Guidelines for the identification, selection and description of nationally based indicators of land degradation and improvement

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INDEX

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1. INTRODUCTION

This *guidelines booklet* is addressed to the LADA partner countries and, more in general, to the increasing number of countries which are expressing their interest in implementing the LADA approach for mapping Land Degradation.
The specific objective is to provide guidelines for the identification, selection and description of nationally based indicators of land degradation.
The LADA approach is well defined by a range of specific documents and manuals.
The National indicators common to all countries are based on the LADA-Wocat QM manual. Further national indicators, socio-economic, are also proposed as possible common indicators. They are all described and included in the DIS4LADA on-line system (synthetically presented below). They create a common, harmonised way to assess land degradation at the national level.

However, LADA is aware that the overall picture obtained may be not exhaustive and that in order to capture local specificities some other indicators may be needed.
For this reason the approach is flexible and countries are encouraged to suggest country-specific indicators. The DIS4LADA system was in fact designed to host both *country specific* and *common to all countries* indicators.
LADA also defined a method to select country specific indicators based on inter-participatory work and institutional consultation and collaboration, a process that should be coordinated by the local LADA team Coordinator. This method is the subject of the present document.
It is well known that in most countries, assessment and monitoring competences are broken down according to administration sectors. Generally land degradation is transversal to these sectors and not managed as such, in an integrated way. Often, such a process of integration and collaboration across sectors and scales is difficult or very slow.

The DESERTLINKS project (Brandt et al., 2006) recognised this problem and developed strategies to overcome it. The FAO involved DESERTLINKS experts[1]

[1] In particular, the pilot work in Tunisia described in the next paragraph has been carried out with the support of an international DESERTLINKS team composed by Claudio Zucca, Jane Brandt, Nichola Geeson, Jorge Garcia Gomez.

through an agreement with the NRD of the University of Sassari (Italy), with the aim of adapting the method to the LADA needs and implementing it in a pilot country. The country selected was Tunisia.

2. THE LADA PILOT EXPERIENCE IN TUNISIA

LADA defined a participatory method based on DESERTLINKS experience to select country specific indicators. This was tested and validated in Tunisia, where, with the collaboration of the local LADA team Coordinator, a participatory process was set up and implemented. The aim of the process was to promote inter-sectoral consultation and collaboration at the national, institutional level.
The activity carried out did not focus on the local level, because it has been integrated in the National component of the LADA project.
The objective was to collect and possibly integrate different vision and experience of experts involved in national monitoring activities, from environmental monitoring to national socio-economic statistics. This objective is challenging, because LD cuts across the responsibilities of different government agencies and governance levels and often there is a lack of synergy between domestic environmental monitoring priorities and objectives (CSD, 2009).
Furthermore, the approaches of different agencies may have been developed from different conceptual bases. So, to create a common understanding of complex issues such as land degradation can require quite a long time if the ground is not prepared and different conceptual frameworks are in use by different actors. But without common understanding it is not possible to work towards the definition of common sets of indicators.

The creation of the conditions for a constructive joint work was a major result obtained in Tunisia, also thanks to the effective local organisation. In this regard, important lessons were learnt, as pointed out in the following chapter. A very significant concrete outcome was also achieved, in the form of a structured list of indicators.
In Tunisia the definition of issues at the national level required a more complex and *stratified approach* than the original suggested by DESERTLINKS. The work was thus adaptive.
Finally, issues and indicators were organised according to the specific *bio-climatic zones* of Tunisia and, inside these, in relation to each major *LUS*[2] unit.

The resulting matrix of issues and indicators for Tunisia is presented in **Annex 3** to the present guidelines.

[2] LUS as defined by LADA.

3. A ROADMAP TO IMPLEMENT THE PROPOSED APPROACH IN LADA COUNTRIES

The operational sequence of activities proposed below as a practical "roadmap", broadly reflects the activities carried out in Tunisia, but taking lessons learnt into account.

The process suggested is intended to be coordinated by the local LADA team leader and possibly assisted by a LADA *facilitation* team.

The activities suggested[3] are broken down as follows:

a) First Workshop:

b) Assisted work by local working group: first workshop follow-up

c) Second Workshop:

d) Final elaboration and validation

3.1 First Workshop

The concrete results expected from the first workshop are:

- to set up the methodological and practical aspects of the work related to the definition of issues;
- to prepare the selection of candidate indicators that could start just after the end of the workshop.

All key institutions involved in national monitoring activities, from environmental monitoring to national socio-economic statistics, should participate in the workshop.
The technical activities should be organised in advance by circulating clear Terms of Reference together with the Program. It is essential that all the actors come prepared to the workshop, aware about what they will be asked to discuss. The present guidelines and its annexes should be distributed to the workshop participants in advance.

The approach should be thoroughly presented and discussed, possibly during the first session. The local team should be fully involved in the following discussions and its participation and feed-back encouraged: they are expected to take commitments toward the implementation of the follow-up.

[3] These represent a "minimum package" and extra meetings can be organised if needed and if resources are available.

This session should be followed by short presentation held by the actors invited. They should be made aware that the aim is not to present all the activities of the respective organisations, but to focus on main methodological aspects linked to:

- monitoring they actually perform and
- data they actually own and manage.

The presentation should be short to leave time to discussions, possibly organised in two working groups. These should be well coordinated and with a balanced composition. The specific subjects of the groups should be:

- Selection of national land degradation issues and indicators;
- Use and implementation of the on line DIS4LADA DB.

A plenary discussion session should be then aimed at raising consensus from the local experts on the topics discussed and on the future work plan.

In synthesis, the following basic structure is proposed:

Session 1: Presentation of the methods to select issues and indicators
Session 2: discussion
Session 3: Presentations by invited actors
Session 4: discussion
Session 5: Working groups
Session 6: final plenary

3.2. Assisted work by local working groups: first workshop follow-up

This phase of the work is particularly important. The main constraint in relation to the achievement of the results expected is related to the involvement of the relevant institutions and to their willingness/capability to make available their knowledge and data. In particular, a reliable definition of the issues relevant to the countries requires consensus, based on a clear understanding of the underlying concepts and an expert vision of the problems related to territorial resources management. In addition, the selection of relevant indicators requires an operational knowledge of the national Data Bases and monitoring systems, to link candidate indicators to actual information sources. As a consequence, this work can be done only if the competent institutions are available to get involved in an interactive, maybe long lasting team work. In turn, this requires clear mandate and definition of tasks and responsibilities.
This question should be raised, and possibly answered, during the first workshop. After that, the local Team should organise the interaction with the different bodies contacted. The quality (specific competence) of the local experts actually involved should ensure the necessary *critical mass* for the process to go on.

From the operational point of view, as an example, in the Tunisian experience, two follow-up work groups were created based on the recommendations issued during the first workshop.
The aim was to draft a working document on local issues and indicators, to be discussed during the second meeting. So, the following groups were created:

- Group 1, to analyze and to define relevant issues and candidate indicators;
- Group 2, to identify the data potentially available to describe the issues.

The two groups should prepare and circulate a draft report among all the actors involved, to reach consensus on a suitable working document in preparation of the second workshop.

In order to fully support the subsequent work, the report should include:

1) A first chapter, with a brief analysis of the actual situation in the country as already studied through the LADA national assessment (natural resources degradation, production systems, resources use and management..). The chapter should specifically report on:
- the identification of degraded areas and ongoing degradation processes;
- the classification of country regions according to degradation types.

2) A second chapter, with the identification of a preliminary list of candidate indicators: these should be intended *to complement the indicators already considered by LADA and common to all countries,* by proposing *country specific* indicators. So, if gaps exist, they should be filled in. Also the specific indicators should be related to degradation level and trend and based on DPSIR system as used by LADA.

3) A third part, about the institutions involved and the data general needs in relation to candidate indicators.

Among the technical aspects to be discussed during this phase, some deserve specific mention:

1) Issues should be associated, in their function of major "indicator boxes", to a more complex frame based on Land Use Systems (LUS) as defined by LADA. These could be further divided into sub-systems: as an example, in Tunisia, it was agreed that specific issues, such as "overgrazing", may have very different definition and features in the South of Tunisia if compared to the North, due to bio-climatic factors. Furthermore, it can be said that often, specific issues are typical of specific LUS.
   So, also in consideration of the role given by LADA to LUS in assessing LD indicators, it is suggested to create a nested frame in which, for each bio-climatic

region, the analysis of every LUS is specifically addressed by recognising and describing the main issues and the related land degradation features. After that, candidate indicators are to be chosen for each issues according to the DPSIR approach (the nested frame adopted in Tunisia is shown in the table below).

