FINAL DRAFT

LADA

LANDDEGRADATION ASSESSMENTIN DRYLANDS

LADA
PROJECT

MANUAL FOR LOCAL LEVEL ASSESSMENT OF LAND DEGRADATION AND SUSTAINABLE LAND MANAGEMENT

PART 1

Planning and methodological approach, analysis and reporting

GLOBAL ENVIRONMENT FACILITY 20 YEARS INVESTING IN OUR PLANET

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LAND DEGRADATION ASSESSMENT IN DRYLANDS

MANUAL FOR LOCAL LEVEL ASSESSMENT OF LAND DEGRADATION AND SUSTAINABLE LAND MANAGEMENT

PART 1

Planning and methodological approach, analysis and reporting

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CONTENTS

Foreword

This document is the first part of a two part manual on local level assessment of land degradation and sustainable land management:

- **Part 1 – Planning and Methodological Approach, Analysis and Reporting**
- **Part 2 – Field Methodology and Tools**

The two parts should be used together as Part 1 provides the background information for the conduct of the methods and tools that are provided in Part 2.

The manual incorporates inputs and feedback from many individuals involved in piloting the local level land degradation assessment tools and methods in the six countries that participated in the **Land Degradation Assessment in Drylands project (LADA)** supported by the Global Environment Facility (GEF) and executed by FAO during the period 2006-2010. It draws on tools developed with the **World Overview of Conservation Approaches and Technologies (WOCAT)** for the assessment of sustainable land management (SLM). It also incorporates feedback from a series of national and inter-country workshops conducted during the period 2007-2010.

The development process was guided by the LADA team in the Land and Water Division of the Food and Agriculture Organisation of the United Nations, Rome, Italy, with substantial contributions from the School of International Development, University of East Anglia, Norwich, UK, under the overall technical supervision of Freddy Nachtergaele, LADA Coordinator and Riccardo Biancalani, LADA Technical Advisor.

Lead authors of the manual were:

- Sally Bunning (sally.bunning@fao.org), FAO Land and Water Division (NRL)
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The participatory testing and adaptation of the tools and methods was an iterative process, with the LADA country teams building on a series of inter-country training and review workshops, namely:

- Initial workshop hosted by the University of East Anglia (Norwich, June 2007);
- Pilot Training of Trainers session hosted by Tunisia (Béja, November 2007);
- Mid-term review workshop hosted by Argentina (Mendoza, January 2009);
- Final review workshops hosted by the Universities of Amsterdam and Wageningen respectively (the Netherlands, August 2010).

The final peer review and editing was conducted by Anne Woodfine, independent expert in natural resources management (FAO consultant).

The support of the host and partner institutions in the six LADA pilot countries, which provided policy, technical and co-financing support for the local assessment piloting and workshop venues, is gratefully acknowledged. Insights, experiences and suggestions were provided by LADA country teams in developing this local assessment methodology, notably by:

- **Argentina**: Elena Abraham (Mendoza Region), Stella Navone (Puna Region), Donaldo Bran and Hugo Bottaro (Bariloche) and Esquel (Patagonia), who coordinated the local assessment teams with the institutes of IADIZA, FAUBA and INTA in the regions; supported at national level by Vanina Pietragalla, Maria Laura Corso and Andres Ravelo, Secretaría de Ambiente y Desarrollo Sustentable;
- **China**: Wang Guosheng, Jiping Peng and Kebin Zhang, with inputs during training by Lishui Nie and Tien Huan *et al*.; and overall guidance by Yang Weixi of the National Bureau to Combat Desertification;
- **Cuba:** Candelario Aleman, N. María Nery Urquiza and Fermin J. Peña Valenti, supported by the Agencia de Medio Ambiente, Ministerio de Ciencia, Tecnología y Medio Ambiente;
- **Senegal:** Déthié Soumare Ndiaye, Gora Beye, Abdoulaye Wele, and other team members, Centre de Suivi Écologique, Ministère de l'Environnement, de la Protection de la Nature, des Bassins de rétention et des Lacs artificiels;
- **South Africa:** Liesl Stronkhorst, Agricultural Research Council and Lehman Lindeque, Department of Agriculture, Forestry and Fisheries, Ministry of Agriculture, Forestry and Fisheries, with support from their institutions;
- **Tunisia:** Hattab Ben Chaabane, Rafla Attia, Leila Bendaya, with technical support of IRA (Institut des Régions Arides), Médenine and CRDA (Commissariats Régionaux au Développement Agricole) de Médenine, Siliana and Kasserine,guided at national level by Hédi Hamrouni, LADA Coordinator, with support of the Direction Générale de l'Aménagement et de la Conservation des Terres Agricoles, Ministère de l'Agriculture et des Ressources Hydrauliques.

A number of technical specialists and other staff in their institutions made significant contributions to the development of this manual. In particular, the valuable contributions of three key individuals Malcolm Douglas, Yuelai Lu and Michael Stocking are acknowledged and also two key partner institutions, namely:

- **Centre for Development and Environment**, University of Berne, host of WOCAT (World Overview of Conservation Approaches and Technologies) Secretariat;
- **United Nations University** (UNU) which supported inputs by UEA and use of an early rapid version of the local assessment manual through its SLM project in the Pamir Alai Mountains in Tajikistan and Kyrgyzstan.

Finally, this work was accomplished thanks to the following institutional support:

- **Technical and policy support of the Food and Agriculture Organization of the United Nations (FAO)** which executed the LADA project, in particular by Parviz Koohafkan, Director, Land and Water Division, and the interdisciplinary Project Task Force; and
- **Funding and implementation support of the Global Environment Facility (GEF) and United Nations Environment Programme (UNEP)** respectively to the LADA project.

The manual draws, in particular, on the following references:

CDE/WOCAT, FAO/LADA, ISRIC (2011) A Questionnaire for Mapping Land Degradation and Sustainable Land Management. Eds.: Liniger, H., van Lynden, G., Nachtergaele, F., Schwilch, G., Biancalani, R. and Woodfine, A.

Department of Agriculture, Government of South Africa (2009). The core indicators for pasture / range condition scoring in LADA-Local were adapted from the pasture (veld)/ rangeland quality and vegetation assessment used in South Africa. (A list of visual indicators for assessing veld condition trend on farms and extensive grazing areas used with farmers, extension staff and researchers and repeated yearly. Ref. Roberts,1970; Roberts, *et al*. 1975; Fourie & Roberts, 1977, as described by Jordaan, 1991).

Douglas, M., (2008; unpublished). Assignment Report from China LADA Local Assessment Training Workshop, 10 -15 October 2008 including Guidelines criteria for the prioritisation of watersheds for improved management;

FAO. (2009a) Towards defining forest degradation: comparative analysis of existing definitions, Forest Resources Assessment Working paper, 154, Food and Agriculture Organisation, Rome, Italy.

FAO (2009b) Measuring and Monitoring Forest Degradation through National Forest Monitoring Assessment (NFMA). Eds. Tavani, R.; Saket, M.; Piazza, M.; Branthomme, A.; Altrell, D., Forest Resources Assessment Programme Working Paper 172, Food and Agriculture Organisation, Rome, Italy.

FAO / TerrAfrica (2011) Sustainable land management in practice: Guidelines and best practices for sub-Saharan Africa (authors Liniger, H., Mekdaschi Schuder, R., Hauert, C. and Gurtner, M.), Food and Agriculture Organisation, Rome, Italy.

McGarry, D. (2006). A Methodology of a Visual Soil - Field Assessment Tool "VS-Fast" to support, enhance and contribute to the LADA program;

Stocking, M. and Murnaghan, N. (2001). Handbook for the field assessment of land degradation. Earthscan Publications Ltd, London, UK.

The participatory tools for Sustainable Rural Livelihoods' approaches/analysis draw from several publications, including:

Ellis, F. (1998). Survey article: Household strategies and rural livelihood diversification. The Journal of Development Studies. Vol.35, No.1, pp.1–38;

FAO Livelihoods Support Programme manuals and guidelines http://www.fao.org/es/esw/lsp/manuals.html; and

Scoones, I. (1998). Sustainable rural livelihoods: A framework for analysis. IDS Working Paper. No.72. Institute of Development Studies, Brighton, UK.

The soil and vegetation assessment methodology used in the local assessments in Argentina and South Africa also drew on the Landscape Functional Analysis (LFA) methodology, developed in Australia and adapted in Argentina as the MARAS system. While LFA has not been incorporated in the manual since it was used and validated for LADA Local in only 2 of the 6 LADA countries it presents, however, an acceptable alternative to the proposed LADA-Local VSA Fast soil and vegetation assessments and is posted on the LADA website.

Tongway, D. and Hindley, N. (2004) Landscape Function Analysis: Methods for monitoring and assessing landscapes, with special reference to mine sites and rangelands. CSIRO Sustainable Ecosystems, Canberra, Australia.

