ANNEX G: SUMMARY OF PROGRESS ON LADA GUIDELINES, METHODOLOGY DEVELOPMENT, CASE STUDIES AND GLOBAL ASSESSMENT

INTRODUCTION

The following resumes and comments the main outputs of the LADA project under its PDF-B phase. It is accompanied by a Matrix which include all products (not all discussed here as about 50 documents, CD's and web-sites were produced over the last two and a half years), and a number of figures and diagrammes not included in the main text for ease-of-distribution sake. The text has been divided into three main chapters one concerning work related to the development of a methodological approach, a second one on global land degradation assessment and a third one on national and local assessments including pilot and case studies. A final synthesis is also included.

I METHODOLOGICAL LADA APPROACH DEVELOPED

GUIDELINES FOR A METHODOLOGICAL APPROACH

Koohafkan et al. (2003) developed guidelines for a methodological approach for assessing land degradation in the drylands. The following summarizes the approach based on earlier findings and reports produced for LADA notably The LADA framework (Ponce-Hernandez, 2002), the review of land degradation databases and methods (ISRIC, 2002) and more specific guidelines on the use of indicators (Snel and Bot, 2002 and FAO, 2002 on land degradation indicators and their use; Lane and Bunning, 2003 for biodiversity; Van Lynden, 2004 for fertility decline, salinization and pollution).

LADA follows a participatory, decentralised, country-driven and integrated approach and makes ample use of participatory rural appraisals, expert assessment, field measurements, remote sensing, GIS, modelling and other modern means of data generation, networking and communication technologies for share of information at national and international levels.
Key elements of the approach are:

- Participation and inclusion of different perception of LD
- Combination of expert assessment and local knowledge
- Use of adapted assessment tools for specific environments

In the following emphasis is paid to the technical aspects involved rather than to the participatory aspects. A tool box is proposed to tackle various aspects.

38.6 million km^2 of land, 29 percent of the total land area, is located in the arid, semi-arid, and dry sub-humid regions. These are the areas covered by the LADA project. There are 1.773 billion people, 30.4 percent of the world's total, living in these areas. Therefore, even though the people living in these areas have an equal proportion of land, the productivity of these lands is severely constrained by lack of precipitation. The classification scheme used for classifying the lands into arid, semiarid, and dry sub-humid lands is the ratio of annual precipitation/potential evapotranspiration and this seems very appropriate even though the ration has some shortcomings. This ratio is highly variable from year to year for a given location, and the variation generally increases with increasing aridity. Therefore, semiarid lands are not only drier than dry sub-humid lands; they are also more variable from year to year. Some measure of this variation was identified under the GLADA study (Figure 1).