NATURAL AGRO-ECOLOGIC REGIONS	*LUS*	*ISSUES AND PREDISPOSING FACTORS*	*TYPE OF DEGRADATION*	*INDICATORS (D,P, S, I, R)*

2) Another important aspect is that, in order to be able to utilize a given indicator, not only the necessary data, but also the methodology to collect and elaborate them must be identified. In fact, the difficulties found in identifying the indicators also depend on collection procedures and actual data characteristics (scale, accuracy, validity etc.). Data coming from different sources may be not comparable. Definitions and terminology harmonization, standardization of data collection protocols, data base developing are necessary steps to improve and optimize the monitoring systems and their use. The description of data must be done as a metadata and should be well documented.

3.3. Second Workshop:

The second workshop constitutes a validation phase in relation to the issues and indicators selected.
The suggested, basic workshop structure should include at least 4 sessions:

- The first session, for the presentation and discussion of the working report, focused on the description of the issues and their association to the LUS (and eventually the bio-climatic regions).
- A second session, for the evaluation of the list of candidate indicators associated to LUS units and DPSIR boxes.
- A third one devoted to select and rank indicators.
- A plenary discussion

In preparation of session 2 it will be very important to spend some time to prevent possible (likely) confusion about the assignment of candidate indicators to DPSIR categories. Actually, the logic of the framework, although easy in principle, requires a certain effort in terms of coherence, when applied systematically.
Also, during the second session, care should be taken in helping people involved to become familiar with concepts related to the *operational performance* of indicators. The very basic criteria to define suitable indicator sets should be a good compromise between relevance and feasibility/data availability. In fact, it is frequently claimed that indicators should use available information; however, indicators must be relevant first.

During this session, or immediately after, it is suggested to organise work groups and ask them to rank the candidate indicators according to practical/operational criteria.
This joint exercise is essential to create consensus about the concepts discussed and constitutes the main outcome of the meeting. In fact, the task is not easy and presumably some hours of joint work will just permit the discussion of a few indicators, contributing to define a common approach.
The joint effort done through the working groups will be also essential in order to plan (during the final plenary discussion) the future work, with a rational distribution of the tasks to be accomplished.

3.4. Final elaboration and validation

The follow-up, final work, should include:

- Preparation of the final version of the full issue-indicator table for the country; indicators may be grouped according to type (e.g.: bio-physical, socio-economic, water resources, or related to land use);

- Eventually, selection (and thus valorisation) of indicators already included in DIS4LADA or in DIS4ME.
  This step is important to check potential gaps but also to avoid redundancy. E.g., it is very important to compare locally selected indicators with LADA indicators, especially indicators included in local assessment manual or in the "bio-physical toolbox". These are already described and uploaded in the system, so it should be avoided to introduce redundant information.

- Refinement of wording in candidate indicators names and definition;

- Selection and ranking of the candidate indicators based on relevance and data availability;
  Headline indicators may be highlighted which have the highest degree of interest;

- Filling in process of indicators in DIS4LADA fact sheets.

During the second step, if some DIS4ME indicators are considered of interest by a LADA country, they can be picked and made visible to LADA through the system interface. They will be marked as "selected fromDIS4ME" but will virtually belong to the indicator system of that country too.

The final report including all the information above is a useful product. However, it should not be considered as the end of the story. Actually, the validation work carried

out should be intended as the beginning of a larger refinement process aimed at setting operational strategies to link the selected indicators to the existing data bases.

A third, summing-up meeting could be organized to discuss the final report.

4. CONCLUSIONS AND RECOMMENDATIONS

With reference to the Tunisian pilot experience, the local Team declared its satisfaction about the overall result obtained. In their opinion the indicators made available by the collaboration with LADA and with NRD will be very useful to help the national institutions charged to monitor land degradation.
The work carried out also contributed to reinforce the institutional collaboration within and outside the Tunisian Lada Committee. Different proposals are being now studied by the Committee to create suitable "observatories" able to implement the monitoring system coming out from the LADA experience.
Some difficulties were actually experienced during the implementation of the activities. During the first phase the number, expertise and commitment of the local actors actually involved was not enough to cover all the sectors and the complexity involved. Also, their commitment was probably not clear enough. Only in a later phase the process was accelerated and the contribution obtained by the local Coordinator became substantial.
Based on this aspect, and on many others managed in the course of the pilot work, some lessons were learned and the approach presented here was refined accordingly.

The main lessons learnt are schematically synthesised below.

Institutional preparation:

1. Effectively involve the relevant stakeholders, in particular public Bodies in charge for national or local monitoring and data owner agencies. As mentioned above, it is important to reach the needed critical mass in terms of issues/sectors covered and in terms of technical expertise and qualification of the involved individuals.

2. Promote mechanisms for their effective participation, ensuring they (and the bodies they represent) take a clear institutional commitment toward spending their work time in the process and toward sharing knowledge and data among each others in view of the more transversal task of monitoring LD. Eventual constraint and difficulties (e.g. availability to share data) must be dealt with at the very beginning.

3. The local Focal Point for the process should have adequate institutional position and mandate to promote a high level commitment from competent Bodies. It should be able to act as a good local catalyst/facilitator during the workshop activities and the follow-up work.

4. The final goal of the collaboration must be made clear in the early phases and the quality and competence of the physical persons which each Body should involve in the process should be defined clearly, as one of the requirements for the success of the initiative.

Implementation of the approach followed in the context of the present work, as described in the above chapters:

5. Make sure that the first meeting is preceded by an effective institutional and technical preparation phase and that the participation is active. The success of the first workshop is essential, also in order to motivate people involved to go on with a kind of process that, typically, is carried out without additional financial resources. TORs and other supporting documents should be circulated in advance and accompanied by a clear introductory letter explaining objectives and requirements.

6. Provide early expert support, before and during the first workshop: the concepts related to LD and Benchmarks and Indicators as defined by FAO, the UNCCD, etc. are often only apparently clear to people involved: in particular, as discussed above, the concept of "operational indicators" may be not clear to the officers involved in management of land resources. In fact, generally quantitative data and statistics are systematically collected only for aspects related to census, demography, economic figures. People involved in the process can relatively easy have a role in suggesting "what phenomena should be monitored in their countries", but no often a real idea about "how" and about the practical feasibility, data availability, scale issues, etc. These key concepts must be clarified during the first meeting.

7. Provide good expert facilitation during the first workshop, to ease conceptual clearing, to promote feed-back and to create favourable conditions for the "home work" after the meeting. The risk exists that participants see their contribution as limited to the workshop time only. A good interaction must be created. A clear tasks distribution and follow-up time table must be agreed. The role of an external expert well aware of the tasks to be performed and of the quality of the expected outcomes can be very important in ensuring a good follow-up.

8. Provide monitoring and advice during the local work phase (workshops follow-up), in particular between the first and the second meeting. Stress the importance of having real interaction and multiple contributions in this phase, because the work elaborated should be as far as possible shared before the second meeting. The Local Coordinator should rely on his staff for collecting and editing

contributions, but should make a real effort to stimulate active participation, avoiding relying too much on its personal capacity to compensate for scarce support coming from others.

9. Make sure to have a strong participation of data owner Bodies, especially during the second meeting. This is essential in order to focus the discussion on "feasibility" of indicators. The limited awareness of real data availability (quantity and quality) often undermines the effectiveness of LD indicator selection exercises made by sectoral experts.

10. Again, provide good expert facilitation during the workshop, to make the discussion effective and concrete and to plan the follow-up accordingly. Criteria to assess feasibility and effectiveness (technical/economical) of indicators are complex. The discussion among local sectoral experts could go on for long time before finding common ground, especially if they had not previous opportunities to compare their different approaches on the matter. A facilitator aware of the typical frameworks (constraints/biases) of different disciplines involved can make a significant contribution to the discussion.

