The use of LADA (Land degradation assessment in drylands) for sustainable land management, reducing vulnerability and adapting to change

Case studies and discussion

- LADA Partnership by Sally Bunning, FAO
- LADA Senegal by Déthié Soumare Ndiaye
- LADA South Africa and Landcare by Lehman Lindeque
- Linking Local Monitoring and Management by Constance Neely, Heifer/HM
- FFS and landscape Approaches by FAO/Landcare
- Partnership on LD in Dryland ecosystem of China Facilitated Discussion by Constance Neely

Closing Comments on SLM/Terrafrica by NEPAD /UNCCD

New Website (Information, technical reports, LADA manuals) [http://lprlada.fao.org/lada](http://lprlada.fao.org/lada)
or contact Lada-Secretariat@fao.org
Why Assess Land Degradation in Drylands?

> 50% of the world’s land is dryland ecosystems - fragile and very vulnerable to over-exploitation and inappropriate land use

- Millions of people worldwide depend on drylands for their livelihoods:
  - 45% of Africa’s population (~325M people!) - 3% per year fall in agricultural production in SSA due to land degradation

- Consequences of LD → reduced land productivity, socio-economic problems, food insecurity, migration, limited development options, damage to ecosystems, vulnerability to climate change.

- Global cost of land degradation >US$42 billion/year (est.), excluding hidden costs of more fertilizer use and loss of biodiversity/landscapes
  - LD compromises the productive capacity and the many ecosystem functions & services that are critical for livelihood/ societal well-being
  - Costly to reclaim degraded land

Despite past efforts, still no reliable global, regional or even national data on the type, extent, trends of LD and its costs. So How can countries
- evaluate progress in implementation/ achieving targets (success/failure)?
- and adjust their SLM strategies and actions for greater effectiveness?

LADA is a UNCCD and Country Driven Partnership

Aim: To develop a methodological framework & tools for assessing LD at a range of scales and in diverse socioeconomic & environmental contexts

- to provide a baseline to assess & monitor impacts of land use/management

- to quantify the Nature, Extent & Severity of LD and Impacts on human managed ecosystems, on watersheds, carbon storage and biological diversity at a range of scales

- to compile and share useful information for planning interventions to combat land degradation, reduce vulnerability and promote Sustainable Land Management (SLM)

- to build capacity from local to national levels to:
  - Analyse and make better informed decisions; and
  - Develop targeted plans, interventions and investments to mitigate LD; and
  - Establish sustainable land use systems and management practices.
DPSIR Framework with National WOCAT/LADA INDICATORS

**DRIVING FORCES**
- Land Use area trend
- Land Use intensity trend
- Soil management level
- Crop Management level
- Deforestation
- Over-exploitation of vegetation
- Overgrazing
- Industrial activities
- Urbanization
- Discharge of effluents
- Washing out of pollutants
- Disturbance of the water cycle
- Natural causes

**DIRECT PRESSURES**
- NPP decline
- BUE decline
- Type of land degradation (soil, biological, water)
- Degree of land degradation
- Rate of land degradation

**IMPACTS**
- Impact on ecosystem services
  - Productive Services
  - Ecological Services
  - Sociological Services

**STATE**
- Incidence of poverty/wealth
- Access rights/Land Tenure
- Population density
- Labour availability
- Inputs and infrastructure
- Occurrence of conflicts
- Education, knowledge and access to support services
- Protected areas

**RESPONSES**
- Macro economic policies
- Land policies and policy instruments
- Conservation and rehabilitation (WOCAT)
- Monitoring and early warning systems
- Commitment to international conventions
- Investments in land water resources

Understanding & addressing the Drivers of LD is key to success in combating degradation: population, markets, tenure security, policy constraints and bottlenecks

LADA is a Stakeholder Assessment

All information is collected & evaluated by land users with technical specialists

*Foto: H.P. Liniger*
Methods/Processes to involve all Stakeholders

• **A Participatory Approach** - all those that influence how land is used
  - in developing the LADA toolkit; and
  - in assessing the Status of land degradation (and land improvement), the
  Causes & Drivers, the Impacts of response measures, and
  - in identifying remedial solutions

• **An Inter-sectoral Process**
  - all concerned disciplines (soil, water, crop, livestock, wildlife, community
development, rural industry, policy);
  - look beyond the state of resources to the effects of land use on the
  functioning of the ecosystem & the services it provides to humankind

• **A Multi-level process** to involve decision makers at all levels
  - commercial & subsistence farmers, foresters, herders, hunters, gatherers
  - other users and polluters of land resources: agro-industry, producers of
  charcoal, wildlife conservation, ...   
  - policy makers (at community, district & national level) who make decisions
  on land allocation, land rights, agriculture and dryland strategies...

