 bags of maize / acre
- Quantity after SLM: up to 9 bags of maize / acre
- Comment: This applies to 1 area of land that was not managed on RMA (rotation management agriculture) and better quality field before SLM, tree growth was suppressed.

LDN indicator ‘land cover (land cover change)’ corresponds to WOCAT category ‘vegetation cover’:

- Vegetation cover: decreased increased
- Comment: An increase of grass species was observed after 3 sampling periods that more species are found on RMA / rotated land.

LDN indicator ‘carbon stocks (soil organic carbon)’ corresponds to WOCAT category ‘soil organic matter / carbon below ground’:

- soil organic matter / carbon below ground C: decreased increased

Figure 1: Example of LDN indicators for an SLM Technology in the WOCAT database and the sliding assessment scale (WOCAT 2018a).
Additional LDN indicators

Highly Diversified Cropping in Live Trellis System (Philippines)

Kahutara at live trellis - "Nam".

*Ghana* is richly known as "Kahutara" served as an example for an anchorage for annual crop diversity cropping type of vegetation and livestock control measure. The technology is well adapted in the country, providing an alternative option for the farmers and increased income due to diversified farming.

Highly diversified crops such as millet, cowpea, sesame, groundnut and soybean in the community. The cropping system is highly diversified which increases crop rotation, which is being practiced in the region. Overall, land being reclaimed and improved soil conditions due to its ability to reduce soil loss. Initially, it took the live trellis system to its farm, including the local farmer in the community. The vegetation cover is very high, which is an essential ingredient to achieve a high living standard. The trimmed soil is very rich in nutrients and will eventually produce a crop year after year. There will help in maintaining soil quality and nutrient levels.

In establishing the live trellis system, livestock turns in sugar cane "drumstick corn" at a rate of 3:1 every height and can be planted in a row. An estimate of 3.1 kg maize planted within a row and also between row is used. When the local farmer uses contiguous in a field, a yield of 3.1 kg maize is harvested. Maintenance of the technology includes weeding and trimming. During weeding, application of diesel is done as in minimal.

The technology has been a practice in the community for a long time, and earth’s corn continues to adapt the technology because of its benefits and performance in rotation and soil loss in the community. It is being introduced in the community. It is being introduced in the community. It is being introduced in the community. It is being introduced in the community. It is being introduced in the community.

*Off-site impacts*
- upstream flooding (undesired)

*Ecological impacts*
- soil moisture
- soil cover
- soil loss

*Socio-cultural impacts*
- food security/ self-sufficiency
- SLM/ land degradation knowledge

*Socio-economic impacts*
- crop production
- crop quality
- fodder production
- fodder quality
- wood production
- product diversity
- diversity of income sources

- increased
- decreased
- improved
- reduced
Adoption of SLM Technologies and LDN response hierarchy

![Diagram showing adoption of SLM Technologies and LDN response hierarchy. The x-axis represents the number of technologies, and the y-axis represents different stages of intervention. The diagram includes bars for different percentages of users adopting the technology, ranging from single cases to more than 50%.](image-url)
Cost-benefits and LDN response hierarchy

Short-term
- Establishment: about 1/3 do not pay back
- Maintenance: <1/5 do not pay back
- All stages similar but...
- Higher investment also gives higher returns

Long term
- Very few that do not pay back:
  \[\rightarrow\] they have offsite benefits!
World Atlas of Desertification 2018

Rethinking land degradation and sustainable management

https://wad.jrc.ec.europa.eu/

Linking Global with Local (SLM BP)
Earth Observation: Trends.Earth

**MONITORING LAND CONDITION**

- Identification of degraded lands
- Can set baselines, and track progress towards LDN
- Best global datasets
- Allows use of best-available local information

Supports all three components of SDG Indicator 15.3.1

- Land Productivity
- Land Cover
- Carbon Stocks
### Summary of SDG 15.3.1 Indicator