11. Possibly organise a third, "summing-up" meeting involving high level representatives, to discuss the results obtained. Such a meeting, organised after a common understanding has been achieved, could constitute a good opportunity to involve higher level officers from the bodies involved, and decision makers, to promote their support and endorsement.
    The final goal of this third meeting should be to ensure data availability and political commitment to implement monitoring indicators in future.

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APPENDIX. THE DESERTLINKS[4] APPROACH

A. The methodological approach

The strategy developed by DESERTLINKS is participatory, in accordance with the recommendations issued by the UNCCD in relation to the definition of desertification indicator sets.
The preparatory documents (the so called "white papers") drafted before the recent UNCC-CST meeting in Buenos Aires state that "*Monitoring and assessment must incorporate multiple knowledges, using a variety of methods and scales, including the (potentially conflicting) perspectives of those who use the land……. Knowledge is often dispersed among a wide range of individuals, groups and agencies that are interlinked across and between scales (horizontally and vertically)……the current knowledge base is highly fractured, with structural and procedural barriers preventing knowledge flows between those at different scales*" (DSD, 2009).

Based on corresponding assumptions, DESERTLINKS involved an open discussion between experts and stakeholders in Portugal, Spain, Italy and Greece, in the course of several workshops held at different levels, particularly local. Institutions and community representatives were invited to discuss together and with scientists and to compare their perceptions of desertification and land degradation.
This was particularly intended at making local knowledge *explicit* and to create bridges between groups. The idea was that *hybridising more explicit scientific knowledges with more implicit local knowledges, researchers and stakeholders could produce more relevant and effective environmental policy and practice to monitor and tackle DLDD*. (Stringer and Reed, 2007).

From the national focal points (as shown in their National Action Programmes) to the local people, DESERTLINKS found that land degradation is most commonly discussed and understood in terms of the problems or *issues* it causes. As an example, it was not common for local stakeholders to think in terms of land degradation driving forces, pressures or responses.
For this reason the approach chosen by the project was:

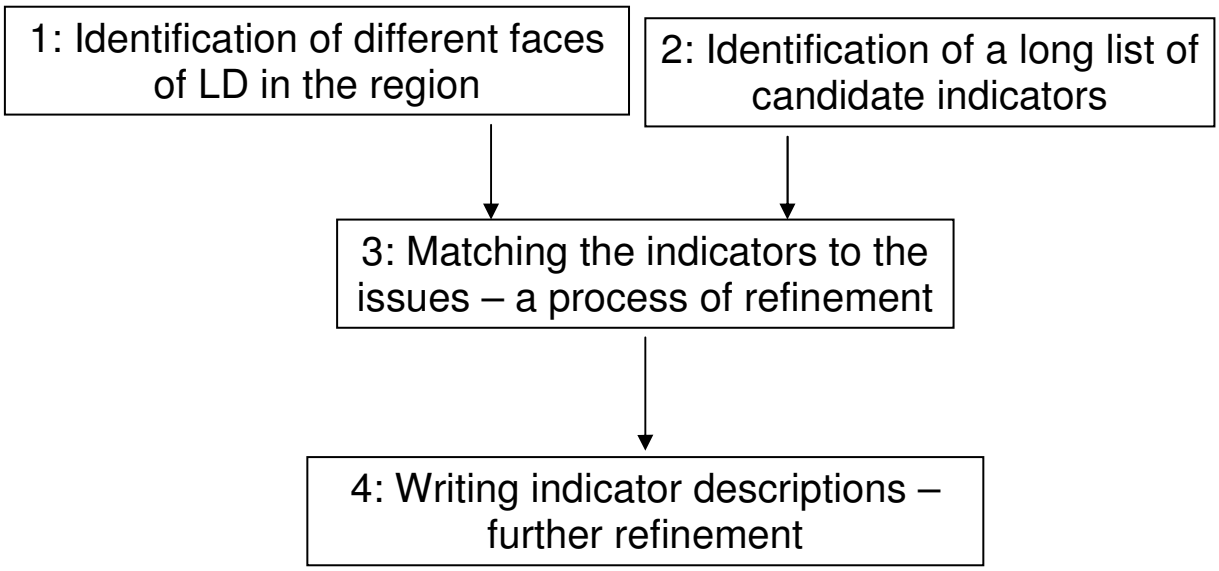
- *firstly to identify the main land degradation issues in each of the study areas;*
- *then to identify indicators of relevance to each of the issues.*

[4] DESERTLINKS Project: Desertification Indicator System for Mediterranean Europe, © DESERTLINKS 2004. Version date 30/09/2005. ISSN:1749-8996.
http://www.kcl.ac.uk/projects/desertlinks/accessdis4me.htm

We can define "*land degradation issues*" as the set of dynamics of the given SES (socio-economic/ecological systems) leading to land degradation and thus to be studied, prevented and mitigated (Zucca et al., 2009). We could say that issues are "the problems" implied by and at the origin of LD phenomena. These problems are dynamic and more easily described as trends, including trends of climatic change and land change induced by human activities.
Since issues are seen as "problems", by one side their definition will be mainly negative (as an example, "mismanagement of grazing" instead of "pastoral activities"). On the other side, they can be related to an actual trend to which a clear negative connotation is given in relation to LD. As an example in the northern Mediterranean case "land abandonment" is a "desertification issue" because it is ascertained that in that context this phenomenon can lead to LD.

B. The implementation

Four steps were implemented to arrive at a comprehensive set of indicators from which sub-sets could be used with confidence in a wide range of situations. This approach is schematically presented by the picture below.



The first step is an exhaustive analysis of all the different aspects of land degradation. In DESERLINKS, sources of information included:

1. Text of the United Nations Convention to Combat Desertification
2. A "Land degradation Enquiry", made to the general public
3. Reports from local participatory workshops on the perceptions of local stakeholders of the problem of land degradation

4. National Action Plans for Portugal, Spain, Italy and Greece
5. First and Second National Reports on the Implementation of the UNCCD, 2000 and 2002
6. Reports of the National Committees to Combat Desertification to the Second MEDRAP workshop "Identification of Sensitive Areas", Tróia, Portugal, 6 to 8 June 2002

The results of the analysis of the various sources is schematically presented in the **Annex 1** to the present guidelines.

The many and various issues were grouped into related themes and sub-themes.
The list of issues underwent a series of cycles of refinement until 10 themes emerged as the major ones in Mediterranean desertification, as identified by both national and local stakeholders.
This approach enables the all-encompassing term land degradation to be broken down into manageable pieces according to how it is perceived by the affected population.

The list of issues finally selected is presented in the box below.

BOX1: Issues of relevance for the European Mediterranean Region.

1. Land abandonment
2. Increase in intensive irrigated farming
3. Overgrazing
4. Deforestation
5. Littoralisation (concentration of economic and social activity in coastal areas)
6. Inappropriate dry farming agricultural practices on marginally productive land
7. Changes in the economic activity in desertification-affected areas
8. Changes in the availability of water resources
9. Changes in the social structure
10. Institutional organisation to combat desertification

All these issues contribute, directly or indirectly, to determine the degradation of the physical environment (casing processes of soil erosion, salinisation, etc.).

Step 2 is the compilation of a long list of candidate indicators from which those to be included in the indicator system would eventually be selected.
The candidate indicators came mainly from within the sources above that provided evidence of the problems and issues.

- Indicators from the National Action Plans for Portugal, Spain, Italy and Greece have been used to identify desertification-affected areas within each country. These

indicators tend to be those for which data is available at the national scale (such as wild-fire incidence, drought index, land use index).

- Secondly there are indicators from over fifteen years of European research into the causes and consequences of land degradation and desertification in Mediterranean Europe. These indicators range from the Mediterranean-wide scale (vegetation cover from remote sensing, regional degradation index) to the sub-national (employment index, deforested area, effective precipitation) to the plot scale (soil depth, tillage operations).

- Finally the local participatory workshops were a source of indicators.

The work carried out with local stakeholders did not generate *participatory indicators* as defined by Reed et al. (2008) and was not based on formal *focus groups*. However it significantly enriched the indicators lists.

In step 3, a progressive review of both the issues and the indicators is undertaken. Project members were asked to use their research expertise to identify which indicators related to each of the different aspects of the issues.
Only those indicators where there was a high level of consensus were included.
Taking this approach allows the user to focus on a sub-set of indicators that are of relevance to the particular face of land degradation in his region.