Oliva, G., *et al*, 2008 Manual para la instalación y lecturas de Monitores MARAS (Monitoreo Ambiental para Regiones Áridas y Semiáridas), INTA, Proyecto PNUD GEF07/G35.

Also posted on the LADA website is the following wetlands assessment tool that was developed in South Africa and used by LADA-South Africa to complement the LADA Local water resources tools. This would need to be validated in other countries for wider application.

Government of South Africa. (2007). Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types, Department of Water Affairs and Forestry, Pretoria, South Africa.

Acronyms and abbreviations

BOD	biological oxygen demand
DPSIR	Drivers-Pressure-State-Impact-Response (D-P-S-I-R)
EC	electrical conductivity
ES	ecosystem services
FAO	Food and Agriculture Organization of the United Nations
FGD	focus group discussion
GEF	Global Environment Facility
GIS	geographical information system
GPS	Global Positioning System
km	kilometre
l	litre
LADA	Land Degradation Assessment in Drylands
LADA-L	LADA Local
LD	land degradation
LSU	livestock units
LUS	land use system
LUT	land use type
m	metre
MDG	Millennium Development Goal
m	minute
ml	millilitre
mm	millimetre
NGO	non-government organisation
N-LUS	national-land use system
SDC	Swiss Agency for Development and Cooperation
sec	second
SLM	sustainable land management
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WOCAT	World Overview of Conservation Approaches and Technologies

CHAPTER 1

Introduction

This section explains the purpose and use of the LADA-Local assessment, the guiding principles for the conduct of a local level participatory assessment and the potential target users. It also provides an overview of the scope and structure of the two part manual.

1.1 Purpose of the assessment

This **local level land resources assessment methodology (LADA-Local)** was produced within the Land Degradation Assessment in Drylands (LADA) project. See Box 1 for the LADA project objectives and outcomes and the website **www.fao.org/nr/lada** for further information.

The main purpose of **LADA-Local** is to provide a standard methodological approach and tool-kit for the assessment of land degradation processes, their causes and impacts at local[1] level in collaboration with local stakeholders and communities. The focus is on human-induced land degradation; however, natural degradation processes are also addressed. For a more balanced and complete understanding, the approach also assesses the extent to which land resources (soil, vegetation, water) and landscapes/ecosystems are being conserved and/or improved by sustainable land management (SLM) practices.

1 "local level" means at the level of the plot/field/ /farm-household/community.

BOX 1 **LADA project (GEF/UNEP/FAO, 2006-2010)**

- **Objective 1:** To develop tools and methods to assess and quantify the nature, extent, severity and impacts of land degradation on dryland ecosystems, watersheds and river basins, carbon storage and biological diversity at a range of spatial and temporal scales.
- **Objective 2:** the national, regional and international capacity to analyse, design, plan and implement interventions to mitigate land degradation and establish sustainable land use and management practices.

These objectives are expected to overcome current policy and institutional barriers to sustainable land use in dryland zones.

LADA outcomes

- Standardised methodological and conceptual framework for the participatory assessment of land degradation and its impact in drylands at global, (sub) national and local scales.
- Teams trained and capacity built in country for the conduct of detailed assessments and analysis (based on at least two sites/pilot country and supported by national policy forums to link local issues such as SLM adoption and bye-laws with national planning and policy).
- Detailed local assessments and analysis of land degradation and its impact conducted (balancing the assessment off critical areas for LD with the learning from areas that largely control /prevent land degradation (SLM) and linking LADA-Local information with policy at national level.
- Products and findings of the assessments used for action and decision-making for the control and prevention of land degradation in drylands.

The local assessment results can be used in the context of a monitoring and evaluation programme aiming at improved and responsive decision making on sustainable land management and rural development. More specifically, the assessment can be used to:

- conduct integrated, participatory assessments of land degradation / sustainable land management (LADA/WOCAT) to assess and monitor the impacts of various land uses, management practices, also technical and policy interventions;
- identify community and natural resources management needs for project development (degradation prevention, mitigation, restoration technologies, approaches and related policies for promoting sustainable land use systems);
- make an inventory of baseline conditions in selected areas at the start of a national programme or project; and to subsequently assess progress and impacts (mid term, final and/or as a post-impact assessment);
- provide more detailed findings and understanding from selected local assessment areas to feed into national level LD/SLM assessments, in particular those conducted using LADA/WOCAT tools and methods, and thereby inform national agricultural and environmental strategies and reporting on progress and impacts in implementation of the United Nations Convention to Combat Desertification (UNCCD) and other land-related international commitments such as the biodiversity (CBD) and climate change conventions (UNFCCC).

Previous land degradation assessments have not moved much beyond the description and quantification of biophysical processes and their direct effects. The LADA Local assessment methodology aims to deliver an understanding, not only of the state and nature of change in the land resources (soil, water and biological resources) and ecosystems, but also of the drivers of and impacts of land degradation and sustainable land management, the impacts they have on ecosystem services and livelihoods, also the effects of recent response measures adopted by land users and other actors. The premise of this approach is that it is not the degradation of the land *per se* that is the problem, but the impacts this degradation has on things that matter to people: their livelihoods and ecosystem services.

This assessment approach, manual and associated training build on country experiences and are expected to enhance the capacity of users to conduct more integrated and participatory assessments of land degradation and to monitor impacts of interventions or changes in land management more effectively. The manual reflects a substantial shift in attention from the conventional focus on assessing degradation to a balanced assessment that looks at both the negative and positive effects and trends of land use / management on natural resources and ecosystem services.

1.2 Guiding principles

Approximately three to four weeks (full-time) are needed to conduct a complete integrated local level assessment with preparation, field work and interviews with land users and households, validation of findings with the community and the preparation of a consolidated report. A number of principles have informed the development of the approach:

Participatory and robust. The methodology is designed to be integrated, participatory, field-based and robust in order to provide base-line data on land degradation and improvement for planning, priority setting and subsequent monitoring activities. In a number of key steps the approach relies on land users' knowledge for information, notably on the history of land-use, the dynamics of resource change, the drivers and impacts of land degradation and sustainable land management. If the relevance of the assessment is clear, it is more likely that land users will contribute information and respond to the findings. Likewise, the involvement of local policy makers and other professionals increases the likelihood that findings will influence policy processes and the design of future local land resources programmes.

Easy to use and meaningful. Wherever possible, methods and indicators have been selected that are easy to use and interpret. The assessment does not require substantial laboratory-based measurements but provides accuracy and validity through combining quantitative and semi-quantitative field measurements with qualitative information from local informants. Validation is also done through "triangulation"[2], rather than through large-scale sampling and repeated technical measurements. It is expected that the precision lost in some areas will be compensated for by the broader, deeper understanding of land degradation delivered by this integrated and participatory assessment. There are, however, situations where laboratory tests may be needed, for example to verify soil nutrient deficiencies, soil carbon stocks, water pollutants, also soil and water salinity.

2 "Triangulation" is the approach where more than one method is used in a study in order to double (or triple) checks on results. We can be more confident with our information and data if different methods lead to the same result.

Widely applicable core methodology. The methods and indicators have been selected and adapted for use across the main land use systems and ecosystems in dryland areas (arid, semi-arid and sub-humid). Nonetheless, the methods are equally valid in humid areas with minor adaptation required of specific indicators and scores. In the interests of consistency and comparability a "core" methodology, comprising a set of core biophysical and socio-economic indicators and some detailed methods for assessing these indicators are proposed. In some areas and under some circumstances, it may be appropriate to assess the proposed indicators using different or locally established methods, or additional indicators may be required. For example, to generate more detailed information on land degradation processes such as wind erosion or degradation associated with irrigated lands.

Towards an ecosystem approach. The primary emphasis in the empirical measurement is on the assessment of the current status and dynamics of the land resources – soil, water and vegetation - in delivering the main **provisioning services** land-users require from the land and the livelihood implications (food, fodder, fuel, water, income, etc). A second important consideration is the need to identify and evaluate significant impacts of land degradation or sustainable land management on other key ecosystem services, particularly the **supporting and regulating services** that determine productivity and ecosystem resilience (*inter alia* nutrient and organic matter / carbon cycling, maintenance of the hydrological cycle and water supply, also conservation and sustainable use of biological diversity). Besides income and food security, other **socio-cultural services** provided by land use systems / ecosystems are also important (e.g. knowledge management, adaptation to change and organizational capacity of land users).

1.3 Target users

In any assessment, the collection and analysis of data only becomes meaningful if it helps to deliver useful outputs. This manual gives guidance and a recommended structure for analyzing and reporting on the assessment in a form that should be useful to most users. Other common outputs produced from an assessment include policy briefs and baseline data sets against which subsequent changes can be monitored. Additional outputs, tailored to specific stakeholders, may also be produced and these should be identified during the assessment planning stage so that relevant, targeted outputs and recommendations are produced.