The LADA Partnership

• FAO, UNEP & GEF developed LADA (2004/5) to help countries in response to
  needs and demands of UNCCD process (full project 2006-10)
• US$ 7.98M GEF resources and US$ 14.98M co-funding (+ in kind)
• Steering Committee with partners, a Management team and peer review
  process and 6 Country teams

**International Partners**
- UNCCD Secretariat + Global Mechanism
- ISRIC - World Soil Information
- WOCAT - World Overview of Conservation Approaches and Technologies (DESIRE)
- GLCN - Global Land Cover Network
- IAMBA /CIHEAM - University of Bari, Italy
- UNU - United Nations University, Tokyo
- CACILM - Central Asian Countries Initiative for Land Management
- Technical Support: Desertlinks - University of Sassari; University of East Anglia, etc.

**National Partners**
- **South Africa**: Institute of Soil Water & Climate, Dept. Agric /ARC
- **Senegal**: Centre de Suivi Ecologique (CSE) Sénégal
- **Tunisia**: DG Aménagement et conservation des terres agricoles
- **Argentina**: Sec. de Ambiente y desarrollo sustentable
- **Cuba**: Agencia de Medio Ambiente
- **China**: National Bureau to Combat Desertification
LADA Global

Makes use of remote sensing, GIS, modelling for data generation

- Analysis of Global Net Primary Production/Rainfall Use Efficiency for identifying hot and bright spots (ISRIC Æ UNEP GEO-4; + Peer Review)
- Development of LADA/Desertlinks Indicators database and methods
- Review of User Needs for information on LD Assessment (IAMB)
- Global/National land cover change studies (GLCN)

Global Indicators
- Net Primary Productivity (NPP)
- Rainfall Use Efficiency (RUE)
- Aridity Index
- Rainfall variability
- Erosion risk

Interpreted using a Global Land Use Systems map

- Land cover, Urban + protected areas
- Dominant soils, terrain and slope
- Climate: Temp./ thermal regime; Rainfall regime
- Agriculture: Livestock pressure; Crops; Irrigation
- Population density and Poverty

...factors due to human interventions that affect the development of land degradation in a given area.

Global to National land use systems analysis

Land use systems of the world

LADA covers large % of worlds drylands

LADA National

Makes use of national data sets, RS/GIS tools + qualitative assessment

Guidelines and tools for national level assessment of LD and land improvement were developed and validated with partners
- National mapping system (on line questionnaire and guidelines (30 arcsec ~900m) (WOCAT/LADA/DESIRE)
- Participatory workshop → technical guidance on national mapping and adaptation of WOCAT tools (South Africa - ARC)

All LADA countries developing national database and information sets and national land use system map
- natural resources (temperature, climate, growing period, soil slope)
- land use (crops, livestock, irrigation)
- socio-economic data (population density, poverty)

National Land use systems are assessed using guided expert opinion

Sustainable land management (SLM) options are assessed at regional/provincial level using LADA/WOCAT manual and questionnaire (using LUS map)

→ Case studies from LADA South Africa and Senegal

LADA Local

Use of participatory rural appraisals, expert assessment + field measurement and set of local indicators

Manual/toolkit for local level field assessment of LD / Sustainable Land management (LADA/University of East Anglia) developed and validated in LADA pilot countries → for use in drylands and wider

Hands-on Workshops (UK, Tunisia) for Training of trainers in 6 LADA countries → practical step by step guide in 9 sections:

1. Introduction
2. Planning the assessment
3. Identifying Local Assessment Areas within priority areas (←national assessment)
4. Characterisation of Local Assessment Areas (transects, community mapping)
5. Identifying sites and households for detailed assessments (SL interviews)
6. Assessment of the type, extent and severity of Land Degradation / Improvement
7. Assessment of the Biophysical Impacts of LD
8. Assessment of soil properties, erosion and productivity (VS-Fast)
9. Assessment of water
Ten Annexes - essential part of the Toolkit - optional tools for specific contexts and additional explanations for example:
- LD within Ecosystem Services and Sustainable Livelihoods frameworks
- Soil and water salinity assessment
- Economics of soil erosion and conservation

→ Local area assessments (selected areas) - integrated understanding:
- of biophysical and socio-economic causes and impacts of LD
- effectiveness of land management practices/approaches
- identification of drivers and policy responses and needs in regard to institutional, economic + policy environment for sustainable land management (SLM)

→ Good practices manual at local level prepared with national-provincial institutes → practical and successful SLM technologies that deserve investment and scaling up

Quantifying the nature, extent, severity and impacts of land degradation

Soil physical degradation
Soil chemical degradation
Biological degradation
Erosion by wind and water
<table>
<thead>
<tr>
<th>W: Soil erosion by water</th>
<th>P: Physical deterioration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt Loss of topsoil by water</td>
<td>Pc Compaction: damage of soil structure by trampling or machinery (weight; frequent use)</td>
</tr>
<tr>
<td>Wg Gully erosion</td>
<td>Pk Sealing and crusting: clogging of pores with fine soil material; creation of an impervious soil surface layer obstructing rainwater infiltration; water-repellent layer (e.g. ashes after forest fire)</td>
</tr>
<tr>
<td>Wm Mass movements</td>
<td>Pw Waterlogging: effects of human induced hydromorphism (excluding paddy fields)</td>
</tr>
<tr>
<td>Wr Riverbank erosion</td>
<td>Ps Subsidence of organic soils, settling of soil</td>
</tr>
<tr>
<td>Wc Coastal erosion</td>
<td>Pu Loss of bio-productive function due to other activities (e.g. construction, mining)</td>
</tr>
<tr>
<td>Wd Offsite effects: sediment deposition, downstream flooding, siltation of reservoirs/ waterways, siltation of water bodies</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>E: Wind erosion</th>
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</thead>
<tbody>
<tr>
<td>Et Loss of topsoil by wind</td>
<td></td>
</tr>
<tr>
<td>Ed Deflation and deposition</td>
<td></td>
</tr>
<tr>
<td>Eo Offsite effects of wind erosion: covering of terrain with windborne sand particles from distant sources</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>C: Chemical deterioration</th>
<th></th>
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<tbody>
<tr>
<td>Cn Fertility decline &amp; reduced organic matter content (not by erosion) - leaching, nutrient mining, oxidation and volatisation (N)</td>
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<tr>
<td>Ca Acidification: lowering of the soil pH</td>
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<td>Cp Soil pollution: soil contamination with toxic material</td>
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<tr>
<td>Cs Salinisation / alkalinisation: a net increase of salt content of (top)soil leading to a productivity decline</td>
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<table>
<thead>
<tr>
<th>V: Vegetation degradation</th>
<th></th>
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<tbody>
<tr>
<td>Vr Reduction of vegetation cover</td>
<td></td>
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<tr>
<td>Vs Quality and species composition decline</td>
<td></td>
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<tr>
<td>Vq Quantity decline (loss of biomass/vegetative production) e.g. through clear felling, fire</td>
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<table>
<thead>
<tr>
<th>H: Water degradation</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Ha Aridification / soil moisture problem</td>
<td></td>
</tr>
<tr>
<td>Hp Water quality decline (pollution)</td>
<td></td>
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<tr>
<td>Hq Water quantity decline (ground + surface)</td>
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</tbody>
</table>

**Types of Degradation LADA/WOCAT**

**Visual Soil Evaluation**

soil properties and problems

Simple, cheap tests in the field

<table>
<thead>
<tr>
<th>Visual soil evaluation (VS-FAST)</th>
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<tbody>
<tr>
<td>Structure- organic matter, compaction,</td>
<td></td>
</tr>
<tr>
<td>Fertility - deficiencies K N P + micro-nutrients</td>
<td></td>
</tr>
<tr>
<td>Acidity and salinity</td>
<td></td>
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<tr>
<td>Vegetative cover and rooting</td>
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</tbody>
</table>