<table>
<thead>
<tr>
<th>Land Area Type</th>
<th>Area (sq km)</th>
<th>Percent of Total Land Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total land area</td>
<td>204,548.3</td>
<td>100.00%</td>
</tr>
<tr>
<td>Land area improved</td>
<td>55,585.7</td>
<td>27.17%</td>
</tr>
<tr>
<td>Land area stable</td>
<td>98,038.5</td>
<td>47.93%</td>
</tr>
<tr>
<td>Land area degraded</td>
<td>50,091.8</td>
<td>24.46%</td>
</tr>
<tr>
<td>Land area with no data</td>
<td>882.3</td>
<td>0.43%</td>
</tr>
</tbody>
</table>

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For more information on Trends.Earth, see http://trends.earth, or contact the team at trends.earth@conservation.org.
Linking Trends.Earth and WOCAT SLM Practices

Calibrating and validating earth observation with SLM field data

Synergizing global tools to monitor progress towards land degradation neutrality: Trends.Earth and the World Overview of Conservation Approaches and Technologies sustainable land management database

Mariano Gonzalez-Roglich, Alex Zvoleff, Monica Noon, Hanspeter Längler, Renate Fleiner, Nicole Harari, Cesar Garcia

- Baty and Goffe Moore Center for Science, Conservation International, 2201 Crystal Drive, Suite 300, Arlington, VA, 22202, USA.
- Center for Development and Environment, University of Geneva.
- National Council of Scientific and Technological R
development.

Source: Gonzales et al. 2019

Fig. 6. Relative frequency of each of the 5 classes of the land productivity indicator representing change between 2001 and 2015 for the SLM technologies present in the WOCAT database and similar sites selected using the matching procedure (control) grouped by intended objective towards addressing land degradation. “n” indicates sample size, and “odds” indicates the odds ratio for an ordinal logistic regression (with 95% confidence intervals in parentheses).

Source: Gonzales et al. 2019
Verifying Global national 3 LDN with Local Assessment: Trends.Earth

Land cover degradation (2002 - 2016)

Soil organic carbon degradation (2002-2016)

Productivity trajectory degradation (2002 - 2016)
Verifying Global national 3 LDN with Local Assessment: Woody Weeds

Legend
- Prosopis spp.
- Acacia tortilis
- Acacia reficiens
- Mixed vegetation
- Indigenous forest
- Plantation forest
- Water
- Rainfed cropland
- Bareland
- Grassland
- Balineses
- Irrigated cropland
- Water weeds


Productivity Trends.Earth

Legend
- Degradation (sign decr. p < .01)
- Degradation (sign decr. p < .05)
- Stable (no significant change)
- Improvement (sign. incr. p < .05)
- Improvement (sign. incr. p < .01)
Participatory expert assessment

<table>
<thead>
<tr>
<th>Degradation per LUS</th>
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<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Extent (area)</td>
</tr>
<tr>
<td>Degree</td>
</tr>
<tr>
<td>Rate (Impact on ecosystem services (type and level))</td>
</tr>
<tr>
<td>Direct causes</td>
</tr>
<tr>
<td>Indirect causes</td>
</tr>
<tr>
<td>Recommendation</td>
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</tbody>
</table>

<table>
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<tr>
<th>Conservation/SLM per LUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name / Group / Measure</td>
</tr>
<tr>
<td>Extent (area)</td>
</tr>
<tr>
<td>Effectiveness</td>
</tr>
<tr>
<td>Effectiveness trend</td>
</tr>
<tr>
<td>Impact on ecosystem services (type and level)</td>
</tr>
<tr>
<td>Degradation addressed</td>
</tr>
</tbody>
</table>

Table 2: Land degradation (Example)

Name: [Name]

Country: [Country]

Mapping Unit Id (LUS + admin. unit): 113

(Savanna + Balloen municipality)

<table>
<thead>
<tr>
<th>Land degradation (Step 3)</th>
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<tbody>
<tr>
<td>a) Type (state)</td>
</tr>
<tr>
<td>b) Extent</td>
</tr>
<tr>
<td>c) Degree</td>
</tr>
<tr>
<td>d) Rate</td>
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<tr>
<td>e) Direct causes</td>
</tr>
<tr>
<td>f) Indirect causes</td>
</tr>
<tr>
<td>g) Impact on ecosystem services</td>
</tr>
<tr>
<td>h) Remarks</td>
</tr>
</tbody>
</table>

| Na | fs | 25% | 2 | t | gi, et. fi. | p, k, t | P1-3, 22-2 | Degradation is concentrated in NW commercial grazing area of interest |
Where are the hotspots or priority areas for intervention?