The results of step 2 and 3 as carried out by the project are presented in **Annex 2** to the present guidelines.

The step 4 is the completion of indicators fact sheets, according to the standardised format for describing indicators used by the CSD (Commission on Sustainable Development) that was modified and adopted for use with land degradation indicators by DESERTLINKS (Enne and Zucca, 2000).
Some indicators that initially seemed to be useful were removed from the list because it was realised that it was impossible to describe them adequately, measure them in any meaningful way or because data availability was a problem.

The Fact Sheet format includes the following sections:

1. Definition
2. Position within the DPSIR logical framework
3. Target and political pertinence
4. Methodological description and basic definitions

5. Evaluation of data needs and availability
6. Institutions that have participated in developing the indicator
7. Additional information

The detailed content of the Fact Sheet is described and discussed in the *DIS4LADA User Manual*.

LADA-NRD LOA
National Indicators Guidelines - Annex I

THE DEFINITION OF LD ISSUES. THE DESERTLINKS[1] EXPERIENCE

The purpose of this paper was to summarise the information compiled by the DESERTLINKS project on the identification of the problems and main issues associated with desertification as well as strategies proposed to combat it. This information was used to organise the way information is provided in the desertification indicator system (DIS4ME).

The information sources included to date are:

1. Text of the United Nations Convention to Combat Desertification
2. DESERTLINKS "Desertification Enquiry" made of the general public
3. DESERTLINKS Reports from participatory workshops on the perceptions of local stakeholders of the problem of desertification.
4. National Action Plans for Portugal, Spain, Italy and Greece
5. First and Second National Reports on the Implementation of the UNCCD, 2000 and 2002
6. Reports of the National Committees to Combat Desertification to the Second MEDRAP workshop "Identification of Sensitive Areas", Tróia, Portugal, 6 to 8 June 2002

Having completed this review, the **next step** was to homogenise the various lists of problems, issues and strategies, making clear which were relevant to the whole Mediterranean region and which were relevant to part of it only. We then began the process of matching indicators from the candidate list to the problems and strategies.

1. The problem of desertification as identified by the UNCCD

(Source: text of the United Nations Convention to Combat Desertification)

The principal, worldwide problems caused by desertification are identified by the UNCCD as

- LOSS OF BIOLOGICAL PRODUCTIVITY
- LOSS OF ECONOMIC PRODUCTIVITY
- LOSS OF COMPLEXITY IN LANDSCAPE

(NB "landscape" is an abbreviation of rainfed cropland, irrigated cropland, range, pasture forest and woodland)

[1] DESERTLINKS Project: Desertification Indicator System for Mediterranean Europe, © DESERTLINKS 2004. Version date 30/09/2005. ISSN:1749-8996. http://www.kcl.ac.uk/projects/desertlinks/accessdis4me.htm.

The particular issues in the UNCCD identifies in the Mediterranean region are

- HIGH RAINFALL VARIABILITY
- POOR, HIGHLY ERODIBLE SOILS
- STEEP SLOPES
- FOREST LOSS FROM FIRE
- LAND ABANDONMENT
- DETERIORATION OF SOIL AND WATER CONSERVATION STRUCTURES
- UNSUSTAINABLE EXPLOITATION OF WATER RESOURCES
- CONCENTRATION OF ECONOMIC ACTIVITY IN COAST (INCLUDING IRRIGATED AGRICULTURE)

2. Problem of desertification as perceived by the general public in affected Mediterranean countries

(Source: DESERTLINKS Desertification Enquiry designed by Roxo)

	Beja	Mertola	Agri	Guadalentín[2]	Lesvos
1	depopulation	depopulation	lack of water	deforestation	lack of water
2	lack of employment	advance of deserts	drought	lack of water	drought
3	drought	deforestation	deforestation	drought	increase in temperature
4	deforestation	drought	temperature increase	soil erosion	fire
5	poor infrastructure	lack of water	climate change	aridity	deforestation
6	lack of water	lack of employment	fire	desert advance	destruction of vegetation
7	desert advance	climate change	desert advance	biodiversity loss	soil and water pollution
8	soil erosion	soil erosion	ozone layer destruction	fire	depopulation

Fifteen problems or issues were listed in the questionnaire and the respondents were asked which of them they associated with desertification. The problems have been

[2] In the Guadalentín the survey was sent to both secondary schools and universities. The results given here are for the two sets of replies combined. An additional question was included in the survey "How do you think desertification is affecting the area?" to which the combined replies were

- droughts, impoverished lands, desert, emigration
- vegetation degradation
- reduction in the quality of life
- increase of temperatures

ranked according to the frequency with which they were mentioned and the top eight have been listed above. These problems are in the top eight in all four affected areas:

- LACK OF WATER
- DROUGHT
- DEFORESTATION

However there is a clear difference between Portugal and the other three

- DEPOPULATION and
- LACK OF EMPLOYMENT

being the two highest rated problems in Portugal and

- DROUGHT,
- LACK OF WATER and
- DEFORESTATION

being in the two highest-rated problems in Italy, Spain and Greece.

3. Problems or signs of desertification as identified by groups of local stakeholders at participatory workshops

The mission for work with stakeholder groups was: to work with local stakeholders to develop a range of indicators relevant to their perception of desertification, land use types and decision making processes; in order to help in the selection of indicators.

The stakeholder groups included:

- representatives from different socio-professional groups and organisations drawn from local communities;
- representatives from different levels of political and governmental decision making, including representatives of the National Committees to Combat Desertification;
- members of the scientific community in the different fields related to desertification, from the natural to the social sciences.

Stakeholders were invited to take part in a series of three workshops which took place over a period of three years in each of the project areas.

The first workshop examined the impact of desertification as it perceived by the local stakeholders. Its objective was to search for candidate indicators related to land degradation and desertification. The study clarified the environmental and socio-economic dimensions of desertification and raised awareness in the population on the issues of land degradation and the need for protection of natural resources.

The second workshop analyzed the effects of different types of land management on land degradation. A complete assessment of the land use systems and land management practices on land degradation or land restoration was made. The stakeholders discussed the best practices to combat desertification which could be used in their local area.

The third workshop analyzed the factors affecting land use decision-making in order to identify indicators related to driving forces and pressures imposed on the natural

resources. The identification of the processes of how decisions about land use and land use change are made provided information for policy makers and land managers in formulating effective strategies for combating desertification.

Portugal

At a series of half day workshops held in four areas in Portugal, groups of local stakeholders were asked to identify the principal signs of desertification. In order of decreasing importance these signs were

- INADEQUATE AGRICULTURAL TECHNIQUES
- POOR AND DEGRADED SOILS
- REDUCTION OF BIODIVERSITY
- LAND EROSION
- PLANNING AND MANAGEMENT OF RURAL SPACE
- REDUCED ECONOMIC ATTRACTIVENESS
- DEGRADATION OF VEGETATION
- DEPOPULATION OF THE RURAL SPACE
- AGEING OF THE POPULATION
- ABANDONMENT OF AGRICULTURAL LAND
- INADEQUATE AGRICULTURAL POLICIES
- FIRES
- LOW PRODUCTIVITY LAND
- WATER RESOURCES

A large number of strategies to combat these problems were suggested in the workshops, together with potential partners who could take part in them. These have not been synthesised.