Training Farmers + extension staff
LD Effects on Ecosystem Services

Reduced goods & socio-economic benefits
Reduced water supply + C sequestration
Increased risk/vulnerability to drought, floods, climate change

Types of Remedial Measures

Prevention  Mitigation  Rehabilitation
### Assessing and Identifying Successful Land Use + Management Practices

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>CA</td>
<td>Conservation agriculture (minimal tillage, soil cover, crop rotations, reduced traffic)</td>
</tr>
<tr>
<td>NM</td>
<td>Integrated soil fertility management</td>
</tr>
<tr>
<td>RO</td>
<td>Fallow land, crop rotations</td>
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<tr>
<td>VS</td>
<td>Strip cropping</td>
</tr>
<tr>
<td>AF</td>
<td>Agroforestry</td>
</tr>
<tr>
<td>AP</td>
<td>Afforestation, sustainable forest management, forest protection</td>
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<tr>
<td>RH</td>
<td>Rehabilitation/control of gullies</td>
</tr>
<tr>
<td>TR</td>
<td>Establishing terraces</td>
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<tr>
<td>GR</td>
<td>Pasture management</td>
</tr>
<tr>
<td>WH</td>
<td>Water harvesting</td>
</tr>
<tr>
<td>SA</td>
<td>Salinity control, improve water use efficiency</td>
</tr>
<tr>
<td>HO</td>
<td>Improve water quality</td>
</tr>
<tr>
<td>SD</td>
<td>Dune stabilisation</td>
</tr>
<tr>
<td>PR</td>
<td>Protection from natural disasters: flood, storm, drought, earthquake, landslides, avalanches</td>
</tr>
</tbody>
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**SWC measures**

- **Agronomic measures**: measures that improve soil cover (e.g., green cover, mulch); measures that enhance organic matter, soil fertility (e.g., manuring); soil surface treatment (e.g., conservation tillage); subsurface treatment (e.g., deep ripping).
- **Vegetative measures**: plantation/reseeding of tree and shrub species (e.g., live fences, tree rows), grasses and perennial herbaceous plants (e.g., grass strips).
- **Structural measures**: terraces (bench, forward/ backward sloping); bunds, banks (level, graded); dans, pans, ditches (level, graded); walls, barriers, palisades.
- **Management measures**: change of land use type (e.g., area enclosure); change of management/intensity level; (e.g., from grazing to cut-and-carry); major change in timing of activities, control/change of species composition.
SL Assessment of Vulnerability and Risk

Sustainable Livelihoods analysis will capture effects of LD on peoples’ coping strategies, risk aversion and mitigation

- effects of change/pressures of population, land use change, markets...
- access to resources, tenure security
- also effects of climate change → unreliable rains, risk/vulnerability to drought/water shortage, effects on food insecurity, migration

DPSIR and SL and ES Analysis should help:
- understand effects of land users and government efforts on ecosystem services (food production, water + climate regulation, C + nutrient cycles....)
- identify successful locally adapted SLM practices and targeted responses to increase productivity and resilience of diverse farming systems (crop + livestock production)

LADA Collaboration → Scaling up

In 6 LADA Countries and in each Region through capacity building (curriculum development, training of development partners)

CACILM in Central Asia

EU Initiatives - DESURVEY, MEDCOASTLAND, DESERTLINKS

GEF/UNDP KM - Land project and with PAP/RAC project

Need to integrate Assessment and SLM in national programs and build capacities for wide adoption and provide incentives for farmers/herders

- TerrAfrica/Strategic Investment Program on SLM in Sub-Saharan Africa led by NEPAD with FAO/World Bank & partners ($150M GEF funds x 3 co-funds)

IAs (FAO, UNEP, UNDP, AfDB) support countries to develop & execute projects and share results through TerrAfrica process e.g. FAO support:

- Kagera Transboundary Agro-ecosystems Management Programme
- Kenya Agropastoral FFS for overcoming LD
- Fouta Djallon SLM programme
- Country SIPs in Ethiopia, Ghana, Kenya et al
Adaptive Management through Farmer Field School Approaches

- Study plot Observation
- Water Harvesting
- Farmers Practice
- Analysis
- Synthesis discussion → decisions