Land Degradation Assessment: the LADA approach

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Abstract
The LADA project has prepared guidelines and manuals to describe land degradation and sustainable land management at different levels and at appropriate scales and has tested them in six countries around the globe. These methods rely on participatory approaches, field surveys and remote sensing. At the same time the project has developed a number of definitions and innovative approaches to characterize and make an inventory of land degradation and sustainable land management. The main recommendation of the project is to streamline and implement the sub-national inventories worldwide to obtain a reliable baseline for impact assessment of land degradation and sustainable management.

Key words
Land degradation, land assessment, sustainable land management, LADA.

The LADA approach
The Land Degradation Assessment in Drylands (LADA) project has as part of its objectives to assess land degradation at local, national and global scale. In order to do so, the project has developed guidelines for each assessment level.

At global level, methods were developed that evaluated long terms in trends in Net Primary Production corrected for rainfall as documented by Zhao *et al.* (2008). Also at global level, a geo-referenced inventory was made of individual indicators associated with land degradation such as slope, soil vulnerability to erosion, long term trends in droughts, biodiversity and socio-economic factors (Nachtergaele *et al*. 2009).

At (sub) national level, Liniger *et al*. (2008), provided methods and approaches to map both land degradation and sustainable land management by analyzing their status, causes and impacts in each major land use type per province within a country. The resulting database provides a wealth of information that is readily available and can be used for monitoring progress and for decision-making on land use and management interventions. A national land cover change study is also undertaken (Latham *et al.* 2008) providing information on land pressures.

At local level, McDonagh and Bunning (2009) documented a systematic inventory method on the status of the land in all its aspects (soil health, water quantity and quality, vegetation status and biodiversity). This information is complemented with local knowledge from land users and key informants on land use and management practices during the field survey and with results from semi-structured interviews of different categories of land users on the causes and impacts of land degradation at the community level.

At the same time, the project built on existing harmonized indicator descriptions developed for the Mediterranean region (Zucca *et al.* 2009) under the DESERTLINK project, to provide an information base of systematically documented indicators that can be used to characterize and evaluate land degradation status. The indicators are organized by scale of application and by their position in the DPSIR framework.

An evaluation of the key sustainable land management (SLM) measures, being used in the country and in local study areas, for the prevention and mitigation of land degradation and rehabilitation of degraded lands, is also conducted using the WOCAT approach (WOCAT 2007).

At each level the information from the various tools are brought together and analyzed to understand the main causes and drivers of degradation and the impacts on livelihoods and other ecosystems services. Finally, a review of relevant institutional and policy issues affecting land users capacities to address land

degradation, is conducted through a SWOT analysis (strengths, weaknesses, opportunities and threats which completes the assessment process in each LADA country.

Hidden aspects of land degradation
This comprehensive approach needed to operate within a framework that could capture the various perspectives and processes of land degradation in a more precise way. . Moreover, it needed to take into consideration the fact that the concept of land degradation has evolved over time as illustrated by the changing definitions that have been used:

- FAO 1979: Land degradation is a process which lowers the current or potential capability of soils to produce

- UNEP 1992: Land degradation implies reduction of resource potential by a combination of processes acting on land.

- MEA 2005: The reduction in the capacity of the land to perform ecosystem goods, functions and services that support society and development.

- LADA 2009: The reduction in the capacity of the land to provide ecosystem goods and services and to assure its functions over a period of time for its beneficiaries..

Over the last thirty years, the object of land degradation has expanded from a focus on the soil to a focus on the ecosystem as a whole and from the narrow concept of production to the more encompassing one of the range of goods and services provided. The LADA contribution to this debate was to draw attention to the fact that it is essential to define the time period over which land degradation processes should be considered, and consequently the need to agree on a baseline against which the present state of the land should be evaluated. Indeed, one can imagine that in a garden of Eden scenario most of the land on Earth should be considered degraded at present, in relation to its pristine state, while if we only go back ten or even thirty years in time the land degradation situation may be less dramatic and more readily understood (and hence addressed). In fact, the time factor is important in order to give a framework for understanding the processes that caused the present situation. One needs to understand if the forces that created the present status are still operating, and evaluate their strength by considering the baseline at a given moment in the past. This understanding is supported by a dynamic use of the DPSIR indicators. The second aspect, by which the LADA definition of land degradation is different from previous ones, is that the role of the beneficiaries or stakeholders is fully recognized. This makes explicit the fact that a same given status of land can be considered good or bad depending on the intended use or value system of the concerned stakeholder. The land degradation situation is therefore qualified "in the eye of the beholder". To complicate the picture one should also consider that stakeholders' opinions may vary over time as a reflection of their changing interest in the land and the goods and services provided, for example, the recent attention to biofuels, climate change adaptation and mitigation and carbon sequestration. These latter aspects regarding time period and use values of beneficiaries are particularly important at local level and should form the basis of negotiation in developing locally adjusted land use plans and sustainable land management (SLM) interventions.

In order to evaluate the goods and services of the "ecosystem" a simplified scheme is proposed by LADA that reflects in accessible terms the various dimensions of land degradation. These correspond very much with the provisioning, regulating, supporting and socio-cultural services developed under the MEA (2005) but tie them down to more tangible objects of study. LADA proposes a particular focus on seven different aspects of goods and services: biomass production, yearly biomass increments, soil health, water quality and quantity, biodiversity, economic value of the land use, and social services of the land and its use. These can be represented using a spider diagram (Figure 1). Changes in these goods and services over time may occur most directly under changing land use conditions because of population pressures, external market forces (e.g. price fluctuations, social conditions of the stakeholder) or institutional measures (legislation on natural resource use, subsidies). Such changes in land use will often be reflected through a change in the shape of the resulting spider diagram (Figure 1). Differences can also be reflected between different land user groups (e.g. smallholder and large commercial farmers) or between the same land user group in two different agro-ecological and socio-economic contexts.