Common stakeholders are:

- Government departments (agriculture, environment, water, forest, soil, land, community development, statistics etc.);
- Local and provincial authorities;
- Land users (commercial and subsistence farmers, herders, foresters and users of biomass energy, other resources);
- Local institutions (producers associations; water users associations, community leaders, representatives of national farmers unions, cooperatives etc.);
- NGOs and projects operating in the selected areas / land resources sectors;
- The national and international scientific community.

Consultation with the main stakeholders during the planning phase is also an opportunity to access available data and link to other relevant ongoing land resources activities. In some cases it may be possible to add tools or increase the emphasis on particular components of the assessment to help deliver more targeted or detailed information to meet an identified need.

Some areas that have been little developed in the manual but are referred to include:

- **land and water pollution:** requiring the development of specific tools (e.g. for heavy metals from mining / industrial activities, arsenic in groundwater supplies etc.);
- **wetlands condition / health:** a key reference is the wetlands assessment protocol used in and proposed by South Africa (Government of South Africa, 2007). This needs to be piloted and could be adapted for use elsewhere ;
- **irrigated systems:** the tools can be used for rainfed and irrigated systems, however, a separate manual is being developed specifically for assessing salinity and sodicity in irrigated systems (McGarry, 2011, version 1, working document);
- **forest degradation:** FAO Forestry Department in 2009 initiated an international process to better understand and develop harmonised forest degradation indicators and assessment methods, as part of the global and national forest resources assessments (FAO, 2009b);
- **market-related drivers and land tenure conditions:** in certain contexts these may require more specific analysis and expertise, particular when it is found that they are important in driving LD or SLM.

Biodiversity and climate change are referred to some extent but where required / relevant could be easily given more attention in the assessment through some additional observations and questions.

1.4 Structure of the LADA Local Manual

This manual builds on lessons learnt from the pilot countries in testing the methods and tools. It explains the various components of the assessment and provides a detailed section to support the assessment team in integrating, analyzing and reporting the results.

The manual is structured in two parts:

- **Part 1** – Planning and Methodological Approach, Analysis and Reporting
- **Part 2** – Field Methodology and Tools

Part 1 comprises 8 chapters providing the background information required for planning and conducting a local level assessment, for understanding the methodological approach and for analysis and reporting of the findings.

1. Introduction
2. Conceptual / Analytical Frameworks (DPSIR, Sustainable Livelihoods Framework, Ecosystem Services Framework)
3. Planning the Local Assessment
4. Land Degradation and Sustainable Land Management Typologies
5. Characterisation of the Study Area
6. Assessing Land Resources Status and Trends, Effects on Livelihoods and Ecosystem Services
7. Analysis and Reporting Results
8. Use of LD / SLM Assessment and Monitoring for Wise Decision Making

Part 2 comprises 7 sections that present the range of tools and methods proposed to conduct a local level assessment in the field with local land users and stakeholders. The land use systems and types being assessed will to some extent determine the precise indicators and tools that are required.

1. Characterisation of the Study Area
2. Reconnaissance Visit and Transect Walk
3. Vegetation Assessment
4. Soil Assessment
5. Key Informant and Land User Interview
6. Water Resources Assessment
7. Livelihoods Assessment

The assessment is an integrated land resources assessment, but for simplification separate protocols are provided for assessing vegetation, soil and water resources status and trends and current SLM practices. It is essential that the findings from these are brought together and analysed by a multi-disciplinary team for the various land use systems / types and integrated with results from the livelihoods assessment with a range of land users/households (selected using wealth ranking) and from the focus group discussions and interviews with key informants.

CHAPTER 2

Conceptual / analytical frameworks

This section presents the three main frameworks that have informed the LADA local assessment methodology, namely the Driving Forces-Pressures-State-Impacts-Responses (DPSIR) framework, the Ecosystem Services (ES) framework and the Sustainable (rural) Livelihoods (SL) framework. The linkages between these frameworks are also explained. In section 7 (Analysis and Reporting Results), detailed advice is given on how the frameworks can be used to help integrate, analyze and report on the assessment findings.

2.1 DPSIR framework

The **DPSIR** (Driving Forces-Pressures-State-Impacts-Responses) framework is used to help analyse the relationships between the **State** (status and trends) of land resources; the direct **Pressures** on land resources; the **Driving Forces** (the indirect drivers that act on the Pressures); the **Impacts** (of changes in the State) on ecosystem services and on people's livelihoods; and possible **Responses** from land users, policy makers and other stakeholders designed to mitigate land degradation, adapt to its impacts or promote SLM. The linkages between framework components are clearly represented in the DPSIR diagram (Figure 1). DPSIR analysis is core to the LADA assessment approach, as it helps the user link all parts of the assessment and guides the synthesis and analysis of the findings. It also compliments the ES and SL frameworks that are used to help understand the impacts of current / recent land uses and management practices on ecosystem goods and services and on the livelihoods of local people.

This diagram shows how the DPSIR analysis is associated with the Ecosystem Services (ES) and Sustainable Livelihoods (SL) approaches and gives examples of DPSIR indicators.

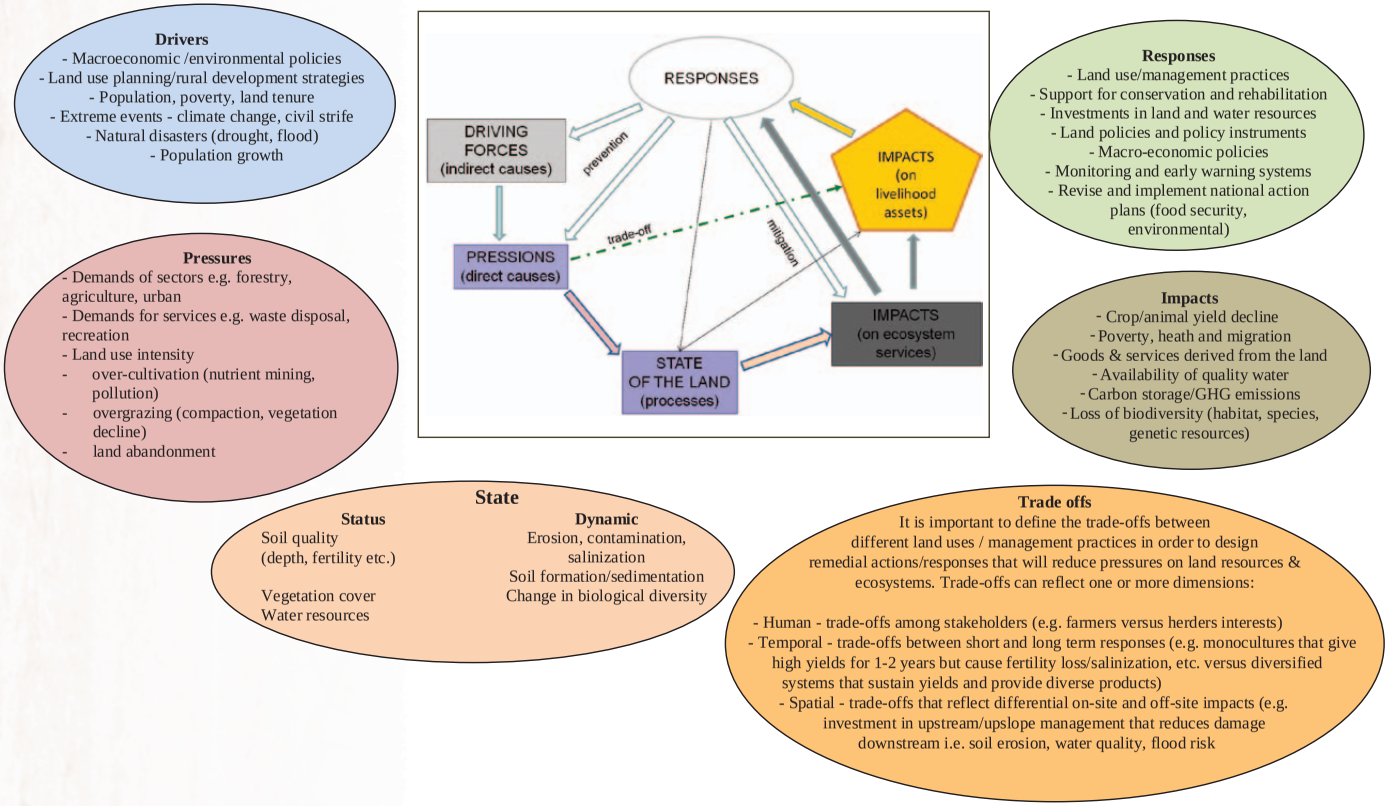

FIGURE 1 **LADA local analytical framework: to analyse findings of the local assessment**

The objective of much of the primary data collection in the assessment is to generate a picture of the **State** of land resources (soil, vegetation, water) and the nature of and change in these resources. A range of indicators and indices are included to do this, supplemented with information from land-users and data from secondary sources. The same mix of information sources is relied upon to help identify important **Impacts** caused by the State of the land resources on ecosystem services and on livelihoods (see Figure 1). Community and land user interviews are particularly important in providing information on the **Driving Forces** (e.g. indirect reasons for adopting a practice that degrades land resources rather than a more sustainable practice). The most appropriate **Responses**, designed perhaps discourage use of the more degrading practices by land-users or encourage and improve SLM adoption, would generally be identified through discussing the assessment results with a wider group of people than those involved in the assessment, including local policy makers, project officers and government officials.

