CHAPTER 7

Analysis and reporting results

7.1 Introduction

This Chapter of the manual presents some methods and a structure for analysing the findings and for presenting the assessment in a well structured report for consideration by decision makers.

The report and database will be an important record of the assessment findings and should be used to mobilise better coordinated follow-up action among the range of actors that provide support for natural resources management and development. These products also provide the baseline for subsequent monitoring of changes, to assess progress in addressing land degradation and the effectiveness of different interventions by stakeholders.

The LADA local assessment methodology deserves to be widely used as a basis for supporting concerted efforts towards sustainable land management through, for example, targeted local and provincial action plans as well as future monitoring and investment planning to prevent or reverse land degradation and promote sustainable land management.

A better understanding of land uses and livelihood strategies used by land users to meet their needs and cope with change, seasonality and shocks can help with the design of policies and interventions to strengthen existing coping and adaptive strategies. Interventions could include: building capacities and improving access to knowledge and education on improved land management practices; strengthening security of tenure and access rights to natural resources for sustainable cropping, grazing and forestry including sustainable gathering / harvesting of fuelwood and other goods (e.g. energy, fodder, food, crafts); providing financial and enterprise development services (not just credit for farm equipment); and promotion of diversification (land use, on- and off-farm enterprises and livelihoods).

The local level assessment findings and analysis shall be documented in the form of a concise report supported by maps, tables and diagrams. The report should:

- explain the location of study area(s), transects and detailed assessment sites in relation to national LUS;
- present (e.g. using maps or Google earth images) the layout and distribution of land resources and land-use types;
- describe land use / management practices and their effects on the status of land resources in term of LD processes and trends (type, extent, severity) and effectiveness of conservation / improvement measures / SLM;
- present the analysis of apparent causes (drivers and pressures), impacts and policy implications on livelihoods and selected ecosystem services; and,
- propose responses for addressing land degradation or to promote sustainable land management.

Finally, it is important to bring together and synthesise findings from the LADA local and national assessments where both have been conducted. This is expected to help highlight broader impacts of land use / management practices on ecosystem services and to draw out policy implications in relation to national action plans to combat land degradation (NAPs), natural resources management and agricultural and forestry strategies, and linkages with climate change and biodiversity.

7.2 Structure of the Assessment Report

The proposed structure of the local assessment report is as follows:

- Introduction of the Assessment
- Methodology
- Characterization of the Study Area
- State of the Land Resources (and trends)
- Driving Forces & Pressures
- Impacts on Ecosystem Services
- Impacts on People and their Livelihoods
- Responses
- Conclusions and Policy Recommendations

Then, for each chapter, the scope and content is described.

7.2.1 Introduction of the assessment report

The introduction should describe briefly the composition of the assessment team (covering skills and background of team members) and key elements of the pre-assessment planning. This should be followed by an explanation of the reasons for the selection of the assessment area, notably:

- To explain the selection of the assessment area (what are the LUS under assessment and why?)
- To explain the rationale and the process by which the study areas were selected and how they represent the LUS found in the assessment area;
- To refer to significant existing interventions and projects relevant to LD / SLM in the area;
- To address specific concerns or questions concerning LD / SLM in the study area that came out of the national assessment or that the team members are interested in (e.g. an explanation of productivity decline in a once productive area).

7.2.2 Methodology

Summarise the approach, including the interactions with and participation of local stakeholders and highlighting where the LADA methodology was and was not followed (i.e.

reasons for omissions, additions, changes; problems encountered etc.). List the secondary information reviewed and used, also the tools / methods used in the field (by LUS).

7.2.3 Characterization of the study area

The study area can be characterized using available secondary information (from technical services, projects and relevant statistics) and the information collected through the community focus group discussion and mapping. This research process should include, in particular: an analysis of perceived and actual changes in climate (rainfall amount and distribution, frequency of extreme events and, as appropriate, temperature changes), population and land use trends, average farm size, livestock type and numbers, land management practices, types of crop, tree and livestock production and yields, access to resources also implications of land degradation and natural resource management interventions over the last 10 or so years.

The section will be largely descriptive and should use the following checklist of issues to be addressed:

- Location, population and settlement history (period as appropriate e.g. up to 50 years) (including cultural and socio-economic stratification, demographic trends, etc.);
- Development activities in recent past (last 10 years), stakeholders involved and nature of their interventions and projects;
- Natural resources: brief description of the topography, soils, vegetation and biodiversity, water and hydrology, climate and wildlife;
- Main forms of land-use: grazing, crop cultivation, forest etc, land management, and income generating activities (business, processing, crafts, etc.), agricultural intensification/ diversification;
- Important formal and informal institutional features: identifying changes and trends in the last 10 years, access to research, extension, credit and financial issues;
- Community organizations (e.g. commodity groups, forest or livestock committees), marketing opportunities and restrictions;
- Land tenure regime: situation, changes and trends (state land, protected areas, ownership, tenancy (security of tenure), leasehold, common property, user rights, access rights), extent of fragmentation etc.;
- Main sources of livelihood: degree of diversification, income generation within and outside agriculture and food security;
- Main / common land related problems, constraints and implications in terms of livelihood strategies (past, present and trends) identifiable at the community level;
- Identifiable gender / socio-economic differentiation in land resources management;
- Indicators of wealth / poverty (to be used for wealth ranking);
- Relevant socio-economic infrastructure (hydraulic, education, health, roads, markets, others) and their accessibility;
- Linkages / interrelationships with neighbouring communities and territories.

This section should contain a copy of the participatory community territory map(s) (Tool 1.4) facilitated by support maps (topographic, soil, etc.) and / or remote sensing images (land cover, time-series NDVI etc.). These should display as much information as possible, including the locations of key resources, main areas and types of land degradation, main

conservation / SLM measures, location and route of the transect / reconnaissance visit and locations of the detailed sampling plots. The transect route can be illustrated using a Google Earth image on which the different landscape features (land use types, land units, severely degraded or restored areas) can be annotated.

The study area characterisation should also contain the transect diagram and indicators table, as well as tables / graphs and figures illustrating specific findings such as climatic and demographic trends based on secondary data.

Information to include in the synthesis (including tables and graphics)

Secondary information on the study area, for example:

- Population, income generating activities, socio-economic data;
- Climatic data (rainfalls, temperature, floods, droughts), farming calendar;
- Maps (topography, soil, bioclimatic zones, land cover and use, etc.);
- Projects / interventions of relevance to natural resources management.

Where possible, secondary data such as population, rainfall, market sales / prices and so forth, should be summarised and presented in the form of graphics. For example, the following graph of rainfall data from Tunisia (Figure 12) shows significant variability in monthly and seasonal rainfall, also in the length of summer dry period. The annual rainfall for the year(s) prior to the assessment can be plotted on such a graph to compare the current situation with the averages and to discuss with land users and compare reality (actual rainfall) with farmers' / herders' perceptions of wetter and drier years.

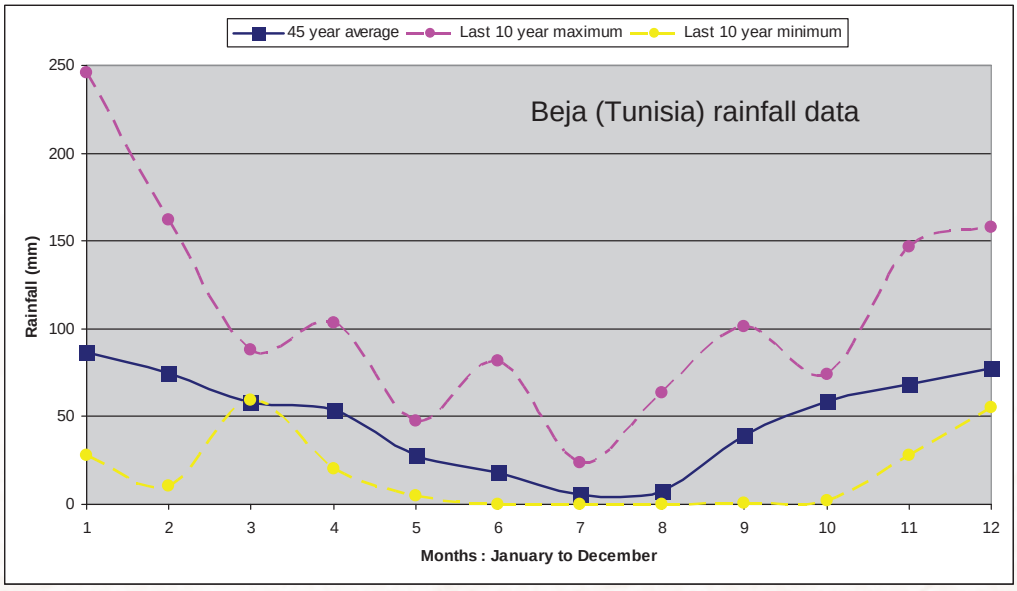

FIGURE 12 **Graph of rainfall data for Béja, Tunisia, over last 10 years**

[Note the Figure shows max. and min. rainfall in any 1 month for the last 10 years) compared to 45 year monthly average.]