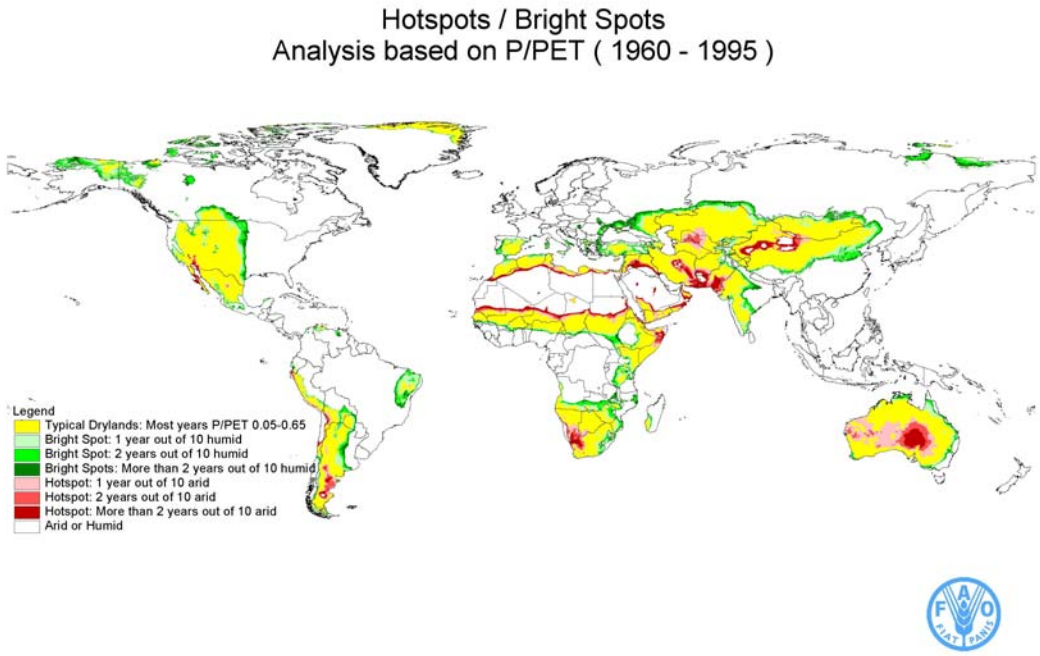
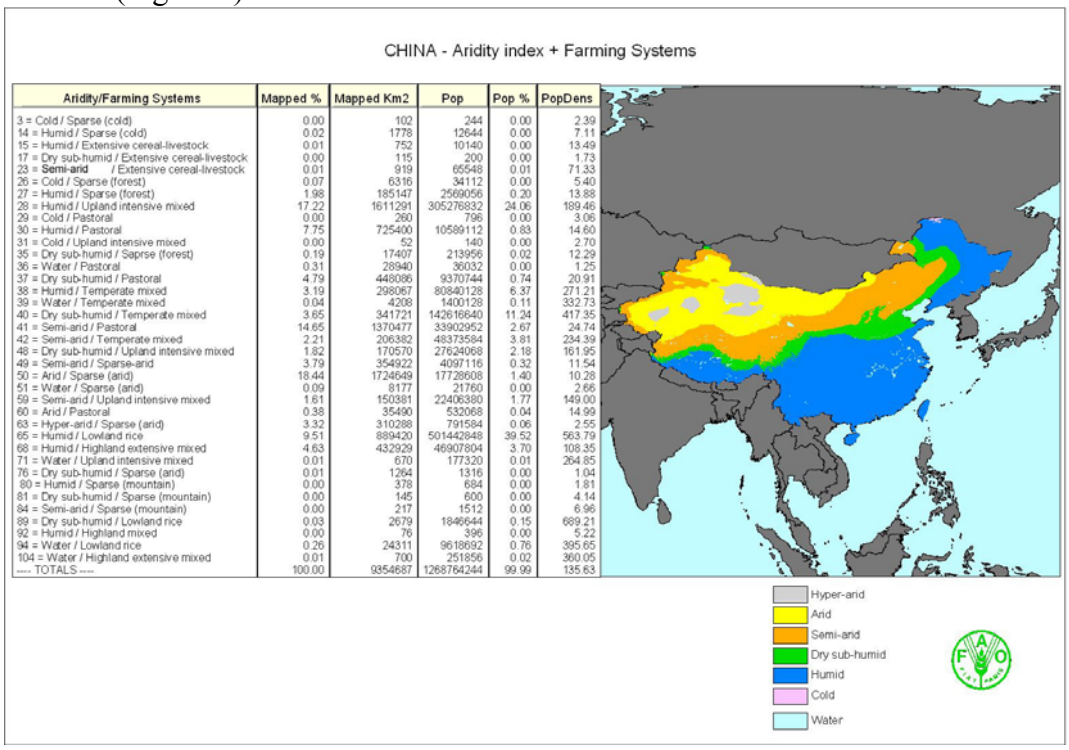


Figure 1: Hot spots and bright spots based on climatic variation in drylands.

Koohafkan et al. (2003) proposes that the causes, status and impacts of land degradation and possible responses be determined and assesses at the same time implying that each of these should be characterized and evaluated. **This holistic approach requires that land systems, rather than single locations, be evaluated.** One approach advocated is to combine the global farming system database with the dryland areas including population affected (Figure 2).



Aridity/Farming Systems	Mapped %	Mapped Km2	Pop	Pop %	PopDens
3 = Cold / Sparse (cold)	0.00	102	244	0.00	2.39
14 = Humid / Sparse (cold)	0.02	1778	12644	0.00	7.11
15 = Humid / Extensive cereal-livestock	0.01	752	10140	0.00	13.49
17 = Dry sub-humid / Extensive cereal-livestock	0.00	115	200	0.00	1.73
23 = Semi-arid / Extensive cereal-livestock	0.01	919	65548	0.01	71.33
26 = Cold / Sparse (forest)	0.07	6316	34112	0.00	5.40
27 = Humid / Sparse (forest)	1.98	185147	2569056	0.20	13.88
28 = Humid / Upland intensive mixed	17.22	1611291	305276832	24.06	189.46
29 = Cold / Pastoral	0.00	260	796	0.00	3.06
30 = Humid / Pastoral	7.75	725400	10589112	0.83	14.60
31 = Cold / Upland intensive mixed	0.00	52	140	0.00	2.70
35 = Dry sub-humid / Saprse (forest)	0.19	17407	213956	0.02	12.29
36 = Water / Pastoral	0.31	28940	36032	0.00	1.25
37 = Dry sub-humid / Pastoral	4.79	448086	9370744	0.74	20.91
38 = Humid / Temperate mixed	3.19	298067	80840128	6.37	271.21
39 = Water / Temperate mixed	0.04	4206	1400128	0.11	332.73
40 = Dry sub-humid / Temperate mixed	3.65	341721	142616640	11.24	417.35
41 = Semi-arid / Pastoral	14.65	1370477	33902952	2.67	24.74
42 = Semi-arid / Temperate mixed	2.21	206382	48373584	3.81	234.39
48 = Dry sub-humid / Upland intensive mixed	1.82	170570	27624068	2.18	161.95
49 = Semi-arid / Sparse-arid	3.79	354922	4097116	0.32	11.54
50 = Arid / Sparse (arid)	18.44	1724649	17728608	1.40	10.28
51 = Water / Sparse (arid)	0.09	8177	21760	0.00	2.66
59 = Semi-arid / Upland intensive mixed	1.61	150381	22406380	1.77	149.00
60 = Arid / Pastoral	0.38	35490	532068	0.04	14.99
63 = Hyper-arid / Sparse (arid)	3.32	310288	791584	0.06	2.55
65 = Humid / Lowland rice	9.51	889420	501442848	39.52	563.79
68 = Humid / Highland extensive mixed	4.63	432929	46907804	3.70	108.35
71 = Water / Upland intensive mixed	0.01	670	177320	0.01	264.85
76 = Dry sub-humid / Sparse (arid)	0.01	1264	1316	0.00	1.04
80 = Humid / Sparse (mountain)	0.00	378	684	0.00	1.81
81 = Dry sub-humid / Sparse (mountain)	0.00	145	600	0.00	4.14
84 = Semi-arid / Sparse (mountain)	0.00	217	1512	0.00	6.96
89 = Dry sub-humid / Lowland rice	0.03	2679	1846644	0.15	689.21
92 = Humid / Highland mixed	0.00	76	396	0.00	5.22
94 = Water / Lowland rice	0.26	24311	9618692	0.76	395.65
104 = Water / Highland extensive mixed	0.01	700	251856	0.02	360.05
---- TOTALS ----	100.00	9354687	1268764244	99.99	135.63