Source: L. Lindeque

FAO-WOCAT Mapping of LD and SLM
Linking FAO-WOCAT Participatory Mapping and Earth Observation

Dominant degradation type

Degradation Severity

Net primary productivity change 2000-2015 (MODIS)

Source: Liniger et al. 2019
Linking FAO-WOCAT Mapping and Earth Observation

Land degradation assessment in the Argentinean Puna: Comparing expert knowledge with satellite-derived information

César Luis García1,2,*, Ingrid Teich1,3,*, Mariano González-Roglich3, Adolfo Federico Kindgard1, Andrés Carlos Ruvelo3, Hansgert Liniger4

1Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina
2Centro de Investigaciones y Docencia en Geografía y Desarrollo Rural (CIDEG), Universidad Nacional de Córdoba, Argentina
3Instituto de Ciencias de la Tierra y Recursos (ICTR), Universidad Nacional del Nordeste, Santa Cruz, Argentina
4Batty & Corinne Masters Center for Science, Conservation International, 1831 Crystal Drive Suite 300, Arlington, VA 22202, USA
5Food and Agriculture Organization, FAO Forestry Department, Via delle Terme di Caracalla, 00141 Rome, Italy
6Centre for Development and Environment (CDE), University of Bern, Winterthurerstr. 42, CH-3012 Bern, Switzerland

Source: Garcia et al. 2019
**SLM and Climate Change Mitigation Co-benefits (SLM + CCM)**

Link between WOCAT and the Carbon Benefit Project (CBP)

- A new version of WOCAT SLM Technologies with more drop down answers (adapted from IPCC)
- Approx. 60% of the questions in the CBP Tool can be answered with the link to the WOCAT database.
- Results from the CBP-Tool (Soil Carbon Stocks, GHG Balance) will be implemented into the Summary of the WOCAT Technologies.
- Future Projects (e.g. GEF) with an interest in Carbon Benefits will use WOCAT and the link to CBP Tool
- The link simplifies carbon benefit calculations of specific WOCAT SLM Technologies
How to link local – national - global for LDN monitoring?


(2) WOCAT-UNCCD SLM BP reporting (avail. May 2019) (local)


(4) LADA-WOCAT mapping combined with data from (1), (2), (3), ...
→ National – landscape) (exist.)

*Participants:*
- Who has used any of these tools for LDN reporting?
- Who is using it to leverage funds + LDN projects?
- Who would like to use it?

(3) Add. Data e.g. Collect Earth (FAO) → (local-landscape)
Conclusions - linking local and national LDN process

Support combination of available and used tools

Improve link between local and national (global) assessment

- Trends. Earth (RS/E0)
- SLM BP (WOCAT-UNCCD) & Carbon Benefit assessment
- Mobile App?! (Land-PKS-WOCAT)
- Review of all data above in participatory process at local & national level → using WOCAT-LADA mapping on LD and SLM

- Other relevant national local data: e.g. Collect Earth (FAO), SOC data +mapping ...

- More indicators to be included → Water! DRR! Biodiversity!
B. SLM implementation strategy **Achieve LDN**

Sustain the natural capital of land and associated land-based ecosystem services

Develop a strategy to Maintain or increase the area of healthy and productive land resources, necessary to support ecosystem services in a specified
- **time frame** ($t_0 \rightarrow t_1, \ldots, t_2, \ldots, t_3, \ldots \rightarrow \text{end 2030}$)
- **spatial scale** (national, subnational, target area)

Scale up SLM measures – management practices and land use systems that
- sustain soil, water and biodiversity resources +
- sustain ecosystem services +
- deliver multiple benefits.