Community focus group discussion findings are an important part of the assessment to understand land users perceptions and behaviour, see Photo 17

- Wealth ranking and land user typologies;
- Community mapping of the study area;
- Institutional mapping of relevant local/ external organisations and their influence (access to and use of resources, capacities, etc.);
- Identification of successful/best land resources management practices in the area.

Table 16 shows How to synthesize findings from a community focus group discussion (Tool 1.1)

Transect findings:

- Reasons for the selection of the transects, their locations (number and length) and what they show (e.g. to compare types of land users and degraded areas with well managed or protected areas);
- Transect diagram summarising information on each land use system / type;
- Maps (topography, aerial photographs, Google Earth images or sketches) to

PHOTO 17 **Group discussion in the field (Mendoza, Argentina) showing facilitator and land users**

TABLE 16 **Land use, livelihoods and socio-economic information in the study area**

Main LUS / LUT (1 to 3)	Land degradation types	Major Socio-economic and environmental changes (10 years)	Types of Land users	Income generating activities	Land uses and management practices	Vulnerabilities
1-			1.			
			2			
			3. etc.			
2- etc.						

PHOTO 18 **Transect crossing the landscape and several LUS (Siliana, Tunisia)**

show transect locations, LUS and the main land use types, water sources, degraded / well managed areas, roads, markets, towns, etc.

In Photo 18, this long transect runs across a range of land use systems and types from A - a forested mountain escarpment (LUS1- with protected and managed forest), to degraded "garrigue" (LUS2), to olive orchards (LUS3), to cultivated land for cereals (LUS4), to Z - a dam for water storage.

The above tools provide a synopsis of land uses, management and land degradation issues in the selected study areas, also an understanding of how socio-economic and institutional factors influence land users' perceptions and management of land resources at farm, community and landscape level. The community focus group discussion, wealth ranking and participatory community territory mapping, guide the location and conduct of transects (1-4 per study area) and reconnaissance assessment with the land users of soil, vegetation and water resources degradation and its conservation (stability) or improvement (restoration or rehabilitation) in relation to land use. The findings provide a rational basis for the location of sampling sites and households for more detailed assessments.

7.2.4 State of the land resources (and trends)

This chapter should present the analysis of the state of the land resources, along with some

perspective on magnitude and direction of recent historical changes. The term "recent" throughout the methodology means in approximately the last ten years, as this is a reasonable recall period to discuss with land-users and also corresponds to the time-frame used in the national level LADA assessment. In some cases, specific events may have had significant implications on LD / SLM over a longer recall time-period and these should then also be considered.

There should be both qualitative and quantitative information available. The quantitative and semi-quantitative data from the biophysical assessments (soil, vegetation, water, ecosystem services) should be integrated and triangulated with the information from the community focus group discussion(s) and livelihoods interviews. In many cases, land-users will identify key LD / SLM features from their perspective i.e. in terms of livelihood implications that are then assessed and compared using the biophysical tools. The land-users will also provide an historical context for the LD / SLM observed.

In many cases, information on a particular land use type (e.g. fenced, managed pasture) or on land degradation process (e.g. overgrazing) will be generated by several tools. For example, the community focus group discussion, livelihoods and land user interviews, soil erosion and vegetation assessment tools will all give information on pasture condition, quality and change dynamics. Hopefully most of the results generated by these tools will point in a similar direction and suggest a similar trend in regard to pasture and overgrazing. This process of drawing from several findings (qualitative or quantitative) to improve understanding is called **triangulation**.

The **comparative sampling strategy** will also help interpretation of results. For example, a good understanding of the state and recent dynamic of land resources supported by a comparison of a degraded area with a better managed area and / or an untouched protected area, will allow the team to identify the extent of degradation and the rate at which change is happening. It may also be possible to use this information to develop simple scenarios, looking at future changes in the "state" of the land resources and the changes in "impacts" that would follow. A "business as usual" scenario could be compared with scenarios where the land management improves and / or deteriorates. It might not be possible to do this in a sophisticated way (through modelling) using only the data provided by this methodology but some elementary scenario development will be possible.

For each land use system (LUS) along the transect and at all sampling sites, qualitative visual indicators and simple field measurements should be are made comparing well managed and poorly managed land and assessing the following:

VEGETATION AND BIODIVERSITY: This section should present and summarise the findings of the vegetation assessments (see Part 2, Tools 3.1 to 3.4) that were conducted with the land users for forest land, grazing land and cropland. This will include observations from quadrats or line transects (a $1m^2$ grid quadrat for herbaceous species; 5, 10 or $20m^2$ quadrats or a line transect in shrub / tree vegetation depending on the vegetation density) (see Photo 19). These should have been repeated (up to 3 times per site) where the vegetation is less uniform, to ensure it is a representative sample. The state of vegetation and biodiversity is determined by the observations of:

- Protective cover (% plant, litter, bare soil);
- Vegetation structure (% trees, shrubs, annual herbaceous species);

- Plant vigour (height, diameter), biomass, regrowth;
- Habitat and species diversity (richness; abundance; useful / undesirable / invasive species and products);
- Productivity (crop, livestock, forestry, energy);
- Effectiveness of vegetative conservation measures - wind breaks, reforestation, fire control, grassed strips, etc.

Trends can be determined from the interviews with local resource persons and land users and, where available, from the use of satellite images and aerial photos to compare the current situation with the situation over the last 10 years.

PHOTO 19 **Line transect to assess vegetation cover and species diversity (Tunisia)**

In croplands, as well as assessing where possible the crop(s) (where they are in the ground), the state of the natural vegetation should be assessed, such as the maintenance of field borders, vegetated strips or bunds, shrubs / trees in fields and around homesteads. The natural vegetation provides host plants / habitats for wildlife including beneficial predators of pests (birds, retiles and insects) and pollinators. A monocrop on a single farm (repeated year after year) or a tendency for all farmers in an area to grow the same crop will both result in a greater risk of pests and disease outbreaks (information from the land users). Crop rotations or sequences and crop mixes should be recorded, as these contribute to reducing community vulnerability to crop losses from drought, disease and pests.

SOIL: This section should present and summarise the findings of the soil assessment that was conducted with the land users for forest land, grazing land and cropland (see Part 2, Section 4). The soil is strongly influenced by vegetation and vice versa, so these findings could be usefully brought together for each land use type. The soil status and trends are determined from observations and measurements of a number of soil properties and of soil erosion:

SOIL PROPERTIES, including physical, biological, chemical properties, should have been assessed using the VS-Fast tools and indicators (see Part 2, Section 4) to provide a comparable score of soil health:

- soil surface and structure (cover, crusting, compaction, depth, water infiltration rate);
- soil organic matter and life - organic matter content, rooting, earthworms;
- pH, salinity, plant nutrient deficiencies.

SOIL EROSION should have been assessed in terms of activity (is it active, or partially or fully

stabilised?) and type of erosion (raindrop splash, rill, gully, stream bank, or mass movement?) and severity (none, slight, moderate, severe?) (see Photo 20 which shows how loss of protective cover exposes the soils to rill erosion and Photo 21 which shows exposed roots due to soil erosion).

A number of optional measurements can be used to estimate the volume of soil loss (depending on erosion type), where it is a critical issue.

The summary of the status and trends of the soil should bring together the findings on soil health and soil erosion as both are related. While soil types vary in erodibility, in general a well managed soil that is rich in organic matter and with a friable structure is less vulnerable to erosion.

Trends in soil erosion and runoff need to be determined from the land users and where available, from the use of historical satellite images and aerial photos (e.g. 10 years before) to compare with the current situation.

PHOTO 20 **Measuring percentage of bare soil and size & extent of rills / gullies (Tunisia)**

PHOTO 21 **Root exposure in stony shallow soil under woody garrigue (Tunisia)**

WATER RESOURCES: The section on the status and trends of water resources is derived from both the key visual water indicators and from discussions with land users (availability, quality, use, access, etc.). As the assessment is conducted at one moment in time, information on seasonality and changes in water resources must be obtained from the community discussion and key informant / households interviews, also secondary data (meteorological, rainfall gauging stations if available etc).
Indicators include:

- Rainfall (distribution, intensity, amount) and climate variability / change;
- Water sources (types, number, size), availability (seasonality) and water quality;
- Water uses for human consumption, livestock, agriculture, industry;
- Water resources management (over a 10 year period) (e.g. water conservation and harvesting activities);
- Water policy and institutional aspects (water allocation, rights and conflicts).

A focus should be placed on the effects of land uses and management on water for human and livestock consumption, also the effective (or otherwise) use of rainfall or irrigation water for agricultural production.

It is important to assess any off-site / landscape impacts of water resources degradation, such as flooding, sedimentation from runoff water or dust storms, salinity due to over-abstraction / irrigation, point contamination of water by housing or industry, upstream land use effects on resources downstream (e.g. water recharge, loss of productive land etc.). It is also useful for the team to think about these impacts not only in biophysical terms but also in terms of impacts on wider communities.