Figure 2: Farming systems, Drylands and Population in China.

The proposed methodology is based on the DPSIR framework (Figure 3)

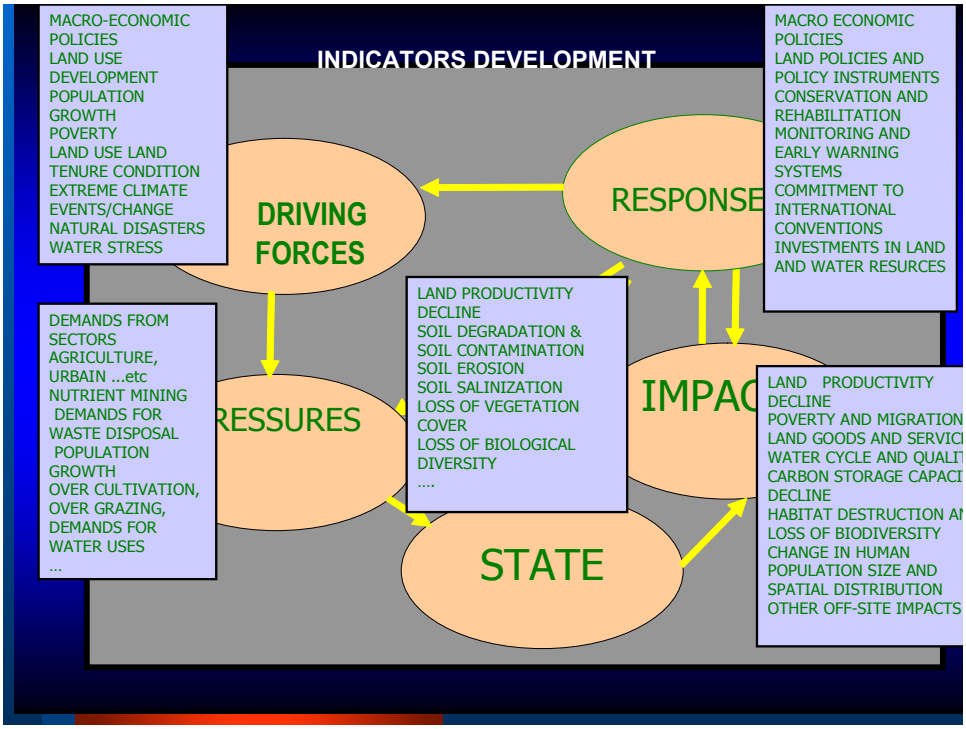


Figure 3: DPSIR Framework with some examples of indicators to be used.

where D is the driving forces, P is the pressure indicator, S reflects the condition of the land and its resilience, I indicate the impact of the increased or reduced pressures, and R describes the response by the land users to release the pressure on the land Figure 3). A large number of possible indicators have been suggested for each of these depending on what scale is being addressed. A primary advantage of the approach is that it allows flexibility for each country to adopt indicators pertinent to their situation and specific problems, but the disadvantage is that it may be difficult or not feasible to compare different countries. Even within an individual country, it may be difficult to get a consensus of what indicators should be used. Two vital documents in this respect are the LADA email conference on indicators (FAO, 2001) and the DESERTLINK (http://www.kcl.ac.uk/kis/schools/hums/geog/desertlinks/index.htm) approach. The latter, although to be completed for areas outside the Mediterranean, forms an excellent basis for national consensus building around problems/indicators.