Enhance national capacities - understanding, knowledge and innovation and planning processes - to support SLM adoption, scaling out and the monitoring of impacts

Provide supportive policy, institutional, governance and financing mechanisms (public, private)
What is the process?
Sustainable land resources management framework

Four interlinked steps to support sustainable management of land resources:

1. **Assessment**
   - Land resources status and trends
   - Degradation
   - Conservation
   - Restoration
   - Prioritization

2. **Planning**
   - ‘Biophysical’ and ‘human’ dimensions in participatory land use planning process

3. **Monitoring**
   - Assessing impact
   - Informing decision makers
   - LDN Targets

4. **Landscape Management**
   - Implementation and scaling out SLM practices
   - Achieving LDN

Support tools:
- Land Resource Planning Tools
- SLM scaling-up WOCAT UNCCD K-hub Farmers’ Field Schools
- LADA Collect Earth SHARP/RAPTA

SFA multiple benefits: biodiversity and ecosystem services, climate resilience, food security and poverty alleviation

Note: Four interlinked steps for land resources planning and management supported by examples of relevant tools/approaches.
Decision Support Framework for SLM mainstreaming and scaling out

Module 1: Operational Strategy and Action Plan for mainstreaming and scaling out SLM

Phase A: REVIEW AND INITIAL STRATEGY AND ACTION PLAN

Module 2: National/Subnational Level Assessment
- Assessment of LD & SLM
- Partnerships with policy institutions and financing mechanisms

Module 3: Selection of Priority Landscapes

Module 4: Landscape Level Assessment
- Assessment of LD & SLM
- Livelihoods and natural resources assessment
- Selection of SLM Best Practices

Module 5: SLM Territorial Planning
- Prioritization and action plan for implementation with stakeholders
- SLM support mechanisms, partnerships with decentralized policy institutions and financing mechanisms

Module 6: SLM Implementation and scaling out
- Multi sector and multi stakeholder process and impact assessment

Module 7: Knowledge management platform for informed decision making

Phase B: Capacity Development

Phase C: SCALING OUT THROUGH POLICIES, TERRITORIAL STRATEGIES, INCENTIVES, FINANCING MECHANISMS
DS-SLM methodological framework (FAO/GEF project)

**Key features**

- SLM mainstreaming and scaling out strategy where, what and how?
- Guidance to countries - Toolbox for land use and management assessment and planning from local/landscape to subnational/national scales
- Participatory, multi-sector and multi-stakeholder processes and capacity building
- Flexible, adaptable to country needs; modular format offers different entry points based on country/landscape gaps, previous activities, data & resources.

Country experiences
1. Assessment + Understanding of LD & SLM by range of actors

LADA-WOCAT Tools for Assessment of LD and SLM (national, sub-national + landscape)

Better understanding of

- **LD processes** and their **direct causes and the indirect drivers**
- **Trends in LD** (protection, reduced or increased degradation, restoration)
- **SLM measures** (extent + Impacts + effectiveness) in conserving land resources + sustaining ecosystem services including supporting livelihoods and well-being

Also analysis of

- **LD Hotspots** (Where? + Why?) + SLM **Bright spots** (What is Working?, Why Success?)
- **Barriers + constraints**
- **What Support is needed to Scale out + Accelerate SLM adoption** (transformational change)
- **Progress** in terms of agreed LDN indicators and targets
  - No net loss & the gain - area with improved “state” (natural resources + ES)
  - Trend rate (rate of increase in area protected, reduced degraded lands and restored area) **Adoption**
Assessing Types / Main Processes of Land Degradation and their Drivers

**LDN1- Loss of vegetation cover**
- **soil protection**
- Reduced infiltration $\rightarrow$ Runoff

**LDN2 Reduced productivity**
- (biomass NDVI)
- Poor crop + pasture/range forest + wetlands mgmt
- Overuse of agro-chemicals
- Poor irrigation / drainage

**LDN3 Loss of SOM**
- (inadequate recycling, OM and nutrients)

**What are the Drivers?**
- Agriculture expansion
- Population growth
- Urbanisation
- Monocultures
- Forest exploitation
- Overgrazing
- Mechanization
- Commodity-driven
- Inadequate knowledge
- Lack of tenure security
- Power differential
- Sectoral approaches & institutional silos
- Economic goals (dominate social & environmental goals)
Assessing Sustainable land management (SLM)