SLM TECHNOLOGIES AND APPROACHES: The evaluation of the effects of successful SLM practices and associated approaches in croplands, grazing and forest lands in the study areas is facilitated by the use of the WOCAT questionnaires. The report should include the effects on the productive, ecological and socio-cultural services provided by ecosystems. [See Part 1 Annexes 2 to 5.] It is possible to document these SLM Technologies (QT) and Approaches (QA) by uploading the assessment results as case studies in the WOCAT database to share the experiences more widely.] The questionnaires help in making the team more rigorous in the evaluation and in carrying-out additional research to collect required additional information that may not be immediately available. For example, information on required inputs and costs, constraints to adoption and effects, not only for preventing, mitigating or reversing land degradation but also the effects in terms of biodiversity conservation, sustainable use and climate change adaptation and mitigation. Such issues are of increasing value for policy makers. The WOCAT questionnaires and database are available on the WOCAT website **www.wocat.org**, also see CDE / WOCAT *et al.* 2008 and 2011 .

To sum up, the chapter assessing the status (and trends) of land resources should present the findings / data collected on the state of the land (and trends) by LUS for all the local assessment area (this may include several different study areas):

- Vegetation and biodiversity;
- Soil proprieties;
- Soil erosion;
- Water resources;
- Changes in the farming / production system (intensification, specialization, diversification, organic agriculture, no tillage, fragmentation, deforestation, reforestation) or protected areas (nature reserve, wetland, etc.);

Direct causes (pressures)	QM Code	Description	Cultivated commercial and irrigated			Grassland		
			Local		National	Local		National
			CA	Conv.		CA	Conv.	
Soil management (s)	s1	Cultivation of highly unsuitable/ vulnerable soils			x			
	s2	Missing or insufficient soil conservation / runoff & erosion control		x	x			
	s3	Heavy machinery	x	x	x			
		Tillage practice		x	x			
Crop + rangeland management (c)	c1	Reduction of plant cover and residues	x	x	x	x		
	c2	Inappropriate application of manure, fertiliser, herbicides, pesticides and other agrochemicals			x			
		Inappropriate irrigation			x			
		Inappropriate use of water in rainfed agriculture (e.g. excess soil evaporation + runoff		x				
		Occurrence and spread of weeds & invader plants						x
Overgrazing (g)	g1	Excessive numbers of livestock				x	x	
	g2	Trampling along animal paths						x
	g3	Overgrazing				x	x	
	g4	Too long or extensive grazing periods in a specific area or camp leading to over-use of palatable species				x	x	
	g5	Change in livestock composition						x

FIGURE 13 **Comparing direct causes of land degradation in local and national assessment (Kwa-Zulu Natal, South Africa)**

Direct causes (pressures)	QM Code	Description	Cultivated commercial and irrigated			Grassland		
			Local		National	Local		National
			CA	Conv.		CA	Conv.	
	g6	Others						x
Disturbance of the water cycle	w1	Lower infiltration rates/increased surface runoff		x				
	w2	Others- Siltation of rivers and stream- lack of CA upstream				x	x	
	w3	Others- Drying up of boreholes and E coli contamination	x					
Over abstraction/ excess with-drawal of water (o)	o1	Irrigation	x	x	x			
Discharges (p)	P1	Sanitary sewage disposal				x	x	
	P2	Waste water discharge				x	x	x

FIGURE 13 **Comparing direct causes of land degradation in local and national assessment (Kwa-Zulu Natal, South Africa)** *(continued)*

- Land degradation problems/types identified in the assessment areas (also locate them spatially in the LUS):
  - Prioritise LD problems by order of importance in terms of :
    - Severity
    - Extent
    - Impacts on ecosystem services and livelihoods.
  - For each selected successful / best land management practice (QA-QT) indicate;
    - Impacts on productivity, on major ecosystem services and livelihoods (use of assets, tradeoffs, vulnerability).

Throughout the report, diagrams, graphics and pictures will be useful to present the data collected (see examples in Figures 13 to 15). Figure 13 shows the comparison that was made through the local assessment of causes of degradation in conventional tillage versus conservation agriculture in cultivated land and of conservation practices versus conventional practices in grassland.

It is important to also provide / make available the field data from the local assessment, in the form of supplementary Excel database or in the LADA local database (forthcoming, in Access) for data analysis, as well as for future monitoring.

7.2.5 Driving forces & pressures

This section tracks back from observations made on the state and dynamics of the key land resources to the causal factors (i.e. the pressures (direct) and the driving forces (indirect)) and includes the analysis of direct and indirect causes of LD / or SLM adoption by LUS.

The focus group discussion (Tool 1.1 (FAO *et al.,* 2011b)) and the key informants and households interviews (Tool 7.1) will provide information on the drivers and pressures of land degradation. In many cases, specific management practices or specific demands people are making on the resources (.e.g. deforestation for fuelwood) are identified as the significant "pressures" on the land resources. Some of the driving forces may be environmental (e.g. drought, rainfall variability, climate change, pest attack) but many will be economic, social and institutional in nature (such as population growth leading to land fragmentation and over exploitation). For this reason, it is important to analyse the role and implications of the different local institutions (government agencies, NGOs, producers groups, community organizations, support groups, etc.) and how they influence land use and management practices of the various types of land users (large- and small-scale farmers including subsistence and commercial enterprises, also livestock keepers (traditional and commercial).

Figures 14 to 16 shows the use of data and graphs from secondary information sources, notably of increase in farmland area over 50 years and share of the population dependent on different livelihoods from agricultural /employment statistics for one study area in China, and of biomass dynamics over a 3 years period from remote sensing data for another study area.

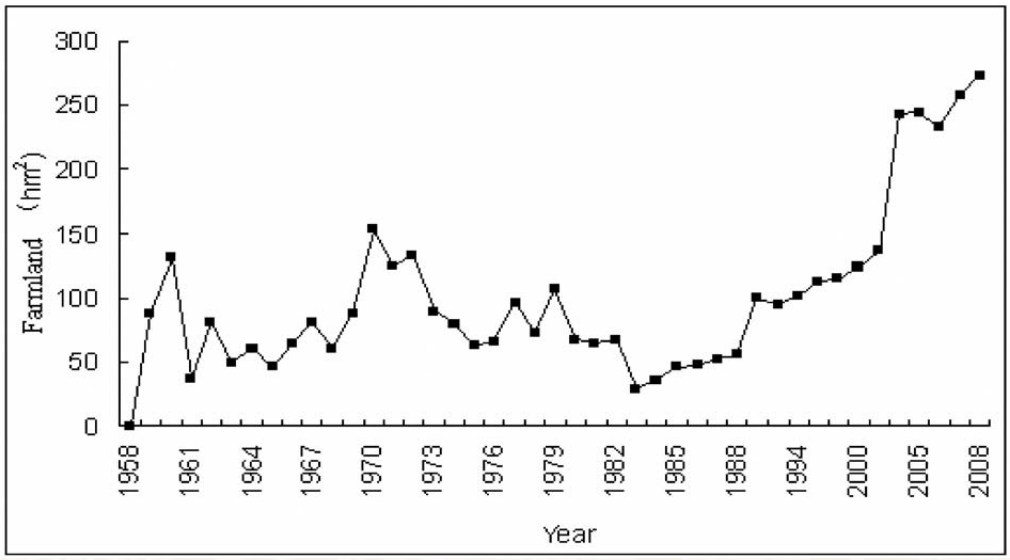

FIGURE 14 **Farmland change 1958 -2008 (China, Wengniute banner, Ulan'aodou)**
(in square hectometers – 1hm2 = 1 hectare)

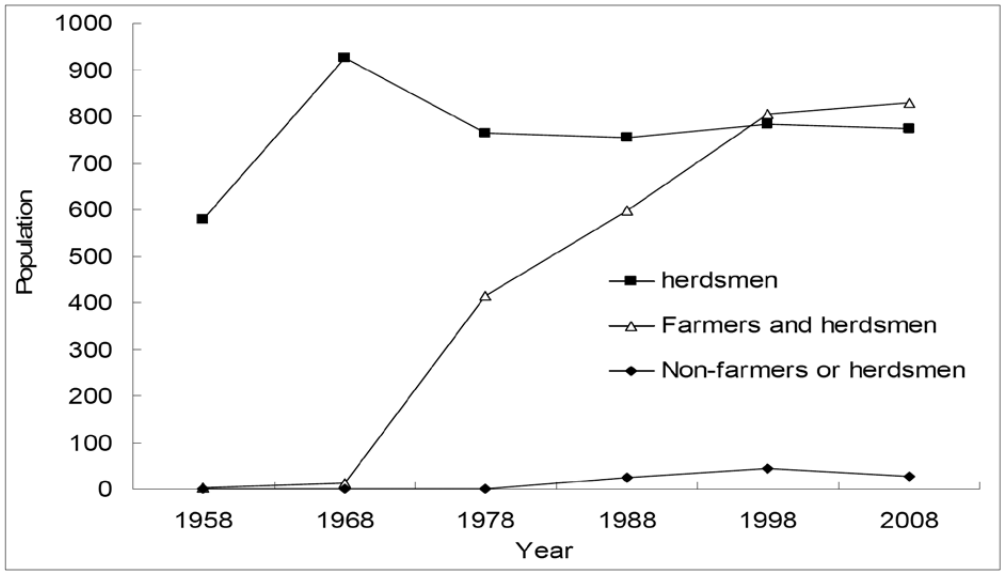

FIGURE 15 **Share of the population in different livelihoods 1958-2008 (Wengniute banner, Ulan'aodou, China)**