In summary, users are encouraged to use DPSIR as the main framework to help with understanding, organizing and presenting the assessment results.

2.2 Sustainable livelihoods framework

The sustainable livelihoods framework helps understand how different household livelihoods interact with the natural, socio-economic and policy environment. For specific types of land users, it helps analyse the drivers of land degradation and/or sustainable land management (LD / SLM) and impacts on their livelihoods and vulnerability. The socio-economic divisions such as wealth, main livelihood activities, gender, ethnicity and so forth determine the natural, physical, human, social and financial assets, which influence LD / SLM. The context also determines the key drivers of LD / SLM, as they affect the access people have to key assets, and what they can do with them.

The livelihood strategies and outcomes of individuals and households (right of Figure 2) are shaped /determined by their per capita **Assets base**, which includes Natural, Physical, Human, Social and Financial assets, (see Table 1) also by their **Vulnerability context** (e.g. seasonality, trends and shocks that are beyond the household's control) (left of Figure 2), and by the **Policy and Institutional context** (centre of Figure 2).

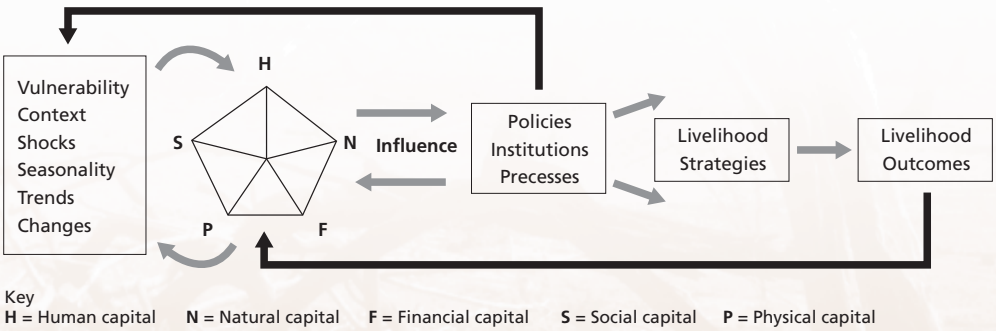

FIGURE 2 **The Basic Livelihoods Framework** *(Source: Ade Freeman, Ellis & Allison, 2004)*

TABLE 1 **Description of the capital assets**

	Per capita / Household assets
Natural capital	The natural resources stocks from which resources flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environmental resources).
Human capital	The social resources (networks, membership groups, relationship of trust and access to wider institutions of society) upon which people draw in pursuit of livelihoods.
Physical capital	The skills, knowledge, ability to work and good health important to the ability to pursue different livelihood strategies.
Social capital	The basic infrastructure (transport, shelter, water, energy and communications) and production equipment and means which enable people to pursue their livelihoods.
Financial capital	The financial resources which are available to people (whether savings, supplies of credit or regular remittances of pensions) and which provide them with different livelihood options.

The first step in using the sustainable livelihoods (SL) approach is the gathering of initial socio-economic and cultural information during the community focus group discussion, community mapping and wealth ranking exercises. This provides initial information on:

- the diversity of land users, land uses and income generating activities;
- important socio-economic and environmental changes (recent and historic e.g. markets for cash crops, land productivity decline, climate change);
- the vulnerability / resilience of different land user groups (in relation to land degradation, poverty, food insecurity climate change / variability, etc.).

The next step is the conduct of interviews with a range of land users encountered during the transect walks and a sample of households from the various wealth groups, also some key informants (e.g. technical experts, policy/ decision makers, workers on ongoing projects). These provide information on the assets base, livelihoods, land management practices as well as interviewees perceptions of the effects of land degradation and of support measures (policy, legislation, services etc.).

2.3 Ecosystem services framework

Ecosystem services are defined as the benefits that humans receive from ecosystems. These benefits can be direct benefits (e.g. food, fodder, recreation etc.) or they may be indirect (e.g. nutrient cycling, pest regulation and pollination etc.). Four categories are commonly identified: provisioning, regulating, cultural and supporting services.

The Millennium Assessment (WRI, 2005) developed and applied this categorization for the 2005 Ecosystem Assessment (Figure 3).

Supporting services generally change slowly and have an indirect impact on people over a relatively long time frame. Changes in the remaining three categories are more direct and short-term in their impacts on people.

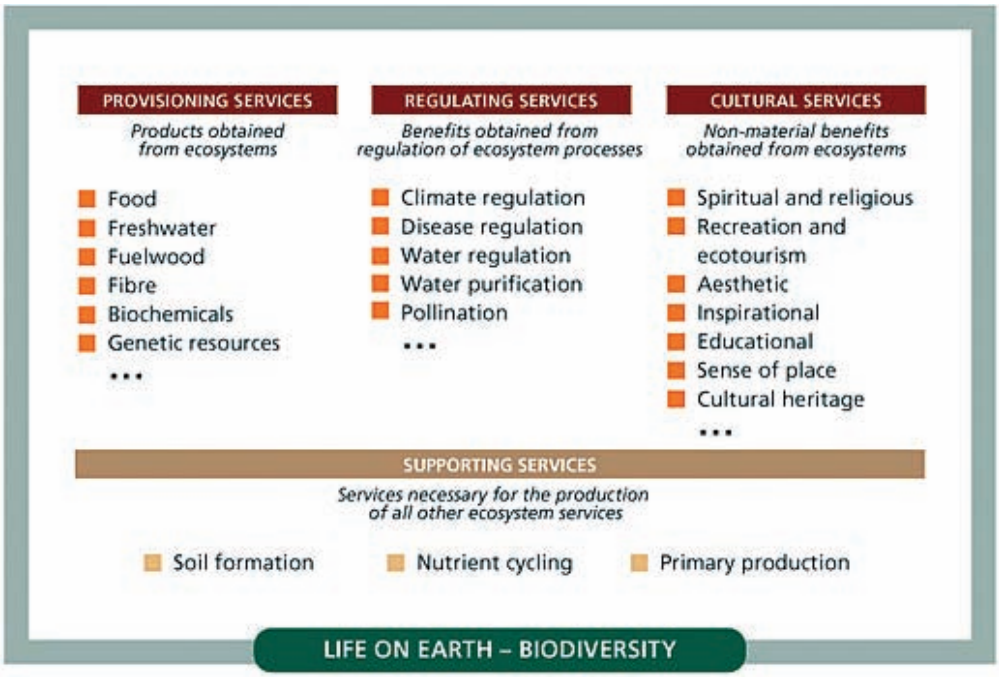

FIGURE 3 **Ecosystems Services** *(Millennium Ecosystem Assessment [WRI], 2005)*

The LD / SLM impacts on ecosystem services are assessed by drawing on the findings of the initial reconnaissance visit / transect walk and the detailed site assessments of vegetation, soil and water resources. The following services should be considered, with emphasis placed on those that are particularly important or at risk in the particular study area:

- **Provisioning services:** crop and livestock production (food, biomass for energy, fibre, wood), other goods (wild foods, building or craft materials etc.), water productivity, availability of land etc.;
- **Regulating services:** ecological processes and their effects on:
  - the carbon cycle i.e. the balance between carbon sequestration on one hand (through biomass production and organic matter management) and on the other hand emissions of greenhouse gases (CH_4, CO_2 and NO_x) through decomposition of organic matter, burning, intensive livestock, farm mechanisation, etc.;
  - maintenance of the hydrological regime (rainfall capture, water regulation and flow, water purification) with impacts on flood and drought severity, incidence and risk;
  - pollination, biological disease and pest regulation and risks of crop failure, livestock / tree mortality;
- **Supporting services:** (necessary for the production of all other ES) including photosynthesis, biodiversity conservation, soil formation and nutrient cycling;

- Cultural services: notably those important for vulnerability / risk aversion, security, enjoyment, status, identity etc.

The effects of changes in these ecosystem services on livelihoods and well-being can be identified. For example, changes in production of food, wood, fibre and fuel and in supplies of freshwater will affect nutrition, health, income and food security, as well as resilience to climate change and perhaps also social relations as access to / competition over natural resources also change.

While in the field and during the analysis of findings, the wider effects of land management on the functioning of the ecosystem and provision of the above ecosystem services can be taken into account. To allow a reasonably rapid assessment, the main focus should be placed on the effects of land use / management on provisioning services and livelihoods (income, food security, vulnerability, etc.). However, also record any significant effects of the current practices (i.e. vegetation cover; soil management) on the key regulating and supporting services notably changes in water regime/ hydrology, in organic matter losses/inputs (biomass and soil) and nutrient losses/inputs.