A vital part of the Methodological Approach is **the identification of "hot spots" and "bright spots."** The guidelines state "a bright spot may be an area without significant land degradation that is stable, naturally or under the present conditions of sustainable management, or a formerly degraded or vulnerable area where land protection or land rehabilitation has been successful or is in progress; bright spots may include low-lying areas where little degradation takes place or areas where degradation was a problem in the past but where successful rehabilitation measures have remedied the situation" and that "a hot spot is an area where swift remedial action is required because land degradation is particularly severe or fast, with actual or expected particularly harmful or extensive impacts on-site or off-site, or because the land is very vulnerable and threatened by degradation." As defined for the LADA project, land degradation is a natural process or a human activity that causes the land no longer being able to sustain properly its economic functions or the original ecological functions. An example how this can be done more systematically was illustrated in the Senegal Pilot study by studying land cover changes complemented by ground checks. (Figure 4). Note that the 1990/2000 and earlier global imagery is available worldwide and the LADA project would be an ideal vehicle to study

changes in major land cover/use (Agriculture/Forestry/Pasture) globally and make images available to dryland countries.

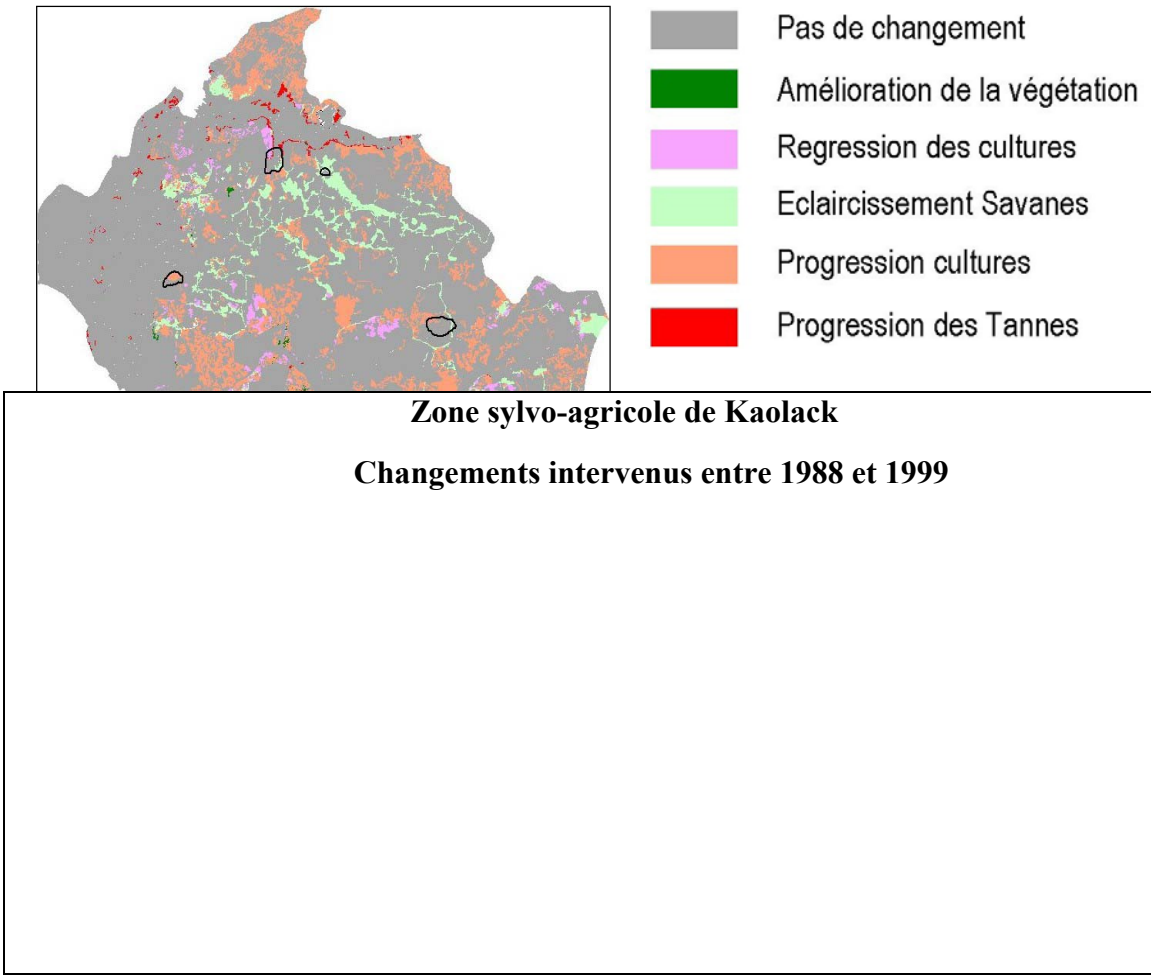


Figure 4: Change in land cover over ten years in Kaolack (Senegal)

The core of the LADA project resulted in the seven-step approach suggested in the guidelines (Figure 5). The most challenging task will perhaps be identifying the indicators to be used and to determine how the indicators will be measured quantitatively. Also, there has not been much discussion in the Methodological Approach regarding the difference between assessing land degradation of rangelands and croplands. The indicators used to assess cropland degradation will likely be substantially different from those used for rangeland, and the proportion of rangeland and cropland will be quite different between arid, semiarid, and dry sub-humid regions. Therefore, there may be merit in having separate task forces for cropland and rangeland assessment.