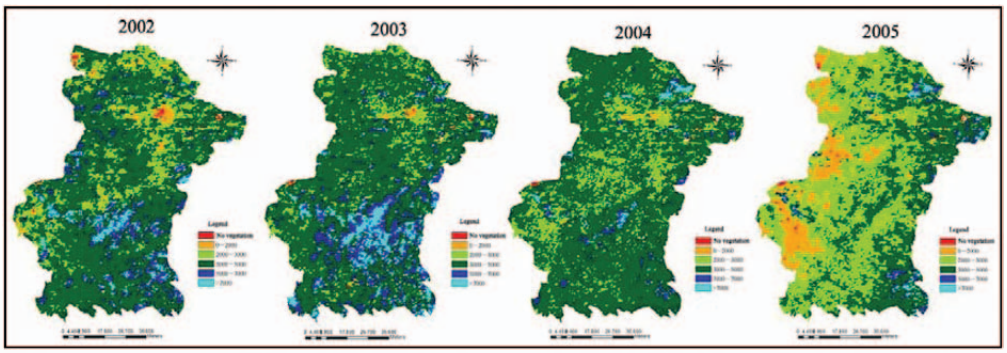

FIGURE 16 **Biomass dynamics 2002-2005 (Yanchi, China)**

Identification of direct and indirect causes of land degradation in the study area

Step 1: For each land use type in the study area, identify the main direct causes of degradation ("pressures" in DPSIR) using the list in Table 17 (below). First place a cross against all those causes that are relevant in the site.

Step 2: Then identify and if possible rank in importance up to 5 causes which are most important / critical in the given site (where 1 = most critical in terms of both severity and extent). Discuss these further in the report, in as much detail as possible, using specific examples from the assessment results.

TABLE 17 **Record of the main direct causes of land degradation in the study area**

LUS/LUT:..... Land user group:.....

Direct causes of degradation	Relevant	Major	Remarks
Inappropriate soil management (s)			
(s1) cultivation of highly unsuitable / vulnerable soils			
(s2) lack or insufficient soil conservation/runoff and erosion control			
(s3) heavy machinery (including timing of its use i.e. too wet / dry)			
(s4) tillage practice (ploughing, harrowing, etc.)			
(s5) others (specify under Remarks)			
Inappropriate crop and rangeland management (c) (annual, perennial, shrub and tree crops)			
(c1) reduction of plant cover and residues (e.g. burning, use for fodder)			
(c2) inappropriate use of manure, fertilizer, herbicides, pesticides, other agro-chemicals or waste (leading to contamination or non-point pollution)			
(c3) nutrient mining (excess removal and inadequate replacement)			
(c4) shortening of the fallow period in shifting cultivation			
(c5) inappropriate irrigation: inefficient method (full / supplementary, over-irrigation, insufficient drainage, use of salty water			
(c6) inappropriate use of water in rainfed agriculture (e.g. excessive soil evaporation and runoff			
(c7) bush encroachment and bush thickening			
(c8) occurrence and spread of weeds and invader plants			
(c9) others (specify under Remarks)			
Deforestation/removal of natural vegetation (f) due to:			
(f1) large-scale commercial forestry,			
(f2) expansion of urban / settlement areas and industry			
(f3) conversion to agriculture			
(f4) forest / grassland fires			
(f5) road and rail construction			
(f6) others (specify under Remarks)			

TABLE 17 **Record of the main direct causes of land degradation in the study area** *(continued)*

Direct causes of degradation	Relevant	Major	Remarks
Over-exploitation of vegetation for domestic use (e) and hence poor protection through:			
(e1) excessive gathering of fuelwood, (local) timber, fencing materials			
(e2) removal of fodder			
(e3) others (specify under Remarks)			
Overgrazing (g) (i.e. leading to a decrease in plant cover, fodder quality, soil compaction and in turn soil productivity decline and erosion			
(g1) excessive numbers of livestock			
(g2) trampling along animal paths			
(g3) overgrazing and trampling around or near feeding, watering and shelter points			
(g4) too long or extensive grazing periods in a specific area leading to over-utilization of palatable species			
(g5) change in livestock composition: from large to small stock; from grazers to browsers; from livestock to game and *vice versa*			
(g6) others - specify			
Land used for Industrial activities and mining (i) (i.e. leading to loss of land resources and their functions for agriculture, water recharge, and causing damage offsite through pollution, etc.			
(i1) industry			
(i2) mining			
(i3) waste deposition			
(i4) others - specify			
Land use for urbanisation and infrastructure development (u) (i.e. leading to loss of land resources and their functions for agriculture, water recharge, and causing damage off-site through runoff, erosion, pollution, etc.			
(u1) settlements and roads			
(u2) (urban) recreation			
(u3) others (specify under Remarks)			

Step 3: Carry out the same exercise to identify the indirect causes (drivers) of degradation in each site using the list in Table 18 (below). Place a cross against all those causes that are relevant in the site.

Step 4: Then identify and if possible rank in importance up to 3 indirect causes which are most important / critical in the given site (where 1 = most critical). Discuss these further, in as much detail as possible, using specific examples from the assessment.

TABLE 17 **Record of the main direct causes of land degradation in the study area** *(continued)*

Direct causes of degradation	Relevant	Major	Remarks
Discharges (p) leading to point contamination of surface and ground water resources, or excessive runoff off-site (neighbouring areas)			
(p1) sanitary sewage disposal			
(p2) waste water discharge			
(p3) excessive runoff			
(p4) poor and insufficient infrastructure to deal with urban waste (organic and inorganic waste)			
(p5) others - specify			
Release of airborne pollutants from industrial activities, mining and urbanisation (q) leading to:			
(q1) contamination of vegetation/ crops and soil			
(q2) contamination of surface and ground water resources			
(q3) others - specify			
Disturbance of the water cycle (w) leading to accelerated changes in the water level of ground water aquifers, lakes and rivers (improper recharge of surface and ground water) due to:			
(w1) lower infiltration rates / increased surface runoff			
(w2) others (specify under Remarks)			
Over-abstraction/excessive withdrawal of water (o):			
(o1) irrigation			
(o2) industrial use			
(o3) domestic use			
(o4) mining activities			
(o5) decreasing water use efficiency			
(o6) others (specify under Remarks)			
Natural causes of degradation (n):			
(n1) change in temperature			
(n2) change of seasonal rainfall			
(n3) heavy/extreme rainfall (intensity and amounts)			
(n4) windstorms / dust storms			
(n5) floods			
(n6) droughts			
(n7) topography			
(n8) other (earthquake, volcanic eruptions, landslides, highly fragile natural resources, etc.) – please specify			

TABLE 18 **Record of the indirect causes (Drivers) of LD in the study area**

LUS/LUT:.....

Indirect causes/drivers of degradation	Relevant	Major
Population pressure (p): High: may trigger or enhance degradation, e.g. by increasing pressure on resources or ecosystem services. Low: may lead to degradation through lack of labour to manage resources.		
Change in consumption pattern and individual demand (c): of the population or in the individual demand for natural resources (e.g. for agricultural goods, water, land resources, etc.)		
Land Tenure (t): Poorly defined tenure security / access rights may lead to land degradation, as land-users are reluctant to invest in management when returns are not guaranteed.		
Poverty (h): limits land-user investment and choice. Poor people often have no alternative but to use marginal land that may be particularly prone to land degradation (e.g. steeply sloping areas)		
Labour Availability (l): Shortage of rural labour (e.g. through migration, diseases, out migration) can lead to abandonment of traditional resource conservation practices such as terrace maintenance. May also alleviate pressure on land resources.		
Inputs and infrastructure (r): Roads, markets, distribution of water points, etc.: inaccessibility to, or high prices for key agricultural inputs such as fertilizers. Quality of infrastructure will affect access to input and product markets.		
Education, access to knowledge and support services (e): Educated land users are less likely to be poor (often have higher returns from their land) and more likely to adopt technologies. Education can also provide off-farm labour opportunities.		
War and conflict (w): leading to reduced options for using the land and reluctance to invest.		
Formal institutions (gf): formal laws, policies controlling access and use of land resources. Government induced interventions.		
Informal institutions (gi): local rules and regulations, social and cultural arrangements & obligations affecting access to resources.		
Climate variability and change (e.g. drought, rainfall variability, climate change which may induce change in pests, diseases)		
Other environmental changes /stresses e.g. change in land use such as shift towards monocultures leading to stresses such as pests, loss of cover, chemical pollution, etc.)		
Others (o): (specify)		

TABLE 19 **Record of the drivers of SLM**

Drivers of SLM (i.e. best practices)	Relevant	Major
Knowledge and skills (i.e. through training, extension)		
Institutions (i.e. strong producers' organisations, extension services etc.)		
Policy support (i.e. land rights, incentives)		
Legislative support (e.g. byelaws, recognition of common property resources etc.)		
Infrastructure and services (roads, markets, credit etc)		

Step 5: Rather than just a simple case of a driving force exerting a pressure on a resource, it is important to identify where there may be a more complex chain of explanation or a hierarchy of driving forces and pressures (i.e. driving force A causes driving force B, causes pressure A, causes LD). Document these cases as described in Box 5. These interrelations are particularly important if they affect a large number of land-users or if they are found in several LUS or study areas.