CHAPTER 3

Planning the local assessment

This section guides users on setting up the assessment team and collection of relevant background / secondary information. It also covers the selection of study area and sampling strategy; discussions and interviews with land users and advises on how to conduct the field work for the assessments.

3.1 Composition of the team, assessment steps and timing

The assessment collects information and data on land use / management and livelihoods; vegetation, soil, water resources, land productivity, also other environmental and social services. In addition, it involves the synthesis and analysis of the findings and the production of outputs.

Ideally the team members should have expertise in all these main disciplines:

- soil science and agronomy:
- water resources management:
- animal production (settled/ pastoral systems, livestock, wildlife, etc.):
- social sciences (e.g. land tenure, rights, gender, etc.):
- agricultural economics (e.g. costs, benefits, tradeoffs, etc.):
- ecology - forest and rangeland management.

A multidisciplinary team will help to ensure that the assessment has both scientific rigour and delivers outputs which are relevant and accessible to all stakeholders. It is most important to include at least one person with experience of socio-economic assessment and use of participatory rural appraisal (PRA) tools such as focus group discussions, community/territory mapping, organizational analysis, household interviews, etc.

PHOTO 1 **Local assessment team**

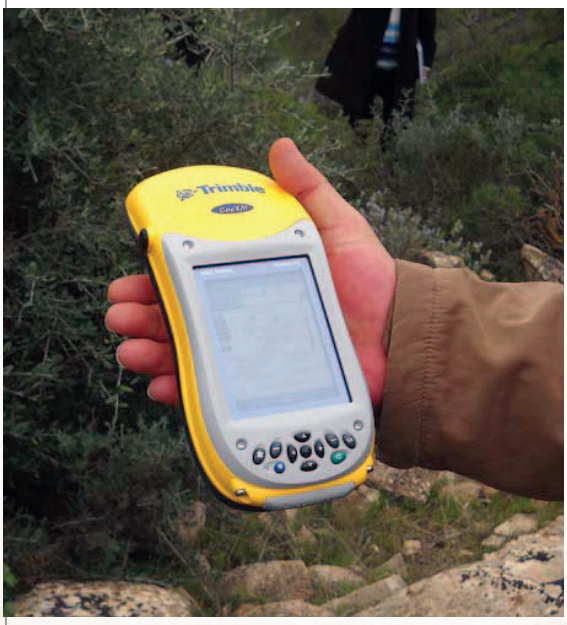

PHOTO 2 **Equipment and hand tools**

Where possible, the team should be made up largely of experts from the local assessment area, however if this is not possible (e.g. lack of capacity or training in the assessment methods), the assessment team should be guided and supported by local representatives, for example, technical staff from the district / provincial offices and relevant projects on the ground.

A team leader is required to coordinate the assessment team and process and to also lead the final analysis of the results and the assessment products (database, report, case studies and policy briefs). Experience of field work, team management, natural resources assessment, data collection and participatory and inter-sectoral assessment are all desirable qualities for the team leader. Moreover good communication, exchange and data sharing between all team members are essential.

It should be possible for a team of approximately five to ten people to implement this assessment in a period of four weeks (full time), including time for analysis, feedback and report writing.

The coordinator of the team should ensure that the required field tools and equipment are procured well before the assessment begins (International ordering can take more than one month). A list of required field equipment (such as GPS, see Photo 1) is provided in Annex 1.

Figure 4 below shows the main steps in the LADA local assessment process.

3.2 Selection of the assessment areas

Local assessment area selection should be driven by the aims of the assessment team or sponsor. In the LADA project, LD / SLM information was required from the local assessment that could be extrapolated to give a picture of land condition

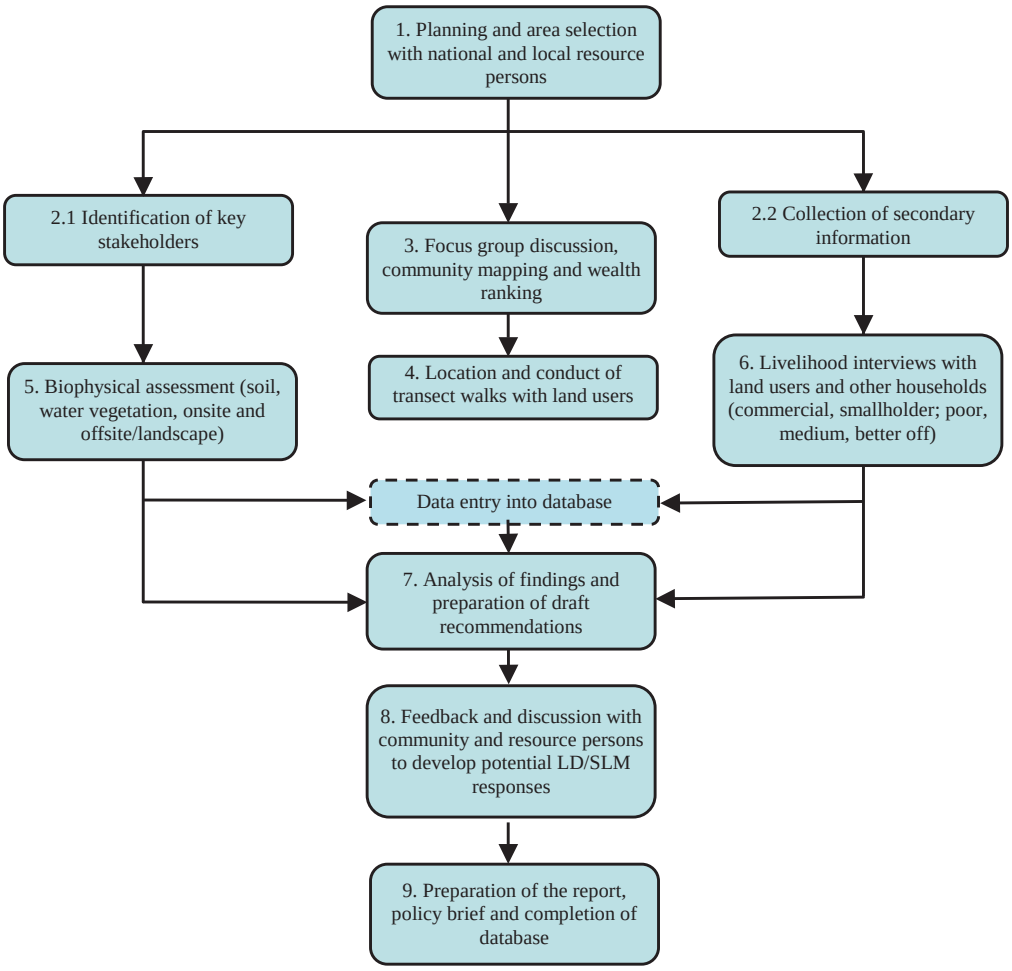

FIGURE 4 **Main steps in the LADA Local Assessment**

in larger land units or land use systems. Thus it was important for local assessment locations to be representative of these larger areas or systems. In other situations, the users might be interested in conducting the assessments in particular locations for different reasons e.g. concerns over land degradation, a wish to understand apparent improvements in land management, a particular policy or project focus etc.

Local policy makers and other stakeholders should be consulted and involved in the assessment where practicable as they will generally be interested in the assessment activities and results.

The timing of the assessment in terms of seasonality is important and should be agreed with local stakeholders. In drylands, the

vegetation condition may change dramatically between seasons and could influence the team's perception of degradation severity, see Photo 3. If the assessment is done after the rainy season it may be necessary to return to the area in the dry season to validate findings. Importantly, the timing should avoid peak periods for farmers / herders or technical and extension staff.

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PHOTO 3 **Field with improved fallow before & 1 month after rains (Diagaly, Senegal)**

Linkages should be established between the local assessment and national LD / SLM assessments using LADA-WOCAT methods (using the QM questionnaire, CDE / WOCAT *et al.*, 2011), where it is being or has been conducted - or other natural resources assessments, in order that the findings can be validated and used in support of decision making. See Box 1.

3.3 Land Use Systems (LUS) and Land Use Types

In LADA, the **Land Use system (LUS)** is the basic unit of evaluation for the assessment of land degradation and sustainable land management at global, national and local levels. The LUS classification is based on the actual use of the land. LUS units are mapped and characterised using a number of biophysical and human parameters, including those relating to the land use or farming system, to the resource base/ biophysical attributes and to relevant socio economic attributes (see FAO, 2011). These include:

- **Land use / farming system attributes**: dominant crop type / extent, livestock type density, irrigation type/scale, input level (management index);
- **Resource base / biophysical attributes**: slope, soil type, rainfall / temperature regime, length growing season, altitude (DEM/ terrain);
- **Socio economic attributes**: population density, poverty level, infrastructure, protected areas and urban / rural population.