Figure 5: The seven steps LADA approach with corresponding outputs.

APPROACH AND DEVELOPMENT OF A METHODOLOGICAL FRAMEWORK FOR LADA (Raul Ponce-Hernandez, 2002).

The proposed approach is to develop a **methodological framework**, rather than a method. It is hoped that the framework would bring enough flexibility, in terms of the procedures, techniques and state of the databases as to accommodate for the particular circumstances of the country or region where it is applied.

The base entity for the application of the methodological framework is the **country.** It is envisaged that national assessments, based on an adequate statistically-sound sampling frames can be the basis for "upscaling" or "downscaling" to any sub-national or even global levels. Procedures for achieving these are part of the framework.

The LADA methodological framework is underpinned by the theoretical considerations. **An integrative modular systems approach** is proposed for the LADA assessments. The modules consists of sets of procedures, which have been identified as being part of a main core of thematic or disciplinary procedures, integrated into a unit which performs a major task (s) for the degradation assessment according to the driving forces-pressures-states-impacts-responses paradigm. Each modular array performs a set of core tasks and takes input form and delivers output to other modules. The flows of data and information are all integrated. Further, some of the modules could even have some degree of overlap. The emphasis here is on bringing the necessary elements of information and data together, from the different capitals pillars of the livelihood systems. That is to say:

- the natural capital
- the social capita
- the human capital
- the financial capital

These capitals translate into the integration of information and data from:

- Biophysical
- Socio-economic
- Cultural

- Demographic databases and information.

In addition to attempting to integrate socio-economic and biophysical data and information, the approach to the framework development attempts to reconcile scale-dependent views of the land degradation assessment problem in drylands. From the small scale, generic view provided by changes in land cover and other parameters such as soil reflectance through satellite imagery and remote sensing, to the detailed view of a farm plot on the ground where features of the degradation processes and their indicators would become far more clear. In this sense, the approach to the methodological framework development can be said to be a compromise between top-down and bottom-up in terms of scale.

The procedures for the assessment under the approach are based fundamentally on indicator variables and "proxies". However, the framework would use any "hard" data provided by detailed measurements (e.g. sediment plot data), wherever they are available.

The modular array can be summarized into six basic steps at the highest level of methodological generalization:

1. Definition of target areas for the assessment.
2. Zoning or stratification of such areas (partition of variability)
3. Application of a sampling frame.
4. Performance of ground field assessments and land cover:
   - Apply field degradation assessment methods based on field indicators.
   - Facilitate a participatory auto-diagnosis process where farmers and land users identify degradation processes and problems.
   - In parallel, perform remote sensing image analysis of the selected scene and map out the state of vegetation cover through band ratio indices (NDVI, GVI, etc.) and through the Spectral Mixture Analysis (SMA) approach.
5. Integrate results, map out degradation and find out causality:
   - Define legend for degradation types and intensity classes.
   - Integrate driving forces (D) and Pressures (P).
6. Integrate analysis of impacts (I) and responses (R) from the socio-economic assessment and the participatory "auto-diagnosis".

The final step is the reporting of findings both, in terms the spatial distribution of types and intensity of land degradation as well as in terms of a concrete and succinct description of its causes (driving forces and pressures) as well as the impacts on the different livelihood sub-systems and the responses to those impacts by the stakeholders.

GUIDING PRINCIPLES FOR THE QUANTITATIVE ASSESSMENT OF SOIL DEGRADATION

van Lynden et al. (2004) discuss the guiding principles for quantifying soil degradation. They considered soil degradation as a process that describes human-induced phenomena which lower the current or future capacity of the soil to support human life and as one aspect of land degradation with others being degradation of vegetation or water resources. van Lynden et al. (2004) also focused only on indicators for salinization, nutrient decline and soil pollution. There are many other indicators commonly used for assessing soil degradation.

The document draws heavily on work previously used in GLASOD, ASSOD, and SOVEUR. The assessments are largely qualitative, limited and rely largely on expert knowledge. However, van Lynden et al. (2004) stress that expert knowledge should preferably be supported by hard data. They also point out that sustainability is a problem of equilibrium, which applies at all scales and to all aspects of land use. Of interest was their view that it is not possible ─ and probably not desirable ─ to define sustainability today on behalf of the next generation. They stressed, however, that it is possible to maintain the potential of land resources so that future generations can develop their own values, priorities and possibilities to satisfy their needs.