Where possible, a flow chart should be prepared with the land users to show the cause effect relations.

7.2.6 Impacts on ecosystem services

Adopting an integrated ecosystem approach improves understanding of the biophysical and socio-economic / human interactions that determine land degradation or improvement.

Drawing on the findings of the reconnaissance visit / transect walk and during the detailed site assessments of vegetation, soil and water resources, the LD / SLM impacts on ecosystem services are assessed including impacts on:

Production and productivity:

- production of food, fibre, energy (through crops, livestock, forestry), other goods;
- water productivity, availability of land;
- risks of crop failure, livestock / tree mortality, etc.

Ecological regulation and life-support:

- nutrient cycling – break down of organic matter, soil fertility replenishment, pollution (nitrates, phosphates, etc.);
- carbon cycling - C sequestration through biomass production, organic matter management (including reduced tillage), and regulation of GHG emissions (biomass burning, methane emissions from livestock and irrigated systems, fuel emissions from mechanised farming, etc.);
- maintenance of the hydrological cycle / regime (rainwater retention, flow, protection of wetlands, purification, flood and drought severity and incidence and salinization (e.g. where evapo-transpiration exceeds precipitation);
- conservation of biodiversity and associated functions (pollination, biocontrol of pests and diseases;
- climate regulation – through shade, windbreaks, water conservation etc., which also contribute to climate change adaptation.

Socio-cultural services (i.e. those provided by the environment), including;

- livelihoods (e.g. farming, forestry, fisheries, ecotourism);

BOX 5 Example of direct and indirect drivers of land degradation: a chain of explanation

In this example two neighbouring banana farmers in SE Uganda were encountered on apparently very similar land. Farmer A was conserving his land with trash lines, grass strips and ditches, farmer B was not. The first impression of the extension officer was that farmer B was not interested in protecting his land as he had been shown the same techniques and given the same help as farmer A. A brief but careful discussion with the farmer lasting perhaps 20 minutes revealed the following - presented here as a "chain of explanation":

- Farmer B had in fact tried the recommended SWC techniques several times but the force of water coming from upslope was too great and the ditches and trash lines were washed away – why? ▸
- Because upslope fields in supposedly protected forest areas had been recently opened up leading to a greater volume and force of water on his land during heavy rains –why? ▸
- Because some farmers were able to open fields without problems in these areas, even though there are local bye-laws prohibiting this – how? ▸
- Because the families involved were influential within the village and few could oppose them and anyway government forest protection policies / local byelaws were poorly enforced and ineffective.

Thus, in a relatively short time it becomes clear that the driving force of this problem is not the farmers' attitude, nor even the techniques themselves (though more effective options might be available) but weaknesses in the formal and informal institutions protecting forested watersheds and problems with their enforcement. A "chain of explanation" is apparent with a sequence of linked factors or influences contributing to create the situation observed in the field. Understanding this chain is useful as not only are interventions frequently possible at several points in the chain but the most appropriate point of intervention is often not one that addresses the most immediate cause of the problem. In this example it might be more appropriate to look closely at local forest protection by-laws and community capacity to enforce them rather than just giving the land-user the best available advice on SWC. Improvements in by-law enforcement might benefit large numbers of land-user without requiring them to invest more of their resources in soil protection.

- spiritual and aesthetic value (e.g. landscape or recreation value);
- vulnerability / risk aversion (conflict resolution, food security).

Table 20 provides an example of how to score the impacts on each service and describe the relevant change. It uses the example of irrigation in and around a wetland

This shows, for example, that the effect of the given land management practice on food security may be positive or negative depending on the type of land user.

The DPSIR framework (see Chapter 2) encourages teams to look at the impacts of land degradation on both ecosystem services and livelihoods. The LADA methodology does not intend to deliver a full ecosystem services assessment but focuses on the main ecosystems services affected by LD / SLM, in particular the provisioning services (food production from crops and livestock) as these capture the main productive uses people derive from their land resources and can be more readily assessed. However, it is important to think more broadly about ES impacts. The analysis should generate some information on important ecological (regulating and supporting) and socio-cultural services from which it will be possible to infer the impacts of LD / SLM on these services using the assessment findings. This may be backed-up by available scientific knowledge from relevant studies and research (e.g. changes in water table, river flow and water supply; sedimentation of reservoirs, soil analysis of nutrients and carbon etc.).

The information on ES impacts will be derived largely from qualitative information from the

TABLE 20 **Impacts on ES of a given land management practice**

Example of irrigation in and around a wetland

Ecosystem Services	**Impacts** (-3 to +3)	**Description**
Productive services		
P1 animal / plant quantity and quality	+2	increased yield due to irrigation
P2 water for human, animal and plant use	- 3	river water extraction reduces flow and quality
P3 land availability (productive area/caput)	+1	wetland developed for irrigation
Ecological regulating & life support services		
E1 Hydrological regime	- 2	downstream water shortage; risk of flash floods
E2 Carbon cycle	- 2	C emissions from drained wetland
E3 Species diversity	- 2	reduction in number of cultivated species /loss of wetland species.
Socio-cultural services		
S1 Food security.	+/-	More food but poorer farmers not benefiting
etc.		

community focus group discussion and key informant and household interviews, as well as on the findings of the biophysical assessment including impacts of land degradation on soil, water resources, vegetation (biomass quantity and pasture quality) and crop, livestock and tree / forest productivity.

A procedure is provided below to help the team members to carry out a simple analysis of LD / SLM effects on some key ecosystem services. A simple scoring system is provided to assess and prioritize, through in-depth discussion, those impacts believed to be most significant.

Identification of land degradation impacts on ecosystem services in the study area

The aim of this part of the analysis is to identify the wider effects of LD / SLM on different ecosystem services. The range of key ecosystem services are listed in Table 21 (below) and for each suggested indicator a possible proxies are given.

Step1: For each land use system, assess the type of ES impacts caused by LD / SLM according to the list of potential impacts in Table 22 and Table 25 Impacts should be assessed in areas with land degradation through comparisons with areas without land degradation (i.e. areas that are already well managed or protected).

Step 2: For each type of impact identified determine the degree of impact from -3 to +3 (see Table 21). The same land degradation process can cause negative and positive impact(s) at the same time (e.g. erosion in one place can lead to accumulation of fertile sediments further downslope or down stream). Moreover, it can affect positively or negatively the food security of different land users.

Step 3: Identify and rank in importance (1 to 5) a few of the most significant ecosystem service impacts identified by land use systems (see Table 22). Discuss these further, in as much detail as possible, using specific examples from the assessment results.

Step 4: Take care to consider whether the effects of degradation have been partially hidden or compensated by various response measures by the land users. For example, fertilizers may be used to

TABLE 21 **Degree of impact on ecosystem services**

-3	High negative impact: - land degradation contributes negatively (>50%) to changes in ES
-2	Moderate negative impact: - land degradation contributes negatively (10-50%) to changes in ES
-1	Low negative impact: - land degradation contributes negatively (0-10-%) to changes in ES.
0	No observable change/impact
+1	Low positive impact: - land degradation contributes positively (0-10%) to the changes in ES
+2	Moderate positive impact: - land degradation contributes positively (10-50%) to the changes in ES
+3	High positive impact: - land degradation contributes positively (> 50%) to changes in ES.