National LUS classes can be further subdivided at local level through other available information related to land use for example:

BOX 1 **National - Local LADA linkages**

Where a national land degradation (LD) and sustainable land management (SLM) assessment has been or is being conducted using the LADA-WOCAT mapping method (QM) which is based on a land use systems (LUS) map and selected administrative units (e.g. district or province), the selection of local assessment areas can be guided by the results of this national LD / SLM assessment and in collaboration with decision makers. Such a clear and robust stratification strategy based on the LUS is required, to allow the findings of the local assessment (field level) to be linked to the results of the (sub) national assessment. It is important that the areas chosen for the local assessment should represent the LUS of interest at country level (i.e. a technical sector or policy makers may wish to analyse in more depth the DPSIR relations in specific areas that are degrading (i.e. high potential areas) or areas that are improving with a view to adapting or strengthening the response measures.

Based on the pilot countries experiences in conducting their local assessments and testing the LADA methodology, the selection of the local assessment areas can be done either by targeting a specific land use system (LUS) of interest, or by selecting an area of interest and assessing the main (2-3) LUS within that area. The most suitable approach in a particular situation depends on the heterogeneity of the assessment area in terms of LUS and of the land management practices present within a LUS.

Where both local and national assessments are being conducted, the reasoning behind the sampling should follow this sequence of steps:

1. Based on the LUS map and national assessment of LD and SLM, identify the nationally important LUS i.e. those most requiring in depth investigation;
2. For the selection of your local assessment areas, choose the areas where these important LUS are most represented (1 area can include 1 to 3 important LUS)
3. Depending on the homogeneity or heterogeneity of the LUS, select your study areas (2-6 km) inside that larger local assessment area (20-60km). If very homogenous, one larger study area may be sufficient; if heterogeneous, a few study areas would be needed to well characterize the LUS. (Variability in the LUS itself can be caused by farm size, land tenure, terrain, management (conventional, conservation, organic, extensive grazing, and intensive grazing), etc.)

- **Land tenure and size of farms**: land areas used for large, commercial farms are often quite distinct from small commercial farms or areas which are mostly used for subsistence farming;
- **Forest management and exploitation:** countries may have geo-reference information at sub-national level which distinguishes different types of forest management and exploitation (including selective felling, firewood gathering etc);
- **Water resources and irrigation**: it may be possible at sub-national level to delineate areas which make use of different water sources (rivers, aquifers, man- made reservoirs above or below ground) for different purposes e.g. for irrigation;
- **Fertilizer use, mechanization and other inputs**: cropland may be further subdivided using information available such as use of inputs by crop (fertiliser, organic matter, herbicides etc.) and seed varieties;

- **Recreation areas, parks, reserves, wetlands, etc.**: may be further differentiated and may fall in any land use system. Protected areas data and maps are available from the World Database on Protected Areas.

Table 1 (below) shows the main LUS classes at national level (adapted from South Africa, as shown in the manual for national level land degradation / SLM assessment (QM) CDE / WOCAT 2011) with some examples of how these can be further differentiated into Land use types depending on resolution (scale) and information availability (using examples from Tunisia).

TABLE 1 **Major land use systems and land use types**

Code	Land Use Systems (national level)	Land Use Types (LUT) (local level)
F	**Forests / woodland (virgin / natural, plantations and protected)** used mainly for wood production, other forest products, recreation, protection	
Fn	• **Natural forests:** woods / forests composed of indigenous trees, not planted, including riverine forests	May differentiate between types of forest and wood land (e.g. evergreen, (semi) deciduous, xeromorphic) and their density (dense / sparse)
Fp	• **Plantations, afforestation, woodlots:** forest stands established by planting and / or seeding during afforestation or reforestation (including plots and wider wind- / shelterbelts)	
Fo	• **Other:** e.g. selective cutting of natural forests and incorporating planted species	
PF	• **Protected** area that is forested	e.g. Forest Reserve
G	**Grassland (unmanaged to intensively managed for grazing by livestock and wildlife and protected areas)**	
Ge	• **Extensive grazing land:** grazing on natural or semi-natural grass lands, grasslands with trees / shrubs (savannah vegetation) or open woodlands for livestock and wildlife, low livestock density	Can distinguish e.g. • tall / medium / short grassland • forbs
Gi	• **Intensive grazing / fodder production:** improved or planted pastures for grazing / production of fodder (for cut and carry-hay, leguminous spp., silage etc.) (Not annual fodder crops).Moderate to high livestock density	
PG	• **Protected grassland** (may or may not be used for grazing)	
S	**Shrub land (unmanaged ,extensively managed or protected)**	
Se	• **Extensive grazing land:** grazing on natural or semi-natural shrub lands, shrub lands with trees / shrubs unmanaged or extensively managed with low livestock and wildlife density	e.g. by type and density • Bush / Sparse Bush / Dwarf Bush / Sparse Dwarf Bush • Garrigue • Tundra • Evergreen / Semi-deciduous / Deciduous / Xeromorphic
Si	• **Intensive grazing:** on shrub land with moderate or high livestock or wildlife density	
PS	• **Protected shrubland** May or may not be used for grazing or browsing	

TABLE 1 **Major land use systems and land use types** *(continued)*

Code	Land Use Systems (national level)	Land Use Types (LUT) (local level)
C	**Agriculture / cropland:** Land used for cultivation of rainfed or irrigated crops (field crops, orchards).	
Ca	• **Annual cropping:** land under temporary / annual crops usually harvested within one year, or maximum of two years (e.g. maize, paddy rice, wheat, vegetables, fodder crops such as maize, oats) May be sub divided into rainfed or irrigated	e.g. • Horticulture • Cereals, • etc
Cp	• **Perennial (non-woody) cropping:** land under permanent (not woody) crops that may be harvested after 2 or more years, or only part of the plants are harvested May be sub divided rainfed / irrigated	e.g. • Sugar cane, • Banana • Sisal • Pineapple etc.
Ct	• **Tree and shrub cropping:** permanent woody plants with crops harvested more than once after planting and usually lasting for more than 5 years (e.g. orchards / fruit trees, coffee, tea, vineyards, oil palm, cacao, coconut, fodder trees) May be sub divided rainfed / irrigated	e.g. • Olive orchards • Vineyards • etc.
Cai **Cpi** **Cti**	**Large-scale irrigation:** • **Annual cropping** • **Perennial cropping** • **Tree or shrub cropping**	• e.g. public or private sector; may include Oases
Co	• **Other irrigated areas**	• may include Oases
PC	**Protected areas used for cropping**	
M	**Mixed land use systems/** types: a mixture of land use within the same land unit.	
Mf	• **Agroforestry:** combination of planted crops and trees	
Mp	• **Silvo-pastoralism:** forest and grazing land	
Ma	• **Agro-pastoralism:** cropland and grazing land (including seasonal crop-livestock change) with moderate or intense livestock density and in some cases irrigated crops	
Ms	• **Agro-silvopastoralism:** cropland, grazing land and trees (including seasonal change)	
Mo	• **Other:** other mixed land	
B	**Sparsely vegetated or bare land**	
Bu	• **Unmanaged:** bare lands, deserts, glaciers	
Bt	• **Pastoral or agropastoral:** e.g. transhumant systems with low, moderate or high density livestock during very short period	
PB	• **Protected bare or sparsely vegetation area**	e.g. national park

TABLE 1 **Major land use systems and land use types** *(continued)*

Code	Land Use Systems (national level)	Land Use Types (LUT) (local level)
O	**Other land use:**	
Ou	• **Urban: Settlements, infrastructure networks:** roads, railways, pipe lines, power lines	
Oi	• **Mines and extractive industries, quarries,**	
Wa	**Natural and artificial water bodies**	
Wu	• **Natural inland water bodies unmanaged** (inland natural lakes, permanent and seasonal rivers, streams)	
Wf	• **Inland water bodies used for food production:** natural lakes, rivers, streams and ponds used for aquaculture and fishing	
Wo	• **Other:** Waterways, drainage lines, canals, ponds, dams (man made)	
PO	• **Protected areas of open water**	
Wt	**Wetlands**	
	• **Unmanaged wetlands, swamps, bogs etc not managed**	
	• **Mangrove**	
	• **Wetland with agricultural activities**	
PW	**Protected wetland**	e.g. Ramsar designated

Protected areas or wetlands may be subdivisions under the other LUS (forest, grassland, agricultural, shrub etc.). However they are shown here as a separate LUS to emphasize that their conservation and sustainable use is very important in drylands and to ensure they are not neglected.

The following sequence of photos (4-8) shows a range of diverse land use types in drylands in the pilot LADA countries.