Italy

- IMPOVERISHMENT AND DEGRADATION OF TERRITORIAL RESOURCES
  - Reduction of available water resources (Env and Econ)
  - Bad maintenance of pipelines (Inst)
  - Decrease of land productivity (Econ)
  - Less tourist attraction (opportunity or dangerous) (Econ)
  - Increase of deforestation and fire risk
  - Abandonment of traditional technologies and tacit knowledge (Econ)
- CLIMATE CHANGE
- INCREASE OF TERRITORIAL DISPARITY (COSTAL/INTERNAL (SOCIAL)
- REDUCTION OF RURAL POPULATION
  - Elderly of rural population
  - Abandonment of agricultural land
  - Ecosystem alteration due to the innovative agricultural technologies
  - Demographic pressure
  - Increase of social conflict for the use of natural resources, especially water

- ABSENCE OF PERCEPTION OF THE ECONOMIC VALUE OF NATURAL RESOURCES
  - Degradation and low quality of life (Env)
  - Increase of the cost for services (especially transport) due to territorial degradation (Econ)
  - No integration of environmental variables in the territorial and sector policies and/or missing of integrated approach from the policy makers (Inst)
  - Development policies (for the agricultural sector) not responding to the local peculiarities (Inst)
  - Absence of controls on the results of public founds
- ABSENCE OF TERRITORIAL NETWORK ABLE TO MANAGE THE PHENOMENA THAT IS CAUSE/EFFECT OF WEAKNESS OF SOCIAL CAPITAL (INST)

Spain

The local stakeholder workshop in the Guadalentín concluded that soil resources are running out in the area. Even though this is identified as a very severe problem, it is not considered a priority at a political level. Two agricultural systems exist in the Guadalentín basin and they are related to two different kinds of sensitivity to the environment: intensive farming, consuming resources and being very aggressive to the environment; and dry farming which is more and more marginal. The perceptions of the stakeholders to the origin of the problem (not in order of importance) were:

- SOIL RESOURCE IS NOT PROPERLY VALUED
- SLOPING SOILS ARE PLOUGHED
- EXISTENCE OF A VERY INTENSIVE AGRICULTURAL SYSTEM
- THE IDEA OF MULTIFUNCTIONAL AGRICULTURE DOES NOT WORK IN THE GUADALENTÍN
- LACK OF SOIL PROTECTION MEASURES BY THE ADMINISTRATION
- CULTURE OF NEW AGRICULTURE BASED ON IRRIGATION AND EASY MONEY
- TECHNICIANS AND MANAGERS DO NOT HAVE SUFFICIENT KNOWLEDGE ABOUT DESERTIFICATION
- THE TWO SYSTEMS OF DRY AND IRRIGATED FARMING LEADS TO A FRAGMENTATION OF THE TERRITORY
- OVERGRAZING
- NEW CULTIVATION ON SLOPING OR FORESTED SOILS
- INTENSIFICATION OF DRY FARMING
- NOT ENOUGH QUALITY IN DRY FARMING PRODUCTION
- "MENTAL DESERTIFICATION"

The stakeholders' perception of the signs and consequences of desertification (not listed in order of importance) were:

- LOSS IN CROP PRODUCTION
- LOSS OF WATER QUALITY
- NEW IRRIGATION CULTURES ON DRY FARMING AREAS
- DISAPPEARANCE OF SPRINGS
- DEPOPULATION AND POPULATION MOVEMENTS IN RURAL AREAS
- DEGRADATION OF ABANDONED AGRICULTURAL LAND

Greece

The results obtained from: (a) the questionnaire filled in collaboration with the local land users, and (b) the workshop organized in the island of Lesvos showed that the main impacts of desertification in the island are related to loss of land productivity and farm income. Specifically the main impacts of desertification in the island of Lesvos, in a decreasing order of importance are the following:

- LOSS IN AGRICULTURAL CROP PRODUCTION
- LOSS IN FARM INCOME
- ABANDONMENT OF AGRICULTURAL AREAS
- LOSS IN WATER RESOURCES
- INCREASE OF IMPORTED ANIMAL FEED
- INCREASE OF PASTURE FIRES
- LOSS OF SOIL RESOURCES
- LOSS IN BIODIVERSITY
- SALINIZATION OF LOWLAND
- FLOODING OF LOWLAND AND SEDIMENTATION

4. National Action Plans for Portugal, Spain, Italy and Greece and associated documents

Sources:

Italy

- *National Action Programme to combat drought and desertification, Rome, December 1999 http:/unccd.int/actionprogrammes/northmed/national/2000/italy-eng.pdf*
- *National Report of Italy on the Implementation of the UNCCD, 2000 http://www.unccd.int/cop/reports/northmed/national/2000/italy-eng.pdf http://www.desertification.it/doc/nationalreport.htm*
- *Committee for the review of the implementation of the convention. Second reporting process on UNCCD implementation. Italy National Report, April 30 2002. http://unccd.int/cop/reports/northmed/national/2002/italy-eng.pdf*
- *Report of the National Committee to combat desertification, to the second MEDRAP workshop "Identification of Sensitive Areas", Troia, Portugal, 6-8 June 2002.*

Greece

- *Greek National Committee for combating desertification: First national report on the implementation of the United Nations Convention to combat desertification. Athens March 2000. . http://unccd.int/cop/reports/northmed/national/2000/greece-eng.pdf*
- *Greek National Action Plan for combating desertification. (Extended Summary), Athens - January 2001. http://www.unccd.int/actionprogrammes/northmed/national/2001/greece-eng.pdf*

- *Greek National Committee for combating desertification: Second national report on the implementation of the United Nations Convention to combat desertification. Athens April 2002. http://unccd.int/cop/reports/northmed/national/2002/greece-eng.pdf*
- *Report of the National Committee to combat desertification, to the second MEDRAP workshop "Identification of Sensitive Areas", Troia, Portugal, 6-8 June 2002.*

Portugal:

- *National Action Plan to Combat Desertification – 17 June 1999.*
- *Portugal – Summary of National Report http://www.unccd.int/cop/reports/northmed/national/2000/portugal-summary-eng.pdf*
- *National Report on the implementation of the convention to combat desertification in Portugal. April 2002. http://www.unccd.int/cop/reports/northmed/national/2002/portugal-eng.pdf*
- *DISMED Technical workshop on thematic and sensitivity mapping on desertification and drought – Portuguese report, March 2002. http://p-case.iata.fi.cnr.it/dis-med/Djerba-presentations.htm*
- *Report of the National Committee to combat desertification, to the second MEDRAP workshop "Identification of Sensitive Areas", Troia, Portugal, 6-8 June 2002.*

Spain:

- *SPAIN SURMODES website: http://www.eeza.csic.es/Spain SURMODES*
- *DISMED Technical Workshop on NAP information needs. Spanish NCB report, July 2001. http://p-case.iata.fi.cnr.it/dis-med/ . DISMED_Florence_spain_NCB.rtf*
- *National Report on the implementation of the convention to combat desertification in Spain. April 2002. Il informe sobre el programa de accion nacional contra la desertification. http://www.unccd.int/cop/reports/northmed/national/2002/spain-spa.pdf*
- *Report of the National Committee to combat desertification, to the second MEDRAP workshop "Identification of Sensitive Areas", Troia, Portugal, 6-8 June 2002.*

Whole Annex IV

- *Second Annex IV subregional report for the implementation of the UNCCD. Athens, Greece, April 2002. http://www.unccd.int/cop/reports/northmed/regional/2002/group_of_annex_iv_countries-eng.pdf*

5. Reports of the National Committees to Combat Desertification to the Second MEDRAP workshop "Identification of Sensitive Areas", Tróia, Portugal, 6 to 8 June 2002

Although the information from these reports is also given in the table above, the principal findings are given here, country by country to give a clearer impression of the national pictures. These reports contain more recent developments in work done by the national committees, particularly relating to the consultation of stakeholders about the problem and mitigation of desertification in their own locality, and about potential solutions. They also contain further information about indicators which have been used by the national committees to map environmental sensitivity.

Portugal

The report summarises the results of the series of half day workshops held in four areas of Portugal. Because the workshops were run jointly by the Focal Point and DESERTLINKS the signs of desertification identified by the stakeholders have already been listed in Section 3 above. However, this report also highlights the potential **solutions** that were recognised by the stakeholders.

Relating to soils:

- *MINIMUM TILLAGE AND OTHER GOOD AGRICULTURAL PRACTICE*
- *NATURAL GRAZING*
- *AIDS TO CULTURES THAT ENRICH THE SOIL*
- *SUITABLE LIVESTOCK DENSITY*
- *DIVERSIFICATION OF SPECIES USED IN AFFORESTATION*
- *SCRUBLAND MANAGEMENT*
- *CREATION OF WATER RESERVOIRS*
- *PREVENTION OF FOREST FIRES*
- *USE OF TRADITIONAL PRACTICES*
- *RIVER PROTECTION*
- *REDUCTION OF OVERLAND FLOW*

Relating to the economy

- *BETTER ROAD NETWORK*
- *ETHNOLOGICAL AND CULTURAL ITINERARIES*
- *ORIGIN DENOMINATION PRODUCES*
- *COMMERCIAL CONDITIONS TO REGIONAL PRODUCES*
- *RURAL AND ENVIRONMENTAL TOURISM*
- *FISCAL BENEFITS*
- *PROMOTION OF QUALITY OF LIFE*
- *REQUALIFICATION OF URBAN AND RURAL CENTRES*
- *BENEFITS TO SETTLE YOUNG PEOPLE*
- *BENEFITS TO SETTLE ENTERPRISES*
- *PUT INTO PRACTICE TO ATTEND THE INFORMATION OF PEOPLE LIVING ON VILLAGES*
- *DIGNIFY THE WORK OF THOSE LIVING IN DEPRESSED AREAS*

Spain

The Spanish report describes the results of a two phase consultation exercise with stakeholders held in Madrid in 2001. In the first phase managers and policy makers from national, regional and local administrations were involved and in the second phase members of civil society.