TABLE 22 **Record and rank the types and level of impacts of LD on ecosystem services Record all relevant ES and then rank the 5 most significant ones (1 to 5)**

LUS/LUT:..... **Land user group:.....**

Type of impact on Ecosystem services	Impact (-3 to +3)	Rank (1- 5)	Description of the Impact on ES
P Provisioning services			
(P1) production (animal / plant quantity and quality including biomass for energy) and risk			
(P2) water (quantity and quality) for human, animal and plant consumption			
(P3) land availability (area of land for production per person)			
(P4) others (specify under description column)			
E Regulating and supporting services			
a) Hydrological services:			
(E1) regulation of excess water such as excessive rains, storms, floods e.g. affecting infiltration, drainage, runoff, evaporation, etc.			
(E2) regulation of scarce water and its availability e.g. during dry seasons, droughts affecting water and evaporation loss, etc.			
b) Soil services:			
(E3) organic matter status			
(E4) soil cover (vegetation, mulch, etc.)			
(E5) soil structure: surface (e.g. sealing and crusting) and subsoil affecting infiltration, water and nutrient holding capacity, salinity etc.			
(E6a) nutrient cycle (N, P, K)			
(E6b) carbon cycle			
(E7) soil formation (including wind-deposited soils)			
c) Biodiversity:			
(E8a) biodiversity at habitat level			
(E8b) biodiversity at inter- and intra- species level (plant varieties, animal races etc)			
(E8c) associated species and functions (Pest and disease control- above and below ground; pollinators; soil organisms			

TABLE 22 **Record and rank the types and level of impacts of LD on ecosystem services** *(continued)*

Type of impact on Ecosystem services	**Impact** (-3 to +3)	**Rank** (1- 5)	**Description of the Impact on ES**
d) Climate services:			
(E9) greenhouse gas emissions (CO_2, methane, etc.)			
(E10) (micro)-climate (wind, shade, temperature, humidity)			
(E11) others			
S Socio-cultural services / human well-being			
(S1) spiritual, aesthetic, cultural landscape and heritage values, recreation and tourism			
(S2) education and knowledge (including indigenous knowledge)			
(S3) conflict transformation			
(S4) food & livelihood security and poverty			
(S5) health			
(S6) net income			
(S7) protection / damage of private and public infrastructure (buildings, roads, dams, etc.)			
(S8) marketing opportunities (access to markets, etc.)			
(S9) others			

Source: This list has been adapted from the Millennium Ecosystem Assessment (WRI, 2005)

partly compensate for the productivity loss caused by soil erosion and nutrient loss, however the inherent soil fertility may be being impoverished; or the treatment of polluted water may be used to compensate for the decline in water quality. Factors that are not related directly to land degradation but a consequence of reduced ecosystem health or resilience may contribute to yield declines (e.g. pests and diseases, weather influences).

Step 5: Provide any additional information on the LD and SLM impacts on ecosystem services for the main types of LD / SLM respectively see Table 24 and 25.

7.2.7 Impacts on people and their livelihoods

One of the objectives of a livelihoods analysis is to deliver an improved understanding of how socio-economic, cultural and institutional factors influence land-users' views and their management of their land resources. It helps analyse both the drivers and pressures leading to LD / SLM and the impacts of LD / SLM on people. Understanding these LD drivers helps to identify policy responses for the diverse land user groups.

TABLE 23 **List of SLM impacts on ES**

Production/ economic benefits of SLM	Socio-cultural benefits of SLM	Ecological benefits of SLM

• Increased crop yield (CY)
  - increased animal production (AP)
  - increase fodder production
  - increased fodder quality
  - Increase wood production (WP)
• Reduced risk of production failure (RF)
• Increased water availability / quality (W)
  - household
  - livestock
  - irrigation
• Reduced demand for irrigation water (DI)
• Reduced expenses on agricultural inputs (AI)
• Increased farm income (FI)
• Diversification (D) of
  - products
  - income sources
• Increased production area (new land use) (PA)
• Other (PO):
	• Community institution strengthening (C)
	• Improved conservation/ erosion knowledge (K)
	• Improved situation of socially and economically disadvantage groups (S)
	• Improved food security/ self-sufficiently (F)
	• Conflict mitigation (CM)
	• Improved health (H)
	• Other (SO):
		• Increase water quantity and / or quality (W)
		• Improved harvesting/ collection of runoff (R)
		• Increased soil moisture / reduced evaporation) (SM)
		• Improved land cover (reduced runoff) (LC)
		• Recharge of groundwater table / aquifer (G)
		• Reduced hazards (flood, drought, storms) (H)
		• Reduced wind velocity (WI)
		• Increased biomass (B)
		• Increased soil organic matter (nutrient recharge) (OM)
		• Reduced greenhouse gases and C emissions (C)
		• Reduced soil loss (SL)
		• Reduced soil compaction/ crusting (SC)
		• Reduced salinity (S)
		• Increased animal and/or plant diversity (D)
		• Reduced invasive species (IS)
		• Increased pest control (PC)
		• Other (EO):

TABLE 24 **Land degradation types and impacts on ES at site and landscape levels**

Land degradation type	Main ES affected	
	Site level	Catchment / landscape
Overgrazing	• reduction in protective vegetation cover • reduction in species diversity and pasture quality • shortage of water in water points	• increased runoff and erosion • reduced carrying capacity for livestock and wildlife • lack of recharge of groundwater and sedimentation of water points
etc.		

There are many examples from dryland areas showing that providing land-users with technical options for more sustainable land management can be useful, but it is rarely enough on its own to change behaviour significantly in the long-term.

Attention is paid in the land use / livelihood analysis to consider what people are already doing or trying to do to manage their resources and meet their needs. Why are certain households, innovators or succeeding entrepreneurs? What

TABLE 25 **Impacts of sustainable management practices on ecosystem services**

	Impacts on Ecosystem Services		
SLM measures & interventions	**Production/socio-economic benefits**	**Socio-cultural benefits**	**Ecological benefits**
Reduced tillage	Increased crop yields	Reduced manual land tillage	Improved rainwater infiltration and reduced evaporation Reduced sheet erosion
etc.			

are the constraints or opportunities for others to follow? In a specific study area it may be possible to identify several different strategies: those intensifying crop or livestock farming; others who depend on mobility and diversified income from off- farm work and so forth.

The review of assets (pentagon diagram – Figures 17 and 18) helps readers to understand the strategies and trade-offs operating (e.g. natural assets such as forests and land quality may be drawn down in order to build up human capital in the form of education or health care). In the short term, households find ways to cope with change but in time their longer strategies also need to be adapted to the new context. In this regard, the expert teams should pay attention to the ways that households and wider communities are coping with and adapting, notably to population pressures and climate change (for example pressures on land and fragmentation may influence their coping strategies to address rainfall variability or increased incidence of extreme events - storms, drought, floods etc.).

The LADA local livelihoods (socioeconomic and institutional) analysis should be completed using information from:

- **Community Focus Group Discussion** (Tool 1.1 (FAO et al., 2011b)): This generates initial information about the range of land-users, their individual and communal land management regimes and the area history. It also informs on how the socio-economic and institutional factors influence land users' perceptions and management of land resources at landscape level. It helps in interpreting secondary information.
- **Wealth ranking** (Tool 1.2) is used to categorize the household / livelihoods in the community in terms of relative wealth status or wellbeing since this determines views and behaviour in relation to the land resources that are used directly (e.g. farmland) and those in the wider study area (fuelwood, water, recreation). Both the extent to which people are responsible for LD / SLM and how they are affected by the impacts of LD / SLM are strongly linked to their wealth status.
- **Institutional mapping** (Tool 1.3) shows the different stakeholders and their roles and influence in term of sustainable land management.
- **Household livelihoods interviews** (Tool 7.1): These help identify most of the

relevant issues that determine sustainable resource use and land degradation and "trends" or changes over the last 10 years or so. Based on the 20-30 households interviewed (depending on community heterogeneity), it is possible to identify the socio-economic and institutional factors influencing how land users view and manage their land resources. Moreover, the various categories of land users identified during the wealth ranking will serve as a basis for the livelihoods

BOX 6 **Questions that the livelihoods assessment should try to answer**

Who is being affected by land degradation? Who is practising / benefiting from sustainable land management (SLM) and who is not (wealthy / poor, men / women)? and Why?
Why is there a diverse and patchy engagement in SLM by communities?

How does land degradation / engagement in SLM (prevention and restoration) relate to specific livelihood features and strategies
"Good" and "bad" land management often fits within a quite deliberate livelihood strategy in terms of risk aversion, market orientation, diversification, etc. Understanding the key elements of this strategy can explain behaviour and help guide support interventions.

What are the important socio-economic, institutional and policy drivers for land degradation, SLM and dryland development (e.g. population pressure, tenure security, effectiveness and fairness of local governance, markets / market access, infrastructure, national / regional policies).
It is important throughout the socio-economic component of the assessment to identify what are the main drivers of behaviour leading to LD, and also what are the main incentives for practicing SLM.

How does policy affect land degradation and facilitate or hinder engagement in land degradation control / SLM?
Policy influences fall within the "institutional" question above but there should be a direct consideration of the impact of national and regional policies on land management. There will almost always be a particular policy or policy process (or a policy vacuum, implementation gap, perverse outcome etc.) affecting the behaviour of land-users with respect to their land.

In addition to the natural resources assets, what roles do social, financial, human and physical forms of capital (assets) play at the local level in influencing perspectives on land and its management?
The livelihoods approach helps to adequately address all the assets: natural (land resources,) **social** *(i.e. community organisation),* **financial** *(income, access to credit/savings etc),* **human** *(i.e. capacity, know-how) and* **physical** *(i.e. infrastructure) and gives great emphasis to the role of asset access and ownership in influencing land management behaviour.*

What are the important trade-offs land-users make between the different assets to which they have access and how do these affect land management?
It is vital to develop an understanding of the strategy of the land-user and the tradeoffs that that household has been obliged to make.