3.4 Sampling strategy

The following 3-tiered sampling strategy is recommended where there is a need to extrapolate findings up to a sub-national (e.g. provincial) or national level:

Local assessment area (Tier 1): The first sampling tier below national level. The local assessment areas should / are likely to be selected to inform stakeholders about land resources in the main LUS within a country. The areas are typically geographically defined units: administrative units such as districts, or biophysical units such as watersheds. The choice of these areas should be made on the basis of the LADA / WOCAT national assessment results, and / or discussions with policy makers. They could be areas of economic importance, of high potential, of rapid change, or selected in specific agro-ecological zones and with specific types and levels of degradation. The selection may depend on logistics (i.e. not too remote to reduce time and cost), recent projects or investments (i.e. to assess their impacts) or other factors. It is essential that areas are representative

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PHOTO 4 **Wooded savanna used for agro-pastoralism, Touba Ndar Fall area, Senegal**

PHOTO 5 **Wooded vegetation and bare rock surfaces in drylands in Guantánamo, Cuba**

of the issues / areas of national priority concern and interest with respect to land degradation and / or SLM so that the findings will have broad relevance. One local assessment area can be effectively a sample of one or a few nationally important LUS. They can be quite large, for instance hundreds of km^2 where the landscape is very homogeneous. They will often be quite heterogeneous, including several land use types, land management practices, degradation processes and SLM measures, also a range of impacts on people and ecosystem services.

Study area (Tier 2) Within the local assessment areas, a few study areas for the field level assessments should be chosen to assist cross-

PHOTO 6 **Irrigated cropping in dryland in Xiaobazi, Fengning, China**

PHOTO 7 **Grassland in Camagüey-Las Tunas, Cuba**

PHOTO 8 **Sparsely vegetated dryland and bare rocky slopes in Argentina**

checking between local and sub–national assessment results and to enable the findings to be brought to a level at which substantive decisions can be made. The most important consideration in choosing the study areas is that they should be representative of the local assessment area and, where a national LADA assessment has been conducted, also representative of the selected Land Use Systems (LUS) present within the local assessment area. The ability to extrapolate the assessment findings from local level to provincial level and above depends on this representativeness. As the local assessment areas are often quite large, in general, it will be necessary to select two to four study areas in order to capture the diversity of LUS, land use types and management practices, also LD / SLM situations within each local assessment area.

The study area may contain a single or several settlements / communities, with distinct community territories (delimited) but often with overlapping resources use arrangements (e.g. for water, grazing and fuel wood). In other cases, the settlement pattern may be dispersed households or clustered in larger family units and with varying degrees of authority (weak to strong) in terms of natural resources management. In drylands, a dispersed settlement pattern is quite common to reduce pressures on fragile resources. Land-users may be sedentary or mobile and the mobility may be permanent (i.e. nomadic) or seasonal (agropastoral). It is important for the assessment team to think about this pattern in the planning stage, in order to achieve a representative sample of the local population and LUS.

The community or local organizational unit is likely to be an important part of the sampling strategy, as the rules and systems regulating access and management of land resources are often organized at local / community level. Thus even if the study area contains several communities, some community level data collection and analysis is required to fully understand such issues.

An appropriate study area could be:

- a delimited territory (community, local organization / grouping of land users) ;
- a territory shared by 2 or more communities (NB the boundaries may vary according to the use i.e. the community land may not have the same boundaries as the land area used for extensive livestock watering and grazing);
- a small catchment or watershed or selected landscape unit;
- a randomly selected area within the local assessment area (LAA).

Transects and Detailed Assessment Sites (Tier 3): An effective way to sample the study area, the selected LUS, the landscape and how it is used by the land users and the wider local population / community is through a transect-based sampling approach. Transects should be selected to cross the landscape (maybe from a higher to a lower elevation or from a settled community to a more remote area) and to cut across a range of land use types and land users (commercial, smallholder; farmer, herder, mixed; land owner, tenant, farm labourer etc.).

Transects

- Transects do not need to follow a straight line. They are used to verify features raised in the local / community discussion and to identify sites for detailed assessments. They are appropriate for use in detailed quantitative sampling.
- The alignment of transects should be chosen to provide an overview or

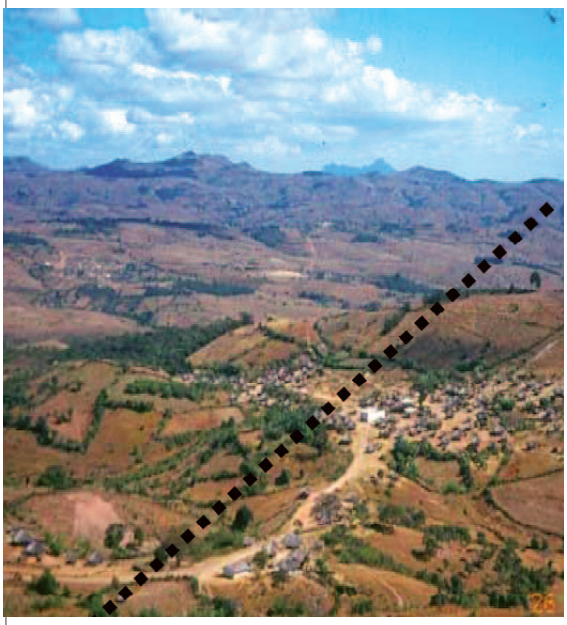

PHOTO 9 **Transect cutting across a landscape and village**

characterisation of the study area, including the landscape / natural resources and the human management context within which land degradation and sustainable land management (LD / SLM) are occurring. This characterisation should enable the team to confirm that the study area is representative of the LAA and of the national level land use systems (LUS) within it.

- The characterisation will, in turn, provide the team with a rational basis for selecting the location and number of sites along each transect for the detailed assessments (i.e. based on the different land users, land use types and management practices and SLM interventions).

There are two options for locating the transects:

- In a more diverse terrain (e.g. varying topography and LUS) a transect of several kilometres in length can be

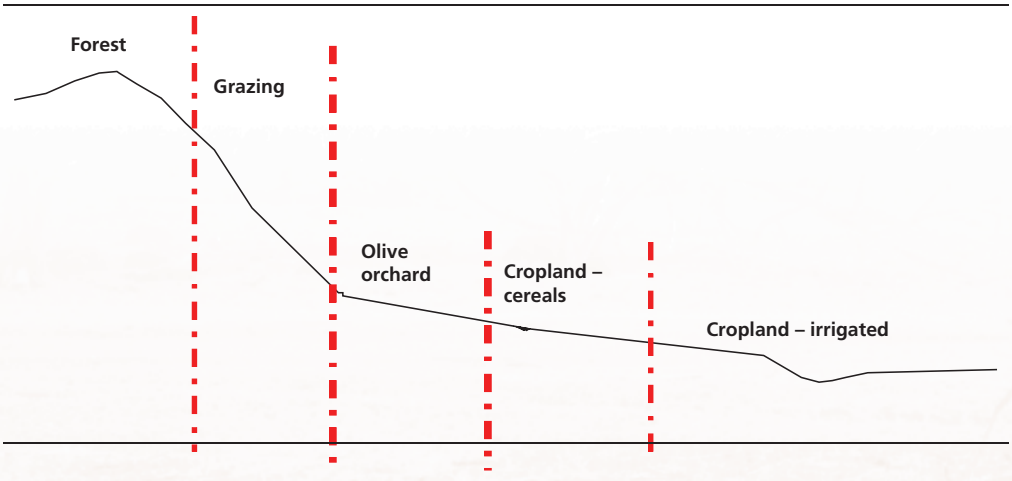

FIGURE 5 **Schema of a transect crossing different land use types in Tunisia**

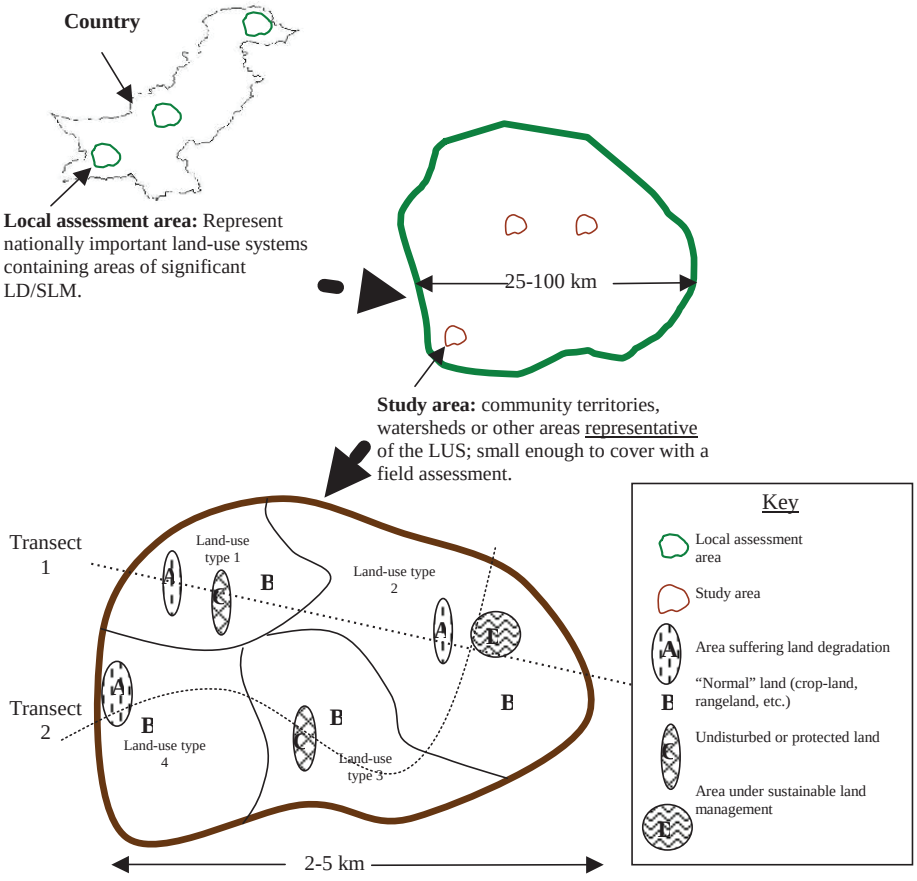

FIGURE 6 **The sampling strategy of the local assessment**

selected to cut across the various main land use systems / types and thus the main types of degradation and SLM practices in the study area; (see Photo 9 and Figure 5).