The principal **problems** related to desertification were identified as:

- SOIL EROSION
- WILD FIRES
- AGRICULTURAL AND FORESTRY PRACTICES
- EROSIVE CLIMATE CONDITIONS
- SOIL ERODIBILITY
- SOIL SALINISATION
- OVER EXPLOITATION OF AQUIFERS
- CONCENTRATION OF AGRICULTURE IN IRRIGATED AREAS
- INVESTMENT IN IRRIGATED AGRICULTURE
- POPULATION INFLOW.
- AGRICULTURE AND STOCKBREEDING SYSTEMS
- RAINFED CROPS ON STEEP AND MODERATE SLOPES
- HETEROGENEOUS DISTRIBUTION OF LIVESTOCK DENSITY
- OVER GRAZING
- ABANDONMENT OF MARGINAL FARMING SYSTEMS
- RAPID EXPANSION/CONTRACTION OF MARGINAL LAND IN RESPONSE TO MARKET CHANGES
- INTENSIVE AGRICULTURE
- LACK OF INVESTMENT ON CONSERVATION SYSTEMS
- LITTORALISATION OF THE ECONOMY

Solutions to combat desertification included:

- *FULL IMPLEMENTATION OF AGRI-ENVIRONMENTAL MEASURES TO AVOID SOIL DEGRADATION AFTER MARGINAL LAND ABANDONMENT*
- *FOREST RESTORATION*
- *INCREASE IN PLANT COVER*
- *INCREASE IN DIVERSITY OF VEGETATION COVER*
- *PREVENTION OF WILD FIRES*
- *MAINTAINING SOIL AND WATER CONSERVATION STRUCTURES*
- *TARGET AREAS DEGRADED CLOSE TO OR BEYOND THEIR REGENERATION CAPACITY*
- *EFFECTIVE MONITORING AND ASSESSMENT OF RESTORATION ACTIVITIES*
- *EVALUATION OF PAST RESTORATION ACTIONS*
- *AID SYSTEMS TO PRIVATE LAND OWNERS TO GAIN COOPERATION IN RESTORATION*
- *AFFORESTATION WITH SUITABLE TECHNOLOGY AND IN PRIORITY AREAS*
- *AFFORESTATION OF SEMIARID MARGINAL LANDS WITH FODDER RESOURCES*
- *INCREASED RESEARCH AND TECHNOLOGY TRANSFER REGARDING RESTORATION TECHNIQUES.*

Greece

No mention is made in the report of a specific consultation exercise with stakeholders. However the public and authorities generally understand desertification to mean.

- THREAT AND CONSEQUENCES OF DROUGHT
- SCARCITY OF FRESH WATER SUPPLY

Italy

In April 2002 the Italian National Committee held a consultation exercise with local stakeholders in Licata, Sicily. **Problems** associated with desertification are perceived by the stakeholders to be:

- SCARCE WATER RESOURCES
- PROGRESSIVE DECLINE IN ECONOMIC ACTIVITY
- INADEQUATE DEVELOPMENT OF NEW ECONOMIC ACTIVITIES
- PROGRESSIVE SPECIALISATION IN AGRICULTURE
- ABANDONMENT OF HILLY AREAS
- LOW LEVELS OF COMPETITION BETWEEN EXTREMELY SPECIALISED COMPANIES
- LACK OF MARKETING SUPPORT STRUCTURES
- LOW QUALITY WATER RESOURCES

Solutions were seen to be:

- *INCREASE WATER AVAILABILITY TO CIVIL AND AGRICULTURAL USES BY PURIFICATION AND RE-USE*
- *RAISE THE QUALITY OF PRODUCTION AND COMPETITIVENESS OF AGRICULTURAL PRODUCTS*
- *CONVERSION OF ABANDONED AGRICULTURAL UNITS TO AGRITOURISM FACILITIES*
- *ECONOMIC AND REGIONAL PLANNING MEDIUM TO LONG TERM*
- *DEVELOPMENT OF CITIZEN AWARENESS AND PARTICIPATION*

LADA-NRD LOA

National Indicators Guidelines - Annex II

RELATING INDICATORS TO ISSUES.

RESULTS OF THE DESERTLINKS[1] EXPERT CONSULTATION.

The great majority of the indicators listed in these tables have been fully described in DIS4ME. However, a few have not yet been described, these are shown in *italics*.

Some of the indicators listed in the tables are defined as Headline indicators.
Headline indicators are mentioned in many indicator systems, as the key indicators, the most important indicators, summary indicators, or indicators useful to make headlines in the media. The European Environment Agency suggest that "The purpose of environmental headline indicators is to provide simple and clear information to decision-makers and the general public about progress in environmental policies and the key factors determining the state of the environment and whether we are moving towards environmental sustainability." Desertification headline indicators should have a similar purpose.

A range of alternative indicators is available according to data availability. In DESERTLINKS we have been seeking key headline indicators that can be defined and measured in the same way in adjacent areas or countries to provide a credible basis for comparison and monitoring change. They may be already in widespread use in the countries of Annex IV, or be additional indicators selected to further enhance a common approach. Headline indicators are often calculated from a collection of indicators as an index.

Issue-indicators relationships are schematically described according to the three following item:

- what can be observed (or process or state dynamics);
- reasons for what is observed (or factors influencing the issue or driving forces and pressures);
- consequences of what is observed (or impacts and responses).

The different facets of each theme are given in sub-themes and indicators of direct relevance. Some are also suggested as headline indicators which, if considered as a group, form a sub-set of indicators encapsulating the major processes in the issue. Some indicators appear more than once because they relate to more than one theme.

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[1] DESERTLINKS Project: Desertification Indicator System for Mediterranean Europe, © DESERTLINKS 2004. Version date 30/09/2005. ISSN:1749-8996. http://www.kcl.ac.uk/projects/desertlinks/accessdis4me.htm.

Table of indicators relating to **Inappropriate dry farming practices on marginally productive land**

Inappropriate dry farming practices on marginally productive land	Sub-theme	Indicators
What can be observed (process or state dynamics)	Farm income, including subsidies	Net farm income (Headline)
	Income from off-farm employment	Parallel employment
	Land management changes	Land use evolution (Headline) Tillage operations Tillage direction Fragmentation of land parcels Farm size (Headline)
Reasons for what is observed (influencing factors or driving forces and pressures)	Climate	Climate quality index (Headline) Rainfall Rainfall seasonality Rainfall erosivity Potential evapotranspiration Aridity index (1) Aridity index (2) Drought index Drought
	Soil	Soil quality index (Headline) *Soil organic matter in surface soil*
	Economic and socio-economic conditions	*Agricultural prices* EU production subsidies Irrigation potential realised Urban sprawl Farmer's age
	Farming practices	Tillage operations Tillage depth Tillage direction
	Land use	Land use type Land use intensity
Consequences of what is observed (or impacts and responses)	Land abandonment	Land abandoned from agriculture
	Soil degradation	*Soil erosion*
	Policy enforcement	Policy enforcement
	Agri-environmental management	Agri-environmental management