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

Combination of SLM Measures ➔

Integrated Systems Focus
- Sustainable Crop management
- Sustainable Grazing management
- rangelands and pastures
- Sustainable Forest management

SFM

Improved Agroforestry, Rangeland managemnt, Crop-livestock, Agrosilvopastoral systems
**Module 4 Landscape level assessment**

- identify **priority locations** using landscape assessment results
- identify potential **SLM practices** in multi-stakeholder workshops
- document and **assess SLM data** and good practices
- negotiate and select relevant SLM options with stakeholders
- build up evidence for informed DM

**Tools:**
- **WOCAT Questionnaires and Database on SLM Technologies and Approaches**
- **LADA local assessment**
2. Land use planning - A key component of LDN (UNCCD Technical Guide)

LDN as a planning principle
- guides the implementation of a “no net loss” policy.
- involves land-use decisions - generate land user benefits
- evaluates positive+ negative impacts of land-use options

1. Prioritise avoidance of land degradation (less costly)
- sustain ecological and economic benefits and prevent further conversion of natural ecosystems

2. Minimise degradation (NR and ES)
- sustain productive potential to extent possible (population growth, food production etc.)

3. Restore degraded lands (more costly)
- transform to biologically and/or economically productive areas by restoring ecosystem functions, and to extent feasible ecosystem services

5. Counterbalance newly degraded areas, unavoidable degradation (e.g. due to population growth+development needs) by restoring land that is already degraded (gains).
   Enabling a state of no net loss (“neutrality”).

Like for like: No net loss (gains =/> losses) within the same land cover class and the same ecosystem. (similar land resources and services)

Prioritise in situ restoration in or as close as possible to degraded site in the same territorial unit.

No loss of natural land

Restore more than you degrade: Degradation process can be fast while restoration may take one or several decades. Need to offset the significant time lag until a new balance is reached and “buffer” to mitigate other risks of counter-balancing.

Manage “no net loss” at the same scale as land use planning: within (sub-)national boundaries at the scale of biophysical or administrative domains at which land use decisions are made, to facilitate effective implementation.

Counterbalance domestically (avoid it between nations)
Land Resources Planning Toolbox

The LRP Toolbox is a freely accessible online source for a range of stakeholders, directly or indirectly involved in land use planning. The Toolbox contains a comprehensive number of existing tools and approaches that are used to implement land resources planning. The overall goal of the Toolbox is to make potential users aware of the existence of these tools, facilitate access to their information, and assist with the selection of those tools that meet the requirements of different stakeholders, operating at different levels, in different regions, and in different sectors. See the users' guide for more information.

For further information or comments please contact us at LRP-Secretariat@fao.org.

Biophysical approaches/tools

This category of tools gives prominence to biophysical attributes (climate, soil, terrain, water, etc.) and their interactions in the land evaluation process. The output, in most cases, guides the users to suitable options for land use alternatives, based mainly on biophysical attributes. Land suitability and similarity analysis are typical examples. Documents describing principles, approaches and guidelines for land evaluation are included, as well as different tools for classifying soils based on the suitability for a specific use, capability or potential. Fertility constraints and management and linkages to yield, productivity, physical and chemical properties. Sophisticated or simplified modelling of crop growth and yield predictions, also fall into this category.
Land evaluation and land planning processes & guides

**Land evaluation process** based on biophysical attributes (climate, soil, terrain, water, atmosphere) and their interactions. The output guides the users to suitable options for land use alternatives.

- **Land suitability assessment**—classifying soils based on suitability, capability or potential, fertility constraints and management and linkages to yield, productivity, physical and chemical properties.
- **Similarity analysis.** Sophisticated or simplified modelling of crop growth and yield predictions.

**Participatory land use planning:** Information on biophysical characteristics and social and economic conditions are used in some approaches with the aim of reaching mutually beneficial outcomes for all stakeholders.

**Socioeconomic Negotiated territorial development** empowering marginalised groups and may be focused to address rights of Access over land and water resources or to promote a Green/bioeconomy.