SELECTION AND USE OF INDICATORS AND METHODS FOR ASSESSING BIODIVERSITY AND LAND CONDITION IN LADA

Lane and Bunning (2003) prepared a very detailed report dealing with dryland biodiversity issues in the context of LADA. They stress the need for choosing a short list of indicators and then developing a cost-effective sampling strategy so that sites can be monitored for changes. Even though they stressed the need for choosing a short list of indicators, they listed some 80 potential indicators at local, ecosystem and national levels.

The authors presented a comprehensive review on land degradation assessment and consequent loss of biodiversity is often linked to poverty, migration and food security. Aside from the highlighted practical and meaningful discussions on land degradation assessments for the drylands, the paper dealing with biodiversity presents important information relating to LADA.

POTENTIAL USE OF SATELLITE REMOTE SENSING FOR ASSESSING LAND DEGRADATION IN DRYLANDS

Lantieri (2003) reviewed the potential of spatial remote sensing for application to the LADA Project. Lantieri grouped the remote sending data into four categories: low and medium resolution civilian optical satellites, high resolution civilian optical data, very high resolution civilian optical data, and spaceborne radar data. Lantieri concluded that there are six broad applications or remote sensing that are highly relevant to LADA. These are: 1) land cover (and some land use) which includes vegetation types and their changes over time 2) land form and landscape; 3) vegetation activity and growth; 4) rainfall and related droughts; 5) soil types and state (moisture and level of erosion); and 6) indicators based on climate and ecological modelling (still under research). Remote sensing will play an important role in the LADA Project including in the identification of hot spots and bright spots based on land cover change.

SUGGESTED INDICATORS FOR LAND DEGRADATION ASSESSMENT OF DRYLANDS

Snel and Bot (2003) and FAO (2003) have suggested indicators that might be used for assessing land degradation of the drylands should be achievable, measurable and recognize applicable data constraints. They propose that indicators should be SMART: specific, measurable, achievable, relevant, and time-bound. Snel and Bot (2003), as did Lane and Bunning (2003) state that the root causes of land degradation and desertification are often poverty and food insecurity. Snel and Bot (2003) go on to say that the immediate causes of land degradation are inappropriate land use, degradation of soil, water and vegetation cover and loss of both soil and vegetative biological diversity, affecting ecosystem structure and functions.

Snel and Bot (2003) point out those indicators should include evaluation of *on-site* effects of land degradation and *off-site* effects (e.g., soil sediment on downstream surface water).

FAO (2003) summarizes the 2003 e-mail conference and lists the potential indicators for use at four scales: global, national and regional, watershed or village, and farm. This is a crucial document because the indicators ultimately chosen will form the foundation for the LADA Project. However, indicators should always be SMART as it was previously stressed.

APPLICATION OF AN ECOSYSTEM APPROACH TO DEGRADATION ASSESSMENT OF DRYLANDS IN ARGENTINA (WRI, 2004)

The study was conducted at the National level in **Argentina**. The study used a very broad approach based on Provisioning Services, Regulating Services, Cultural Services, and Supporting Services. The difficulty with such an approach again goes back to trying to develop an approach that answers all questions, and in the end does not answer any question. The premise of their approach is that ecosystems are essential for human well being. They identify human well being as having the necessary material for a good life, health, good social relations, security, and freedom and choice. These components are so site-specific that they seem meaningless in being a part of a global assessment. The report showed two trends that seem of vital importance — the decline of the sheep industry and the booming soybean production. However, neither of these major trends was really addressed in a quantitative way as to how land degradation, or soil degradation, was affected.

The study did clearly recognize that the process of relating ecosystem change and human well-being is difficult because of the difficulty of documenting trade-offs and the current and future dimensions of the relationships. The indicators used in the Argentina ecosystem study are quite different from those suggested by the FAO (2003) report for the LADA Project.

II GLOBAL ASSESSMENT of LAND DEGRADATION (GLADA)

GLADA (version0.1)

The only available global assessment of soil degradation to date is the UNEP/ISRIC GLASOD study carried out during the 1980s at a 1:5 Million scale (published at a 1: 10 Million scale). The study has been extremely useful in pinpointing areas where specific types and intensity of effects of soil degradation occur, but has also been criticized because of its subjective nature and its reliance on expert opinion only. Since then more specific and objective studies were undertaken, notably the SOVEUR study for Central and Eastern Europe (FAO/ISRIC, 2000) and the ASSOD study for south east Asia (UNEP/ISRIC/FAO, 1998). Moreover, since then an important number of global Terrain and other data have become available with ever increasing resolution, which may to a certain extent refine the findings of the GLASOD study. Using more recent material readily available, the GLASOD study had been improved. The results have been compiled in Arc/Info format and a revised GLASOD (GLADAv0.1) map could now be produced by FAO. Information on the procedures followed and the algorithms used are contained in a specific web-site:

Also relevant information collected over the years by WOCAT (http://www.fao.org/ag/agl/agll/wocat/default.stm) and the SOTER programme (http://www.fao.org/landandwater/agll/soter.stm) when supplemented by national ground observations and checking would result in providing an essential part of GLADA (which still would need socio-economic indicators worldwide incorporated.). A proposal in this sense was prepared by ISRIC, which usefully could be associated with ongoing global land cover studies by JRC or EROS-UNEP.