Table of indicators relating to **Deforestation**

Deforestation	Sub-theme	Indicators
What can be observed (process or state dynamics)	Deforestation	Deforested Area (Headline) Vegetation cover (Headline) Biodiversity conservation (Headline) *Area of cultivated & semi-natural vegetation (Headline)*
Reasons for what is observed (influencing factors or driving forces and pressures)	Climatic conditions	Climate quality index Aridity index (1) Aridity index (2)
	Drought tolerance of forest	Drought Resistance
	Forest destruction by fire	Wild fire incidence Burned Area Fire Frequency Fire Risk Forest fragmentation Fire Protection
	Forest productivity	*Crop Productivity* Forest productivity
	Impact of grazing on deforestation	Grazing intensity Grazing
	Role of forest management	*Sustainable forest management* *Land Use Policy* Policy enforcement Internal resources mobilisation Forest management quality
	Things going on in the wider world	EU production subsidies
	Impact of human population	Population density Urban sprawl
Consequences of what is observed (or impacts and responses)	Change in erosion risk	Erosion risk (RDI)

Table of indicators relating to: **Land degradation**

Land degradation	Sub-theme	Indicator name
What can be observed (process or state dynamics)	Results from composite indicators	ESI (Headline) *RDI (Headline)*
	Off-site impacts	*Sediment deposition (Headline)*
	Changing land use	Land use evolution (Headline)
	Vegetation cover	Vegetation cover (Headline) Ecosystem resilience
	Soil	Soil erosion (USLE) (Headline) Soil quality index Soil texture Organic matter in surface soil rs Soil structure Erosion risk (RDI) Soil depth Soil surface stability Drainage *Salinization potential*
	Control of erosion	Soil erosion control measures Runoff water storage
	Fire	Burned area Wild fire incidence Forest fragmentation
	Changing land-use	Period of existing land use type *Area of cultivated and semi-natural vegetation* Irrigated area
	Water availability	Ground water depth (change in)
	Population	Population density
	Biodiversity change	Biodiversity conservation
Reasons for what is observed (influencing factors or driving forces and pressures)	Climate	Rainfall Rainfall seasonality Rainfall erosivity Potential evapotranspiration Aridity index (1) Aridity index (2)
	Soil	Parent material Slope gradient
	Vegetation	Deforested area
	Changing land-use	Land use type Land use intensity Land abandoned Area of marginal soil used EU production subsidies Irrigated area *Land use policy*

		Water use policy/law
	Production methods	Tillage operations *Area of hillslope cultivated* Grazing intensity *Grazing impact* Farm size
	Productivity change	Net farm income Fertilizer application
	Salinisation	Water quality
Consequences of what is observed (or impacts and responses)	Fire	Burned area Wild fire incidence
	Changing land-use	Land use evolution Irrigated area
	Production methods	Farm size Traditional agricultural products
	Control of erosion	Soil erosion control measures Runoff water storage
	Soil erosion	Soil erosion (USLE) Land abandoned Infiltration capacity
	Change in vegetation	Vegetation cover

Table of indicators relating to: **Economic activity**

Economic activity	Sub-theme	Indicators
What can be observed (process or state dynamics)	Changes in the economic activities in desertification affected areas	Land use evolution (Headline) Population density (Headline) Employment index (Headline) Unemployment rate (Headline) GDP per capita (Headline) Land use intensity (Headline)
Reasons for what is observed (influencing factors or driving forces and pressures)	Climatic conditions	Rainfall Rainfall seasonality
	Ecosystem conditions	Soil erosion (USLE) Ecosystem resilience Area of marginal soil used *Accessibility*
	Benefits and subsidies	EU production subsidies Internal resources mobilisation
	Change in farm income	Net farm income *Prices of agricultural products* *Demand for agricultural products* *Crop Productivity* Farm ownership
	Development of tourism	Tourism change *Protection by national parks* *Land Use Policy* Policy enforcement Tourism intensity *Tourist destination*
	Changing rural population	*Demographic variation index* Farmer's age Parallel employment *Mortality rate* Adult education level *Transient Population*
	Expansion of use of irrigation	*Expenditure on energy* Expenditure on water Irrigated area Groundwater depth (change in) Drainage Irrigation potential realised
Consequences of what is observed (or impacts and responses)	Exploitation of resources	*Current land tax system* *Rate of renewal of resources/rate of use*
	Progressive decline in traditional agriculture	Land abandoned from agriculture Period of existing land use type *Land Use History*
	Development of new	*Farmer cooperatives*

	activities (apart from irrigated agriculture)	*Number of EU environmental certified company/Total companies*

Table of indicators relating to: **Institutional organisation to combat desertification**

Institutional organisation to combat desertification	Indicators
National assessment of desertification risk	ESI Drought index Land use type Land use evolution Erosion risk (RDI) *Salinization potential* Fire risk Drought resistance Acidified area Soil erosion Vegetation cover Water quality Groundwater depth (change in) Flooding frequency Grazing intensity Deforested Area Tourism change Land abandoned from agriculture GDP per capita R & D expenditure
National policy and strategy framework	*Land use policy* *Water use policy/law* Fire Protection *Protection by national parks* Policy enforcement Internal resources mobilisation EU production subsidies *Number of rural development programmes, actions and measures implemented* *Illegal buildings*
Local capacity for combating desertification	Adult education level Employment index Unemployment rate Human poverty index Farmer's age *Demographic variation index* Old age index Population density Population growth rate Fragmentation of land parcels Farm size *Accessibility* *Farmer cooperatives* *Public perception of desertification*

Local use of best practices	Land use intensity Area of marginal soil used Soil erosion control measures *Soil water conservation measures* *Sustainable forest management* Sustainable farming Reclamation of affected soils Grazing control *Reclamation of mining areas* *Number of local action plan to combat desertification*

Table of indicators relating to: **Intensive irrigation**

Intensive irrigation	Sub-theme	Indicators
What can be observed (process or state dynamics)	Increase in intensive, irrigated agriculture	Land use type (Headline) Irrigation potential realised (Headline)
Reasons for what is observed (influencing factors or driving forces and pressures)	Climatic conditions	Climate quality index Rainfall seasonality Aridity index (1) Aridity index (2)
	Soil conditions	Soil quality index Slope gradient Drainage *Soil mapping units* Infiltration capacity
	Water availability	Groundwater depth (change in) Water quality Tourism change Irrigated area
	Income from land	Farm ownership Farmer's age EU production subsidies Net farm income *Prices of agricultural products*
	Things going on in the wider world	*Water use policy/law* *Cultivated area under subsidy*
Consequences of what is observed (or impacts and responses)	Soil salinization	*Salinization Potential*
	Deterioration of water availability	Groundwater depth (change in)
	Change in cultivation techniques	Mechanisation index Fertilizer application *Expenditure on energy* Expenditure on water Area of marginal soil used

Table of indicators relating to: **Littoralisation**

Littoralisation	Sub-theme	Indicators
What can be observed (process or state dynamics)	Economy by sectors (coast)	Value added by sector
	GDP inland/ coast and rate of change	GDP per capita Tourism contribution to local GDP
	Tourism development (coast)	Tourism change Tourism intensity (Headline)
	Population and rate of change (inland/ coast)	Population growth rate (Headline)
	Agriculture development (coast)	Land use intensity
	Expansion of artificial areas and tourism settlements in coastal zones	Urban sprawl (Headline)
Reasons for what is observed (influencing factors or driving forces and pressures)	Role of planning and land use policy (coast)	River basin management plan *Water use policy/law* Policy enforcement
	Employment opportunities (inland/coast)	Employment index Unemployment rate
	Existence of subsidies for economic activities (coast)	*National funding* *Regional/local funding*
	Tourism demand (housing, services etc) (coast)	Urban sprawl (Headline)
	Tourism and irrigation demand for water (coast)	Water consumption by sector (Headline) Aquifer over exploitation
	Land abandonment (inland)	Land abandoned from agriculture
Consequences of what is observed (or impacts and responses)	Water consumption (coast)	Groundwater depth (change in) Water availability Water scarcity (Headline)
	Soil consumption due to urban expansion (coast)	Urban sprawl (Headline)
	Biodiversity loss (coast)	Biodiversity conservation in natural environments Forest fragmentation
	Water pollution (coast)	Water quality
	Land/land use change	Soil erosion control measures

	(inland)	*Soil water conservation measures*
	Sustainable policies	Local Agenda 21 *Water use policy/law* Policy enforcement Penetration of touristic eco-label