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The Future of Our Land, Guidelines for Integrated Planning for Sustainable Management of Land Resources (FUTURE_LAND)

Participatory territorial planning. The farming systems development approach in community planning in the Philippines (PTP PHI)
Support tools for planning

Databases – data and maps - that can facilitate land evaluation and land use planning by providing information and analysis as inputs for the process.

- soil and terrain characteristics, land degradation,
- land cover, land use,
- climatic data including future projections,
- crops and yields, food, agriculture,
- water resources,
- adaptability/suitability of plant species for a given environment,
- socio-economic data and statistics on poverty, population, tenure and gender, food security.

Example of national spatial data infrastructure (NSDI) diagnostic and action plan in Guyana led by Land and survey Commission (FAO Technical Support and Linked to UNGGIM)

Mobile phone Apps - LandPKS
Land Potential Knowledge System USDA supported free modular app.
- for storing and accessing user data, cloud-based storage, global databases and models
- for sharing data, information and knowledge

LandInfo – for rapid soil identification, and accessing soil + ecological site info. (soil infiltration, water-holding capacity (-SOM), Soil Color (phone camera: reference card), LCC for LUP + management

LandCover for rapid vegetation monitoring - rangeland monitoring, conservation, crop residue monitoring

LandManagement – on-farm record keeping (coming SoilHealth Biomass Utilization.)
SLM and ILM Common principles:
• land-user-driven and participatory approaches;
• integrated use of NR at different scales (e.g. farming system level)
• multi-level + multi-stakeholder involvement
• targeted policy and institutional support including incentive mechanisms for SLM adoption and income generation at the local level.

3. SLM through Integrated landscape management (ILM)

ILM = long-term collaboration among different groups of land managers and stakeholders to achieve multiple objectives and expectations within the landscape for local livelihoods, health, and well-being” in a sustainable manner (EcoAgriculture Partners).

Key concept maintain functioning ecosystems
• Enhance soil health, stability, productivity
• Rehabilitate /restore degraded land
• Integrated land and water management (IWRM; Nature based solutions)
• Enhance resilience (reduce vulnerability) to climate change –drought + water scarcity,, erosion, runoff + flood control
• Enhance biodiversity for enhanced functions, livelihood options and diversified diet
• Valuation of ecosystem services

Landscapes for People, Food and Nature (LPFN)
Decision Support Framework for Mainstreaming and Scaling out SLM

Module 5 Territorial planning & Module 6 SLM implementation and scaling out

- review of data and information from landscape assessment
- multi-stakeholder process to negotiate and select territorial responses, considering existing plans and implementation mechanisms
- SLM territorial planning (link to Module 1)
- test implementation and demo sites, farmer-to-farmer learning, awareness raising, capacity building through technical assistance teams etc.

Tools:
- FAO Participatory Land Use Planning (PLUP)
- FAO Land Resources Planning toolbox
Watershed and hotspot management

UNCCD guidance: Contextualise LDN data layers at the watershed level (FAO Hydrosheds + country boundaries and Global Administrative Unit Layers - GAUL) Geonetwork:

1. Facilitate identification of priority watersheds and land degradation LDN hotspots
2. Provide decision support in formulating land use and restoration strategy and design LDN projects / programmes at the country level (transformational).
3. Enable creation of targeted policies and support scaling up action on the ground (transformational).

FAO worldwide review of Lessons learned from countries (last 10 years)

1. Watershed boundaries, stream networks, towns;
2. Landscape slope ranges and soil types
3. Combination of LDN indicators (+ erosion, biodiversity...).
4. Action plan - to be implemented + monitored
Watershed- implies integrated land and water management

Adaptive management in the Design and Implementación of Infrastructure and management Measures for the Protection of Watersheds and Farms

- **Protect** springs and water sources
- **Soil and water conservation** practices on slopes
- **Crop, pasture and forest management** in landscape (hills, irrigated lands, wetlands, green cities)
- Technologies for **water capture, retention and storage** (catchmnets, households)
- **Governance of land and surface and groundwater resources** (access and use rights)- VGGT, VGSSM
- **Improve efficiency** - land, irrigation, energy, food losses, reuse water
- Enhance resilience – **manage and reduce risk** - drought, flood - Reduce Vulnerability (specific groups)
4. Integrate LDN and Climate resilience
   ( ... linked to Biodiversity...DRR)

LD exacerbates climate change and the LDN strategy will generate significant benefits in mitigating and adapting to climate change.