GLASOD
(webversion: http://www.fao.org/landandwater/agll/glasod/glasodmaps.jsp)

This Beta version of a website gives access to soil degradation assessments by country based on the GLASOD survey carried out during the 1980's by UNEP and ISRIC. Maps on the type and causes of soil degradation are available on the Terrastat CD-ROM (FAO, 2003).

IMPORTANT: The maps presented here are derived from regional maps at an original scale of 1:10 000 000 and hence have a very low reliability particularly in small countries. The estimates of the extent affected are very rough estimates and should not be used as precise measured data. National authorities concerned with land degradation are urged to update and refine the present estimates and mapping.

PHOTO LIBRARY of EROSION PROCESSES
(http://www.fao.org/landandwater/agll/photolib/index_e.htm)

The proposed bilingual (English/French) photolibrary and its derived trilingual CD ROM are meant as a complementary and technically annotated photography annex to the "Guidelines for mapping and measurement of rainfall-induced erosion processes in the Mediterranean coastal areas", as introduced in the following pages, as well as to the "Guidelines for erosion and desertification control management with particular reference to Mediterranean coastal areas" published in 2000.

Several practical surveying and mapping pilot experiences have been fulfilled within the framework of MAP-UNEP-PAP/RAC programmes in rather diversified Mediterranean environments (Spain, Turkey, Tunisia and lately Malta). Also, national technical reports referring both to the maps and the surveying areas are available in PAP/RAC headquarters.

III PILOT STUDIES (National and local Assessments)

Three countries ─ Argentina, China, and Senegal ─ were selected for conducting pilot studies. All three provided a national inventory of available information on land degradation and its assessment in the country. More detailed studies were undertaken in pilot areas. However, only Senegal has finalized this study to date. The Argentina study is still ongoing, the China one has focussed more on the development of participatory approaches rather than on technical issues. Results presented below are therefore still incomplete.

Argentina

The collection of all information and available experience on national land and water resources and on the land degradation status in the country in the form of a national report is already available on CD-ROM and in the Internet. This report contains the preliminary stratification rules and identification of the hot spots and bright spots, the quickly perceived state, cause and impact of the land degradation in the country. Main information available for Argentina includes biophysical and socioeconomic information. Other information available is: 1) Satellite imagery and aerial photographs of dry and drought areas, 2) Native and Cultivated Forests, 3) Soil quality, 4) Energy resources, 5) Land degradation data and maps, 6) Climate, 7) Cropping systems, 8) Population Density, 9) Land tenure and related issues, and 10) Land use and management.

A workshop was organized by Leda's Argentinean focal point and supported by FAO was held in 12-17 May 2002 in a view to bring together farmers, advisers, scientists, private sector and decision makers, and representatives from the international organizations (CCD-Global Mechanisms, GTZ, FAO and World Resources Institute) to start and implement the seven LADA Steps.

The Argentina report, the outcome of the LADA Task Force workshop and the detailed work plan can be consulted in the following web pages:

http://www.medioambiente.gov.ar/suelo/programas/lada/default.htm and

http://www.fao.org/ag/agl/agll/lada/arg/inicio.htm

China

An FAO mission visited the Peoples' Republic of China to assist the National Bureau to Combat Desertification (NBCD), State Forestry Administration (SFA), Beijing, with the piloting of the Land Degradation Assessment in Drylands (LADA) approach within the

country. The main aim of the mission was to assist the Chinese National LADA Task Force (NLTF) with the convening of the first Chinese LADA Local Level Stakeholder Consultation/Training Workshop.

The workshop was held in Yan Chi county Ningxia-hui Autonomous Region from 7-10 April 2003. Prior to the workshop the mission was involved in a series of planning meetings with members of the Chinese national LADA Task Force in Beijing to: (i) review the administrative arrangements for the workshop; and (ii) to advise on the methods to be used to facilitate both the group and plenary discussion sessions. Both prior and post workshop the mission had meetings in Beijing with representatives of FAOR, UNESCO and ADB.

China has been progressively implementing Steps 1 to 6 of the LADA approach, and so far has identified six pilot sites as representative sample for land degradation assessment surveys.