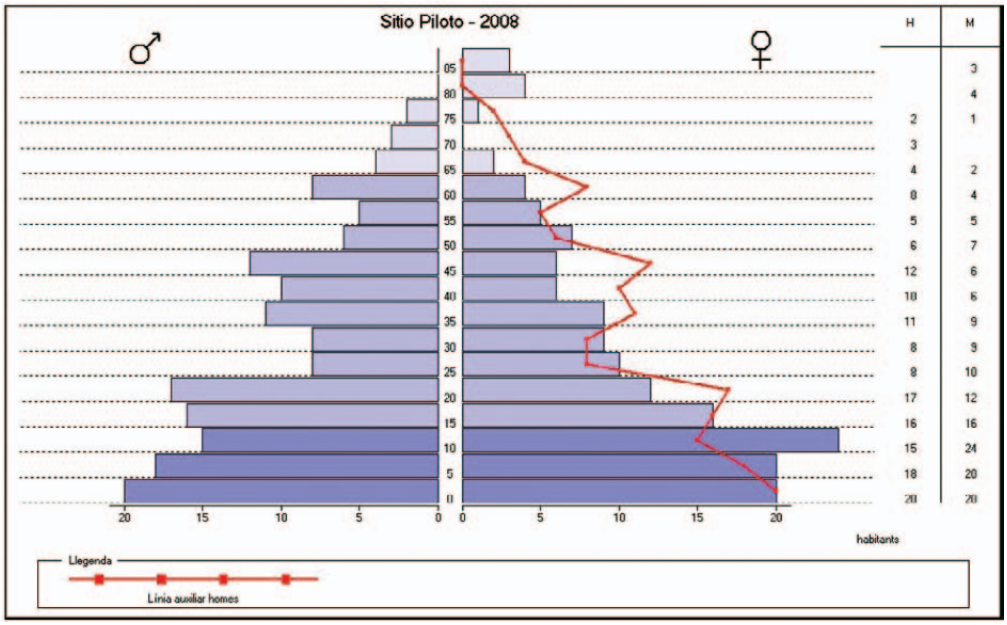

FIGURE 17 **Population pyramid (Mendoza, Argentina)**

analysis as it will help categorise the household interviewed. The capital assets of that household which represents a given wealth group can be shown on a pentagon diagram.

- **Key informants and land users interviews** (Tools 5.1, 5.2 and 5.3) help cross-check and further discuss specific aspects of LD problems and SLM responses, and issues less visible in the field such as water resources, use of farm inputs, livestock management, experiences of by laws and policies, and risks of current practices and or their conservation effectiveness and benefits and constraints to adoption of SLM practices.

Secondary information should be used to complement and validate the information gathered through discussions and interviews (e.g. on household size distribution to ensure the sample of households interviewed is representative or on population growth or age distribution see Figure 16).

The interpretation of assessment results should be complemented by results of the discussions with key informants and community members. It is essential to obtain community feedback on assessment findings, to complete the understanding and develop recommendations for action from community to policy levels.

The results should provide information on the pressures on land resources caused by land-users, their effects on land resources (status and trends), the consequences of LD / SLM on ecosystem services and the impacts on

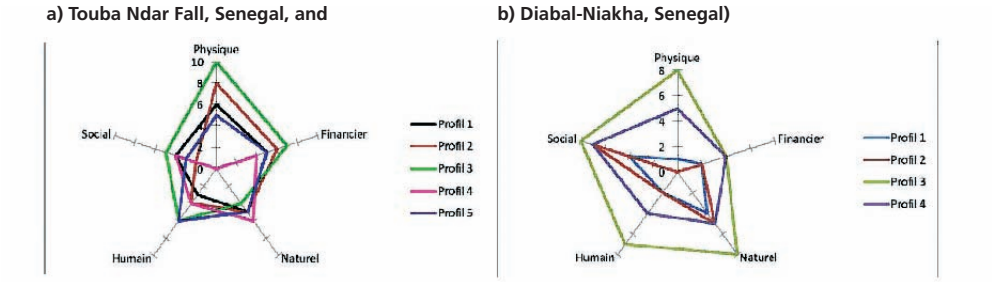

FIGURE 18 **Analysis of household profiles of the working population in Senegal**

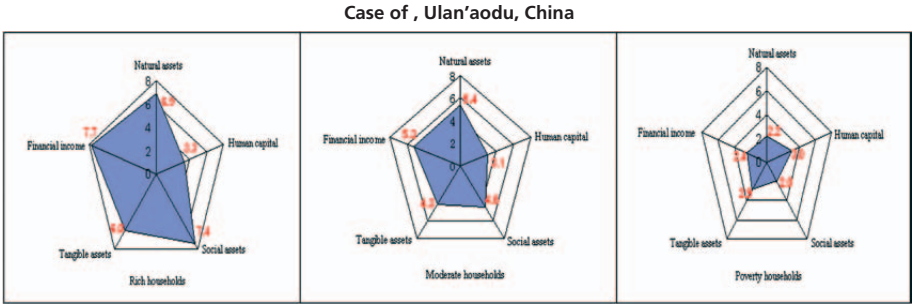

FIGURE 19 **Analysis of profiles of the household working population in China**

household livelihoods (e.g. in terms of food insecurity, poverty, out-migration[6]). Asset pentagons (see Figures 17 and 18) can be drawn for each of the household profiles identified showing different livelihoods strategies, trade-offs and management practices.

Any trade-offs that the various households are making over time (e.g.5 -10 years) in terms of their various assets should be analysed to understand and guide how to intervene to prevent the continuous drawing down of natural resources and promote more sustainable and productive practices. Strategies of small and large farmers can be assessed in terms of technologies (prevention, mitigation, restoration) and investments in SLM (labour, funds etc) and the effects of markets, policies and laws.

Analysis of these findings helps to understand the constraints and extent to which land users are addressing LD. It also reveals the various factors that influence the land users' perspectives on their land resources and that enhances or constrains their ability to practice SLM or LD control / rehabilitation. Besides land users' knowledge of improved management options and socio-economic situation (relative poverty), factors relating to resource and market access,

6 The approach draws on the work on sustainable livelihoods analysis by Ellis (2000) and Carloni (2005).

access rights, tenure and other institutional / policy issues, including associated perverse outcomes (indirect negative effects), should be addressed.

Procedure for identifying the asset indicators for different household profiles

The impacts of land degradation on households such as food insecurity, poverty, out-migration, etc., can be analysed using information from the group community discussion and household interviews. The information on wealth / poverty indicators obtained from the community discussion can help to identify relevant associations between:

- wealth / poverty and land-user activity that causes LD / SLM;
- wealth / poverty and the type / severity of impacts;

In most situations, "wealth" will be the most useful way to stratify the sample of households and land-users interviewed (Tools 5.1, 5.2 and 5.3 (FAO *et al.*, 2011b)) in the study area (see Table 26). However, other social groupings such as by main livelihoods activity, gender, ethnic group, age etc. may also be relevant in many areas.

The sustainable livelihoods approach is based on an appreciation of the assets diversity, activities and strategies, and of the forces affecting and constraining the way those are conducted. These forces are the:

- Public and private sectors and civil society structures;
- Vulnerability context, trends, shocks and seasonality; and
- Processes including policies, laws, institutions, socio-cultural relationships.

These forces affect the value of the assets, access rights, household capacity to be involved in particular livelihoods activities and strategies, and affect also the results of those activities. It is important to elaborate on the impacts on the livelihoods assets and strategies (socio-economic conditions) for the different typologies of land users present in the study areas on the basis of the community focus group discussion and households, key informant and land users interviews (Tools 1.1, 7.1, 5.1,5.2 and 5.3, Part 2).

The asset profiles of the different households can be represented graphically to highlight trade-offs in their livelihoods strategies. This analysis should be conducted with at least 20 (20 to 30) households responsible for managing the land assessed under the detailed bio-physical assessments.

Step 1: Identify the most relevant indicators for each asset based on the initial community wealth ranking. Some common indicators for the different types of assets are given in Table 27 (below). These should illustrate the differences between different categories of land users (better off, average and poor). Any association

TABLE 26 **Households classification by typology and wealth**

Land user Typology	Households wealth class		
	Poor	Average	Better off
Farmer			
Herder			
...etc.			

TABLE 27 **Typical important indicators in determining relative wealth at household level**

Capital Assets	Indicators*
Physical	House, car, farm equipment, tractor, bicycle, animal traction, TV
Financial	Land ownership, saving, credit, insurance, income from farming, off- farm income, subsidies
Natural	Size of crop land, size of grazing land/pasture and quality, size of forest land, timber, fuelwood, forest products (honey, medicine), water (rainfed or irrigation), livestock number
Human	Health, labour, education, knowledge, skills
Social	Kinship networks, associations, membership organisation, peer group networks, access rights (land / water), access to technical assistance, access to markets, access to financial services, access to health services, access to education, access to safe drinking water and sanitation

* This list is not ordered and not exhaustive. Context specific indicators should be identified by the team with the community.

between LD / SLM or impacts felt and wealth groups should be identified and discussed.