**Mitigation**: Avoiding and reversing LD can reduce greenhouse gas emissions and enhance sequestration by increasing carbon stocks in soils and vegetation.

**Adaptation**: LDN plays a key role in strengthening the resilience of rural communities against climate shocks by securing and improving the provision of vital ecosystem services.

Soils alone can sequester 1–3 billion tonnes of CO2/year and the land sector as a whole has a mitigation potential of 7–11 billion tonnes of CO2/year, (1/3 of all fossil fuel CO2 emissions (UNCCD, 2015).

**Climate smart agriculture Toolbox and national Policy/Strategy**


**Land use planning for Low Emission Development Strategy (LUWES)**
5. Decision Support Framework for Mainstreaming and Scaling out SLM

- Countries to design and conduct a **mainstreaming strategy** to integrate SLM into key **national / subnational decision-making processes**

- Start from **barriers** at local level, be **simple**; focus on **few objectives and activities**

- **prioritize decision-making capacity in long term** (beyond project for SLM implementation + scaling out)

- Integrate strategies at national and **landscape** levels

- Strengthen **partnerships** and **capacity development**

**Tool:**

- **FAO DS-SLM Mainstreaming Tool Module 1**
DS-SLM mainstreaming approach

SLM Mainstreaming and scaling up strategy

- Alliances
- Capacity building
- Knowledge management
- LDDD and SLM assessments
- DS-SLM tools
- Best practices – SLM Technologies

Decision-making processes
- Policies/regulations
- Projects
- Territorial Planning
- Financing and incentives
- Local decisions

SLM BEST PRACTICES SCALING OUT

Barriers for implementing and scaling out SLM best practices
Ej. Falta de incentivos para MST
Multistakeholder engagement & Enabling environment
What is hindering / enabling outscaling of SLM?
(1063 SLM Technologies shared worldwide)

1. Financial resources
2. Knowledge
3. Institutional Setting & Legal Framework - Governance
Identify opportunities to Mainstream LDN / SLM in National development policy frameworks

• **National planning processes** (development planning and land-use planning),
• **Poverty Reduction and Food Security** Strategies
• National action plans related to the Rio conventions
  • **UNCCD NAPs** often include an assessment of the enabling environment. The LDN target setting process can update and/or complement this assessment and propose targeted action to **improve policy and legislative, institutional and coordination frameworks**
  • **REDD+** (Reducing Emissions from Deforestation and Forest Degradation) strategies
  • **NDCs** Nationally determined contributions under UNFCCC;
  • **National Biodiversity Strategies and Action Plans (NBSAPs)** under the CBD.

• Voluntary guidelines on responsible land tenure and VG Sustainable soil management

**Do we need VG on Planning and implementing SLM?**

• SDGs 15.3 and links e.g.
Land use plans to increase financing / investments to achieve LDN (UNCCD guidance)

LDN mainstreaming at policy level is also a prerequisite to increasing finance for LDN-related activities on the ground. An assessment by the GM (2009) on interrelationship between policy & financing for SLM

Key areas for action:

• strengthen the **information and evidence base** on the scale and determinants of soil (land) degradation and their costs, economic or otherwise (22);

• **enhance security of land tenure** in policies and institutional support for poorest and marginalised farmers who are most vulnerable to land degradation;

• **use a programmatic approach to SLM** to match human & financial resources with needs based on evidence (i.e. impact of LD on poverty and economic performance);

• **carry out public finance reforms** to improve effectiveness of planning and management of public resources and their allocation to in line with agreed priorities.
Decision Support Framework for Mainstreaming and Scaling out SLM

Module 7 Knowledge management platform for informed Decision making

- compile and share knowledge on **global and national platforms** for evidence-based decisions
- **standardized & harmonized** knowledge management to enable comparisons (e.g. between different Technologies)
- facilitate exchange - share SLM practices on **Global WOCAT SLM Database** recommended by UNCCD

Tools:
- Global WOCAT SLM Database
- DS-SLM knowledge platform
- National platforms
7. Monitoring, assessing progress & impacts + informing decision makers

**What are the purposes of monitoring? (UNCCD guidance)**

- to help assess effectiveness of a policy or set of interventions in achieving intended outcomes and whether they have been implemented efficiently
- to help track progress made towards intended outcomes (agreed targets and indicators)
- to serve as early warning system for potential problems and lead to identification of remediation or adaptive management actions;
- to support the learning of what works well (or not), in which situations where and for what reasons.