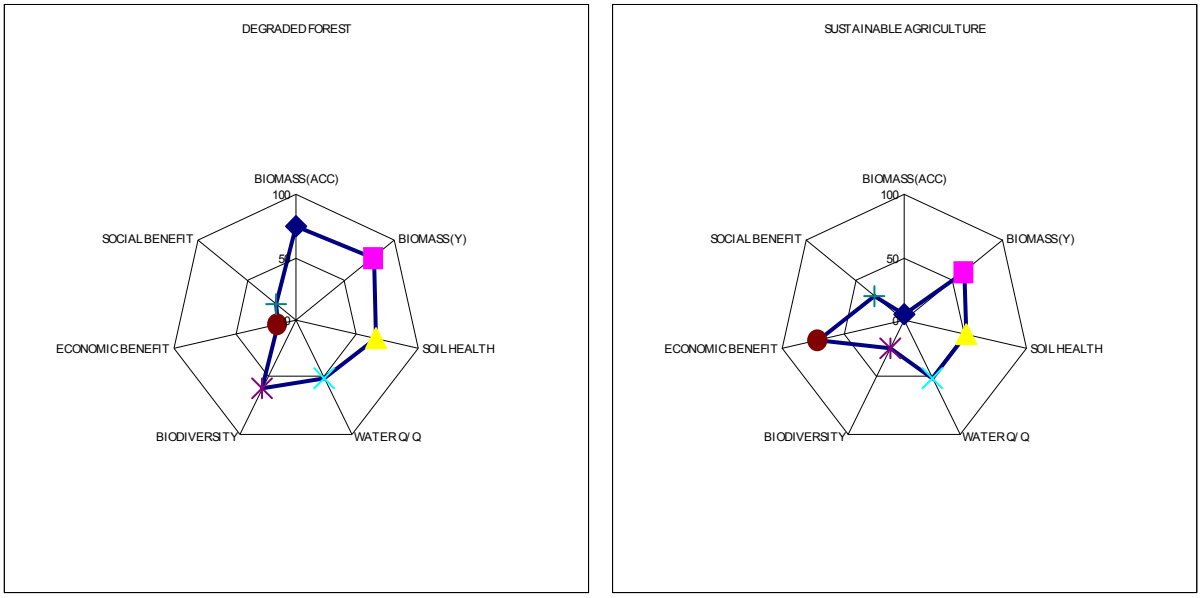

Figure 1. Goods and services evaluation in two different land use system

What is important, apart from the absolute changes in the different goods and services, as illustrated in the two diagrams above, is the fact that seldom all seven axes move in the same (positive or negative) direction when land use is changed. In other words, this reinforces the notion that land degradation is not an absolute value (as already indicated and hence emphasizing the importance of the opinion of the stakeholder in determining the effects of degradation on the goods and services and hence the value of land).

This dual aspect of subjectivity that characterizes land degradation and value is captured by LADA by drawing on the widest possible consultation with stakeholders both at (sub) national as at local level. This is the only way to generate consensus and produce balanced and reliable results.

A final issue to be discussed is the way the assessment of land degradation and improvements at different levels can be linked. The question of feedback from global to local level and vice versa was tackled early on by LADA. It was recognized that the single most important factor that drives land degradation in all its aspects is land use and intensity of management. Land use in itself is driven by socio-economic market forces and biophysical potentials and constraints of the natural resources. The recognition of land use as the unique base unit in which land degradation can be defined required that a universal system of land use inventories was developed. FAO and the World Bank had previously developed a Farming Systems inventory (Dixon *et al*. 2001) which was built upon by George and Petri (2006) to develop a national approach to land use inventory. That system, in turn, was further elaborated at a world scale using readily available global databases for defining global land use systems (Nachtergaele and Petri 2008). The principles used in this global land use system (LUS) are then applied at national level adding details on aspects of land use that are available at national level but not captured by global databases. The six LADA pilot countries, Argentina, China, Cuba, Senegal, South Africa and Tunisia, have all produced these national land use system maps for their territory at scales that vary from 1:250 000 to 1:1 000 000. The resulting LUS units are then used as the basis on which to evaluate land degradation and sustainable land management (SLM) in each of the main sub-national divisions of the countries. The national land use system units are used to identify and focus attention to priority issues requiring investigations in specific systems that deserve particular attention through local level studies. At local scale the national land use systems units are further characterized by land use types. (McDonagh and Bunning 2009) to assess and compare the effects, on-site and off-site, of specific management practices (e.g. repetitive tillage or conservation agriculture, water harvesting or irrigation) and, to the extent possible, to gauge their impacts on the key productive, ecological and socio-cultural services of relevance in the local area study area (e.g. reliable harvests, water supply, carbon and nutrient cycles). This focus on land use as the basis for assessing land degradation and improvement results in nested and scalable information from local to global level and vice versa.

Conclusions and Recommendations.
LADA has prepared guidelines to assess and monitor land degradation and sustainable land management at different levels and has tested them in six countries around the globe. These methods rely on participatory, multi-disciplinary approaches, and the combination of field surveys and remote sensing analysis.

A number of specific aspects of land degradation have been clarified by LADA. These concern the importance of temporal changes and trends to be measured against a baseline, the subjectivity of values and the need for participatory approaches to take into account the perspectives of land users and other stakeholders, and the central place of land use and its inventory in assessing land degradation.

It is recommended that the sub-national LADA/WOCAT approach to land degradation assessment is implemented through capacity building at a regional and national basis to allow a solid and complete world inventory of the status and trends of the land and thereby to improve understanding of the effects of human activities on the range of ecosystem goods and services.

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