Step 2: Give each household a score (1-10) for each capital asset and fill in Excel as in Table 28 (below).

Step 3: Identify the different household profiles that reflect groups of similar households interviewed in the study area, this may not exactly coincide with the wealth ranking.

Step 4: Create the asset pentagon for each of the household profiles identified showing different livelihoods strategies, trade-offs and land management practices.

Step 5: A written section should describe the different household profiles present in the study area, as reflected in the asset pentagon, explaining drivers and pressures causing land degradation and the impacts of land degradation on land users.

7.2.8 Responses

Once the impacts, driving forces and pressures have been identified and analysed, the current responses of land users and communities and decision makers (e.g. incentives for certain crops or land uses, regulations, land registration etc.) can be better understood and contextualized.

TABLE 28 **Summary scoring (1-10) of most relevant indicator(s) for each asset**

Household	Capital Assets				
	Physical	**Financial**	**Natural**	**Human**	**Social**
1					
2					
3					
N					

This section of the analysis and report should present:

The actual responses (already undertaken in the study area);

- Type and efficacy of existing land management measures and practices;
- Support measures available;
- Constraints in their larger adoption.

Propositions of appropriate responses/options (proposed):

- Proposed solutions by categories of land users and wealth:
- Recommendations for:
  - Land users;
  - Stakeholders and decision makers at national, provincial/local levels.

Feedback loops exist between the driving forces, pressures, impacts on people livelihoods and responses (e.g. a negative impact on an important ES will lead to a negative impact on people perhaps causing them to adopt behaviour that creates increased or new pressures on the state). It is often possible to identify positive (or virtuous) and negative (or vicious) spirals and feedbacks and these should be analysed and well understood.

There are a number of cost-benefit tools that can be used to quantify the costs of land degradation and the benefits of control (see Stocking and Murnaghan, 2001) and these can be used in the analysis if useful. Undeniably, soil erosion involves a cost to land users in terms of declined crop yield or increased input demand in order to maintain yield. Comparing the costs and benefits of land degradation and conservation can help land users to make decision on when and where conservation measures should to be taken, as most conservation measures involve extra costs, labour, material or the land forgone.

Procedure to develop response options

The response options should be based on the assessment results and discussions with land users and local authorities. It could be useful to synthesis these by enumerating the types of land degradation and sustainable land management present in the assessment area and locate them spatially in relation to the LUS (see Table 29). Land degradation types can be ordered by severity, extent, and level of impact on productivity. Second, indirect (drivers) and direct (pressures) causes should be summarized, also by order of importance. Then the team should identify the responses required to preventing and mitigating land degradation and enhancing sustainable land management, including: How to increase the adoption of positive responses to land degradation, and their efficacy? What are the needs in terms of training and capacity building? It is important to develop sequences or chains of explanation linking major land degradation types to their causes to the responses required. The proposed responses can be detailed in terms of where (spatially), who (which land users), costs and how to implement them.

Step 1: Analyse the effectiveness, uptake, and constraints to adoption of the key sustainable land management practices identified in the study area to maintain land productivity and ecosystem services.

Step 2: Identify the sequences of responses to prevent or mitigate land degradation (see Table 30). What are appropriate responses? At what level? By which stakeholders? What are approximate costs and means of implementation?

At this stage, extreme care needs to be taken to ensure that proposals remain as possible options

TABLE 29 **Sustainable land management**

Land Degradation Problems	Sustainable Land Management Practices	Conservation Effectiveness (+, neutral or -)	Extent of uptake by land users in the LUS (%)	Constraints to Adoption *

* For example Constraints = No perception of land degradation. No incentives to adopt SLM practices (e.g. insecurity of tenure, seasonal migration, etc). No capability to remedy (e.g. land shortage, labour unavailability lack of capital) etc.

TABLE 30 **Potential responses at different levels of decision making / responsibility**

Recommendations	National level	Provincial level	Other (locality, watershed, etc.)
Policies and strategies			
Land use planning and development- review of actions plan			
Regulations			
Institutional mechanisms			
Techniques • Training • Awareness • Support (inputs, credits, etc.)			

until they have been fully assessed with the community and relevant technical specialists in terms of appropriateness, cost-benefit analysis etc.

The drawing of an organizational mapping (or Venn diagram) can be useful to represent the multiple stakeholders involved in implementing the proposed responses, their interrelations, and their importance.

Moreover, a simple Multi Decision Criteria Analysis (MCDA) could be used to prioritize

TABLE 31 **Simple MDCA for responses analysis**

Response Options	Environmental Criteria			Economic Criteria	Socio-cultural Criteria
	We	Wo	Wa		
Response A	Score				
Response B					
Response C					

e.g. Response A= We x score + Wo x score + Wa x score +...

TABLE 32 **DPSIR analysis by LUS**

LUS	State	Drivers and Pressures	Impacts on ecosystem services and livelihoods	Responses

the response options against a set of criteria identified important based on the assessment (see Table 31).

The criteria should be selected based on the assessment results in terms of the main / priority land degradation types and environmental / livelihoods problems in the area and the scores were given by experts based on the performance of the response option to address each criteria (scale 0-1).

Step 3: Complete a synthesis table summarizing the DPSIR by LUS to link the analysis of the state/trends, with the causes, impacts and responses (see Table 32).

One of the outcomes of the assessment process will be the quantification of the vulnerability of specific physical and human components of the system and the system as a whole in regard to land degradation (i.e. vulnerability of the natural resources, the various livelihood situations and the interactions between human activity, the resources and ecosystem functions).

The identification of future responses should obviously be carried-out in close collaboration with communities, decision-makers and other stakeholders involved (i.e. projects, NGO's etc.) in the area. In order to share and discuss the results of the local assessment, it can be useful to organize a workshop with all stakeholders involved in land degradation control and sustainable land management at regional level. The comments, concerns and recommendations of potential follow-up actions resulting from this stakeholder consultation should be part of the report.

The two pairs of photos below (Photo 22) show the substantive effects of SLM interventions in dryland areas

7.2.9 Conclusions and policy recommendations

This section should be addressed to decision makers and is useful to identify the priorities, aspects that need more in-depth assessment

PHOTO 22 **Degraded land to SLM - before and after project (Xiaobazi, China)**

in order to help future decision making on investments and to:

- Show and analyse any relevant maps from the national LD / SLM assessment of
- LD type, extent, severity, causes and impacts
- Type, extent and effectiveness of SLM measures
- Describe and illustrate with photos and graphs what are the impacts of recent interventions see Photos 22 above.
- Propose solutions to reinforce positive responses to mitigate land degradation and decrease short term negative responses;
- Develop scenarios or chains of explanations (e.g. link sustainable land management measures, agricultural productivity and livelihoods);
- Target responses / recommendations by decision makers and types of intervention (training, awareness, subventions, value chain development, land tenure, etc.);
- Specify spatial responses / recommendations (upstream/ downstream, LUS and LUT);
- Link agricultural policies and the assessment results with the other global issues (such climate change and food security).

Stakeholders' consultation during the development of recommendations is critical to ensure that the results are of interest and use to the various clients and convincing for policy / decision makers to mobilise adapted policies and interventions and priority setting. This includes consulting:

- local land users, producers associations, water users associations, etc.;
- local and provincial authorities for priority setting and planning;
- government departments (environment, land resources, agriculture, forestry, water, local development, etc.) and NGOs and projects in the area;
- funding agencies, scientists and research students.

The recommended responses can be discussed in this section of the report, including: support, interventions, policy change, adapted local regulations etc. These responses might target the impacts directly or the drivers of these impacts. In the case of environmental driving forces (e.g. climate change) an appropriate response might be to support adaptation, ability to cope etc. rather than trying to "manage" the driver directly. The suggestions and advice given here will be important for sustainable land management implementation at community level and policy recommendations at regional and national level.

Annexes suggested for reports include:

I. **Names and functions of team members**
II. **Work planning (agenda)**
III. **Budget**
IV. **Database (Excel or Access tables)**
V. **Names of participants (land users, technical staff, and decision makers) at workshop to present and discuss the assessment results**

7.3 Establishing and maintaining a LADA-Local database

A database should be established for the storage of quantitative and qualitative data generated by the assessments. The initial assessment will provide the baseline for monitoring future changes and trends in the selected district / province or SLM project and, where national assessments are conducted, to feed more in-depth knowledge and understanding into the findings of the national assessment for the area in question.

To facilitate the collection of quantitative as well as qualitative data a prototype database has been developed that will be tested and validated through the follow up LADA-WOCAT project (being prepared for GEF-5 funding as from 2012+). It will be used as a support tool for supporting data collection, maintenance and analysis in the conduct of local assessments. This database builds on the experiences of the FAO Forest Resources Assessment and the development of an Integrated Natural Resources Assessment in Kenya and Zambia.