**FAO-WOCAT + countries + partners (CI etc.) guidance**

- Use local knowledge and evidence (costs benefits, impacts) in combination with RS analysis e.g. Trends Earth for LDN reporting and decision making
- Integrate environmental (LDN, CC BD) and socioeconomic aspects (food security, poverty, equality etc.) in planning and decision making at all levels
- Harmonise and integrate databases (projects /interventions feed into national datasets)
- Use SLM strategy and DM process for policy making and leveraging funding
Use of Innovations (e.g. Collect Earth in Cape Verde-SIDS) for setting targets and implementing LDN

Combine local knowledge and cloud computing

Collect Earth- A Framework for Assessing, Monitoring, and Reporting – can be used for Land Degradation Neutrality (SDG Target 15.3) and other targets
- Can be combined or an alternate to Trends Earth (not possible in SIDS due to scale and inadequacy of global datasets)
- Can be complemented by LADA-WOCAT assessment and mapping tools for more knowledge on LDN and effects of SLM measures (confront local experiences and data with national assessment results and local territorial action planning in the field.

Marcelo Rezende FAO
Land Monitoring Specialist
marcelo.rezende@fao.org
Cape Verde Working Group

Diverse expertise-Departments of Forestry, Agriculture, Statistics
No previous GIS background; Capacity to use a computer and motivation!

- Methodology
- Land use (sub) classes
- Grid Design
- Attributes to assess
  - Tree Cover & Tree Count Trends
  - Vegetation Trend
  - Cropland Productivity
  - Land Use & LU Change
  - LDN Indicators + Erosion
15 experts 2 weeks work to establish targets

<table>
<thead>
<tr>
<th>Sub Indicator</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Use Change</td>
<td>2,109</td>
</tr>
<tr>
<td>Land Productivity</td>
<td>8,545</td>
</tr>
<tr>
<td>Carbon Stocks</td>
<td>Not Measured</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,452</strong></td>
</tr>
</tbody>
</table>

Cape Verde working group decided to include area under erosion processes in national LDN process and in implementing rehabilitation actions in Cabo Verde.
Global soil partnership technical support in improving soil data + SOC maps

- New data for national SOC mapping 2017-18
- National SOC Maps (Stocks)
- Metadata and published reports
- Harmonized methods and indicators (collaboration) Soil profiles, digital SOC map, harmonise methods in soil laboratories, data reliability (scientific)
- National and global soil/land information system
GSOCmap V1.2.0
(20/02/2018)

Guidance Intergovernmental technical panel on soils and collaboration with UNCCD
Science policy Interface

1 Million points- Global SOC Stocks ~677 Pg

- 110 Countries (66% global Coverage)

Contact: GSP-Secretariat@fao.org
yusuf.yigini@fao.org
- **1st Global Soil Organic Carbon assessment & map by countries** as contribution to SDG 15.3.1.
- **SOC Baseline** is crucial considering dynamic nature of soils.
- **Empower** member countries to develop their own national soil information using state of the art techniques (capacity development). **Distributed network approach.**
- Provide support on soil carbon issues → **Help shape policy and action** towards climate change mitigation, sequester more carbon and protect carbon rich soils.
References and links

- UNCCD Land Degradation Neutrality Target Setting – A Technical Guide
- FAO Land use planning toolbox
- Global soil partnership- soil organic carbon mapping and harmonised national soil data sets (GLOSIS)
- Achieving land degradation neutrality: The role of SLM knowledge in evidence-based decision-making (LDN special issue of Environmental Science and Policy).
THANK YOU!