Senegal

The institutional focal point is the Centre de Suivie Ecologique that will initial the LADA pilot studies. This institute has established an interactive network with other institutions and stakeholders in the country. The project has prepared a report of about 30 pages that contains:

1. The identification of potential LADA partners that form the kernel of the LADA national task force with names and addresses and possible function and expertise.
2. A user study of stakeholders defining prime needs with regard to information products and decision support tools directly related to assessing and combating desertification. This survey will be carried out by selecting a representative sample of public sector actors (technicians, decision makers at every level), international organizations and funding agencies, private sector representatives and NGO's directly involved with rural development and agriculture (unions, professional associations etc.). The desired products will be defined as well for their content as for their format, access mode and distribution mode. This study will present a first step for a more detailed study under the full LADA project.
3. A general study of goods and services affected by desertification at national and sub national level, taking into account the findings of the NAP of the UNCCD.
4. More general strategic considerations on how to implement LADA in the country and in Western Africa in general at the institutional level (distribution of responsibilities, activities, operations, coordination and quality control).

In addition three regional workshops were held in which a total of fifty one (51) countries presented national reports on land degradation. The proceedings are in preparation (the one for Africa is available, the one for the Caribbean is finalized, the one for Asia is in draft stage). All will appear as World Soil Resources Reports in 2004.

CASE STUDIES (Local Assessments)

In addition to the Pilot Studies, there were several case studies conducted. Brief reviews are given below for case studies conducted in Mexico, South Africa, Uzbekistan, Kenya, Egypt and Malaysia.

Mexico Case Study

This was an extensive study of two sites — Salinas, San Luis Potosi consisting of 4445 hectares and Las Casitas, Pueblo consisting of 3100 hectares. The study was an attempt to use the Driving Forces-Pressure-State-Impact-Response (DPSIR) paradigm. This study was conducted well and nicely reported. The study was implemented in six well-defined and logical steps.

The complexity of this study was overwhelming. The study clearly took into account the physical processes as well as the social, cultural, political and economic issues related to land degradation. However, there were so many indicators considered that it was difficult, if not impossible, to analyze and interpret the results. This became particularly complex when trying to combine many of these indicators into a map. Although this study was well conducted and well summarized, it clearly illustrates that the approach would not be practical and manageable for making assessments on a country or global basis.

This study should be carefully analyzed by the LADA Committee because it really did follow in principle the guidelines proposed.

South Africa Case Study

The extent of this study was limited and focused primarily on salinity problems. The paper is not a detailed report of a study but it provides a good snapshot of some of the major soil problems. The paper also highlighted the importance of soil organic matter and how the decline of soil organic matter is accelerating salinity problems as well as fertility problems. An estimated 20 percent of the country's total surface area is potentially highly erodible. The authors estimate more than half of South Africa's surface area is under threat of desertification and that although the process can be reversed, it will be a slow process requiring considerable inputs. Although this study was limited, it does indicate a good understanding of the problem and lays out a basic framework that can be used to assess soil degradation but there was little or no attention given to the social and political drivers associated with land degradation.

Uzbekistan Case Study

The Uzbekistan study contains excellent information and although it focuses on salinity in the map presentations, there is information available for producing other degradation maps. However, essentially all of the agricultural land in Uzbekistan is irrigated. The authors identified the important land degradation processes in Uzbekistan as: 1) secondary salinization or irrigated lands; 2) underflooding and waterlogging of irrigated lands; 3) loss of organic matter and increase of fertility decline in soils; 4) widespread occurrence of irrigation erosion of irrigated soils; 5), soil pollution; and 6) aerosol transport of salt and dust from the dry bed of the Aral sea. They concluded that land degradation trends pose a serious hazard to food security, health and safety of the people located in the drylands.

Kenya Case Study

More than 80 percent of the lands in Kenya are drylands and about 75 percent of the country receives less than 500 mm rainfall annually and this is coupled with an annual PET rate of about 2000 mm per year. The irrigation that occurs is mostly in arid regions but amounts to only 84 000 ha although it has been estimated that the potential irrigated area is between 244 700 and 539 000 ha. The study focused on saline and sodic lands but other degradation processes of great importance in Kenya include fertility decline, soil acidification and aluminium toxicity, organic matter decline, wind and water erosion, and

soil compaction. The case study was not very detailed but did indicate that there is perhaps adequate expertise and data available to assess land degradation.

Egypt Case Study

The land in Egypt is nearly all desert and therefore contains little or no land classified as arid, semiarid, or dry sub-humid that make up the drylands. However, irrigated lands in desert areas do come under the umbrella of LADA. Agriculture in Egypt is nearly completed irrigated because nearly all of the area receives less than 200 mm of precipitation annually and the potential evapotranspiration rates are very high. Land degradation does occur in Egypt but it is not widespread. The major land degradation problems in Egypt have centered on hydrological constraints such as waterlogging, salinity and alkalinity; physical constraints such as deterioration of soil structure and compaction; and biological constraints caused by a decline in soil organic matter leading to declining soil fertility. The study focused more on the physical factors with little or no emphasis on social, economic and political factors.

Malaysia Case Study

The Malaysia report also focuses on salt-affected soils. The report is well written but is more of a review article than a study report. It gives an interesting and factual description of agriculture in Malaysia and then describes some of the salinity problems. Soil erosion, fertility depletion, salinisation, water-logging and the lowering of the ground water table have also been recognized as important land degradation problems in Malaysia.

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