- In a very flat / homogeneous landscape (e.g. the groundnut plains of Senegal), it may be preferable to locate, using the information provided during the focal group discussions (FGD) and community mapping, a series of short transects to represent different land use types and land user types that are found in the local assessment area.

Comparison is a key feature of the assessment, for example to compare areas that are showing strong / moderate signs of degradation with areas where SLM practices are used and showing few or no signs of degradation. Through discussion on the ground with the land users the effects of the land use and management practices used in the area (i.e. causes of LD) can be compared, for example, a degraded area (A) on one farm

BOX 2 **Number of sites for detailed assessment and number of interviews**

This example relates to the study area in Figure 3 above in which there are 4 land use types (LUT) (which is higher than the norm but illustrative of the possible complexity):

- In LUT 1, a three way LD / SLM comparison is possible: between degraded land (A) and "normal" land (B), and natural / undisturbed vegetation (C): 3 sites replicated 3 times = 9 sets of measurements
- In LUT 2 a three way comparison is also possible: A with B with an area under sustainable land management (D) = 9 sets of measurements
- In LUT 3 a two way comparison is possible: B with C = 6 sets of measurements
- In LUT 4 also a two way comparison is possible: A with B = 6 sets of measurements.

In this case, a total of 30 sets of biophysical measurements are required to sample this area (9+9+6+6). Interviews with up to three land users per LUT would be required, depending on whether the same land user manages more than one of the sites A, B, C. Thus a total of around 9 livelihoods interviews should be conducted in this study area with the land users, in addition to some additional interviews with local informants and other stakeholders (e.g. hired labourers / herders).

caused by poor farming practices (burning of residues, repetitive tillage etc.) can be compared to a demonstration area under conservation agriculture (D1) and to a good farmer using conventional tillage but with organic matter management from stall fed livestock (D2).

Triangulation is used to address such observations on the ground, with information from land users encountered during the transect walk and with information gathered through household interviews and discussions with key informants.

Sites/plots for detailed assessment

Comparison is at the heart of the sampling strategy. Detailed assessments are conducted in areas of LD, SLM and undisturbed or protected land and then results from these are compared. For example, in Figure 6, A, B and C are compared in land-use 1; A, B and D are compared in land-use 2, etc. The number of comparisons possible will depend on the heterogeneity of the study area (see Box 2).

Photo 10 shows the differential vegetation quality on both sides of a fence (i.e. more woody and drier vegetation on the right). Such a barrier which may result in differential grazing patterns, for example, provides a useful comparison.

The objective with the detailed site assessments is to generate an in-depth understanding of each of the main types / processes of land degradation and the main land management practices in the study area, in which land use system(s) / type(s) they occur and to provide an analysis of their drivers and impacts. It is likely that there will be several or perhaps many distinct land-use types (LUT) present within a study area and these will depend on the diversity of the terrain and the range of land users (land holding size, assets, level of education / training, also other constraints and opportunities such as markets and land tenure security etc.).

As far as possible, the plots / sites should provide a comparative element to the sampling (i.e. degraded land can be compared with land that is not degraded or land under specific

PHOTO 10 **Fencing showing differential degradation (Bariloche, Argentina)**

sustainable land management (SLM) practices). The detailed measurements of soil and vegetation, in particular, should be replicated 2-3 times in each site / plot. The total number of sets of measurements required in the detailed assessment is typically in the region of 20-40 per study area, depending on the diversity of land use and management practices in the area.

If there are available aerial photographs and remote sensing images (such as NDVI), which provide a time-series picture of land degradation and conservation / improvement (over a 10-50 year period), these can help identify study areas, guide the location of transects and those sites / plots of most "interest" for the detailed assessments. For example, there may be areas where there has been a recent marked decline in quality of land resources (such as vegetation), a dramatic change in land-use (e.g. intensified cultivation in marginal areas) or areas where sustainable management practices are being used and land restoration / rehabilitation has resulted in significant improvement in the quality of land resources (soil, water, vegetation and biodiversity).

In this manual, the indicators and methods for the assessment of vegetation and soil and water resources are presented sequentially as Tools 1.1 to 7.1, in Part 2 Field Methodology and Tools of the LADA local manual (FAO *et al.* 2011b). However, in reality the team members will assess both soil and vegetation condition / state (which are intimately interrelated) in relation to the land use practices (degradation processes or sustainable land management) at each selected detailed assessment sites. A simple scoring

system is provided for soil health, soil erosion and pasture / range condition, but not for crop or forest condition.

A visual, qualitative method is proposed in the manual for assessing pasture/range condition in LADA-L. However, further **detailed vegetation assessments** can be conducted, if countries wish, building on LADA pilot country experiences/ research with **Landscape Functional Analysis (LFA) methods** (Tongway and Hindley, 2004), notably i) ecological monitoring of rangelands and wetlands in South Africa, and ii) use of MARAS methods for environmental monitoring of arid and semiarid regions in Argentina. Both experiences used fixed transects with indices of landscape organisation, vegetation and soil (e.g. recording patches, size, distances, basal cover, litter, nutrient recycling) and indicator and alien species in order to assess

TABLE 2 **Definitions and hierarchy of mapping and sampling units**

Level of sampling/unit	Size / number and definitions
Local Assessment area (LAA) (first tier)	Two to six areas per country. Each local assessment area could be anything from a single watershed to a region of several hundred km^2. They should be representative of one or more important land use system (LUS) and will be areas of significant LD / SLM activity and impact.
Land Use System (LUS)	The generalized input and management actions designed to obtain goods and services from the land including these goods and services (FAO, 2007). The study area, which contains the sites where transects and field sampling is conducted, should be representative of the given LUS. *Low resolution (scale 1: 250 000-1:500 000)*
Study Area (second tier)	Two to four locations per LAA to ensure that the area is well represented. Size variable. The study areas must be representative of the local assessment area, containing as many of the main LUTs (as variants of the LUS) and forms of LD / SLM present in the LAA as possible. A study area may represent a community and the territory it occupies or it may have some other delimitation depending on the local environment.
Land Use Type (LUT)	The use to which land is put which may reflect the arrangements, activities and levels of inputs by the land users. (The WOCAT classification system is used in LADA-L). *High resolution.*
Sites/field plots for detailed assessments (third tier)	At intervals along transects, detailed assessment sites will be identified, at each site: Three pairs of plots per land use type (LUT) depending on the number and complexity of the LUT.
Land Unit (LU)	An area of land defined in terms of biophysical land qualities and characteristics that may be demarcated on a map. It may be smaller or larger than the LUT.
Land use	Human activities which are directly related to land, making use of natural resources or having an impact upon the land.
Land cover	Vegetation (natural or planted), water or man-made structures (buildings, infrastructure, etc.) that cover the earth's surface.

heterogeneous morphological characteristics (e.g. bare patches in landscape and grass cover) and relate land use/pressure to effects on vegetation and landscape functionality. Where such a combined soil and vegetation analysis is conducted using Landscape Functional Analysis (LFA) methods it would be useful if results could be compared with the tools provided in this manual to provide feedback to LADA.

Assessment of specific SLM practices

A specific assessment should be made of a few key SLM Technologies and Approaches (see Annexes 2 and 4) that are identified for specific consideration by land users and resource persons in the study area (e.g. those most commonly adopted and / or most effective and / or problematic in terms of skills, cost, maintenance, etc.). These SLM technologies may be related to specific LUS / LUT and land user groups.

The SLM assessment is conducted using the tools developed by the World Overview of Conservation Approaches and Technologies (**WOCAT**) namely the **Technologies questionnaire** (**QT**) and the **Approaches questionnaire** (**QA**). Examples of case studies resulting from the information generated through these questionnaires are provided in Annexes 3 and 5. For each SLM technology / practice assessed, there should be a related approach that is also assessed.

Table 2 shows the hierarchy of mapping and sampling units from the local assessment area to the land use systems, the specific study area, transects, detailed sampling sites along the transects and SLM technologies and approaches in the study area.