Table of indicators relating to: **Changes in social structure**

Changes in social structure	Sub-theme	Indicators
What can be observed (process or state dynamics)	Changes in the social infrastructure	Old age index (Headline) Population density (Headline) GDP per capita (Headline) Adult education level (Headline) Human poverty index (Headline)
Reasons for what is observed (influencing factors or driving forces and pressures)	Changing agricultural system	Aquifer over-exploitation Irrigated area Groundwater depth (change in) Water quality Parallel employment Farmer's age EU production subsidies Net farm income Farm ownership Farm size
	Changing opportunities outside agriculture	Tourism change Employment index
Consequences of what is observed (or impacts and responses)	Changes in the rural population	Old age index
	Littoralisation and urbanisation	Period of existing land use type Urban sprawl
	Changing land use	Land use evolution Land use type Land abandoned from agriculture

Table of indicators relating to: **Water resources**

Water resources	Sub-theme	Indicators
What can be observed (process or state dynamics)	Changes in the availability of water resources	Waste water recycling (Headline) Water quality (Headline) Groundwater depth (change in) (Headline) Aquifer over exploitation (Headline) Effective precipitation (Headline)
Reasons for what is observed (influencing factors or driving forces and pressures)	Climatic conditions	Climate quality index Rainfall Rainfall seasonality Potential evapotranspiration Drought index
	Soil conditions	Soil quality index Infiltration capacity *Rainfall-runoff relationship*
	Changes in land use	Land use type Period of existing land use type Land use evolution Land abandoned from agriculture Area of marginal soil used *Soil water conservation measures* Vegetation cover Deforested Area
	Increase in urban water use	Tourism change Population density *Demographic variation index*
	Increase in irrigated agriculture	Irrigated area *Cultivated area under subsidy* Irrigation potential realised *Irrigated UUA/dry UUA*
	Things going on in the wider world	*Water use policy/law* *Land Use Policy* Policy enforcement EU production subsidies Internal resources mobilisation
Consequences of what is observed (or impacts and responses)	Intensification of agriculture	Expenditure on water Land use intensity
	Reduction in water reserves and quality	Groundwater depth (change in) Water quality
	Change in flooding frequency	Flooding frequency
	Farm income	Net farm income

LADA-NRD LOA
National Indicators Guidelines - Annex III

ELICITING NATIONAL SPECIFIC INDICATORS. A PILOT LADA EXPERIENCE IN TUNISIA (also see the legend below the table)

Indicateurs			CLASSES OCCUPATION SOL			SOCIO-ECONOMIQUES/STAT. NAT. Etc.			SOL-VEGETATION-BIODIVERSITE			CLIMATIQUE			RESSOURCES HYDRIQUES			
			CULTURES IRRIGUEES			**CULTURES PLUVIALES**			**AGRO-PASTORALISME**			**PASTORALISME**			**FORETS**			**Z. HUMIDES**
Pression	**P1**	**N**	aridité climatique	**P5**	**N**	pluviométrie : frequence/intensité phenomènes exceptionnels	**P20**	**N**	superficies emblavées en céréales / superficie des parcours steppiques	*	**N**	P20	*		P1	**P43**		superficie surpaturée à l'amont
(D/P)																		
	P2	**N**	superficie totale irriguée	**P6**	**N**	superficies agricoles pluviale	**P21**	**L**	Charge animal: nombre d'unités de petit bétail /ha	**P25**-E18	**N**	(diminution de) superficie des formations steppiques	**P32**		Moyenne pluviométrique annuelle	**P44**		superficies intéressées par aménagement agricoles à l'amont
	P3		type de culture irriguée	**P7**	**N**	% des terres cultivées en céréales	**P22**	**L**	déséquilibre du bilan fourrager : rapport entre la production de la biomasse et la demande uf	*	**L**	P21	*		P5	**P45**		entité du prélèvement faunique en z. humide dû à la chasse
	P4		taille des exploitations	**P8**	**N**	% terres destinés à cultures annuelles pluviale.	**P23**		Superficie surpaturée	*	**L**	P22	**P33**	**N**	nbre incendies/ an			
				P9	**N**	% cultures céréalières sur pentes.	**P24**		statut foncier/vocation des terres de parcours	**P26**		distribution spatiale cheptel	**P34**		surface incendiée/an			
				P10	**N**	% des terres destinées à l'arboriculture pluviale				*		P23	**P35**		superficie déboisée			
				P11	**L**	Techniques culturales utilisés : mécanisation ;				*		P24	**P36**	**N**	Superficies forestière convertie en zones agricoles			
				P12		Techniques culturales utilisés : labour, direction, profondeur				**P27**		Nmbre infrastructure (point d'eau, zones d'ombrages, pistes)	**P37**	**L**	effectif et type du cheptel/ ha de forêt			
				P13		Techniques culturales utilisés : assolements pratiqués, type de rotation				**P28**	**L**	Densité population rurale; (nmbre de habitants/ha)	**P38**	**L**	densité de la population (n habitants/ ha de forêt)			
				P14		fréquence de labours et semailles				**P29**		Distribution spatiale de la population selon les usages des ressources naturelles	**P39**		distribution spatiale de la population en zone de forêt selon usages des ressources naturelles			
				P15		Type de pratiques pastorales				**P30**		Population tirant une part de leur revenu des parcours	**P40**		volume de bois utilisé/ famille/an			
				P16	**N**	Superficies agricoles à statut foncier collectif/incertain				**P31**		sédentarisation/nomadisme	**P41**		volume de bois prélevé / potentiel de production			

				*		P4												P42		Volume des prélèvements illicites de bois			
				P17	L	Accès aux marchés: quantités et types de produits commercialisés																	
				P18		investissement pour la mise en culture																	
				P19		Accès à l'eau difficile: distance moyenne/points d'eau;																	
Etat	**E1**	**L**	qualité des sols: salinité des sols (conductivité électrique)	**E7**	**L**	superficie affectée par l'érosion hydrique	*	**L**	E10	*	**L**	E10	**E16**	**N**	superficie forestière	**E22**	**N**	superficie et répartition des zones humides					
(S)																							
	E2	**L**	qualité des sols: taux de MO	**E8**	**L**	superficie affectée par l'érosion hydrique et éoliennes	**E13**	**N**	biomasse / indice de végétation	*		E11	**E17**	**N**	densité du couvert forestier(%)	**E23**	**N**	superficie z. hum. affectée par assèchement					
	E3		qualité des sols: taux de fertilité	**E9**		pertes en sol/ha	**E14**	**L**	changement de la composition des parcours en espèces palatable	*	**N**	E13	**E18**	**N**	superficie des formations steppique	**E24**	**N**	superficie z. hum. affectée par pollution					
	E4	**L**	qualité des sols: structure	*		E1				*	**L**	E14	**E19**	**L**	superficies des forêts dégradées	*		E10					
	E5		qualité des sols: Présence /absence de conditions de hydromorphie	*	**L**	E2				**E15**		Inventaire des espèces indicatrices de dégradation irreversible	**E20**	**L**	superficies for. surpaturées								
	E6	**L**	Salinité des eaux (conductivité électrique / dureté	*		E3							**E21**	**L**	superficies for. érodées								
				*	**L**	E4																	
				E10		densité du couvert végétal																	
				E11		Densité couvert végétal steppique																	
				E12		superficie des zones ensablées																	
Impact	**I1**		productivité des terres	*		I1	**I17**	**L**	rentabilité des élevages	*	**L**	I17	**I18**	**L**	Production des forêts	**I19**		qualité de l'eau en z. hum.: oxygénation					
(I)																							
	I2	**L**	rendement des cultures	*		I2	*		I16	*		I16	*	**N**	I12	**I20**		qualité de l'eau en z. hum.: turbidité					
	I3		nombre de familles abandonnant les exploitations	**I9**		quantité d'engrais totale utilisée/ ha/an							*		I13	*	**L**	I16					

	I4	**L**	superficies des terres abandonnées	**I10**	**L**	revenu agricole								*****	**L**	I16	**I21**		abondance faune
	I5	**L**	niveau piézométrique de la nappe phréatique	*****		I3													
	I6		débit des puits	*****	**L**	I4													
	I7		degré de satisfaction des besoins en eau	**I11**		taux de chômage													
	I8		qualité de l'eau d'irrigation de surface et souterraines	**I12**	**N**	envasement des barrages: bathymétrie													
				I13		fréquence inondations													
				I14		qualité de l'eau de surface													
				I15		% de substances chimiques de l'eau des barrages en relation au standard de loi													
				I16		biodiversité animale et végétal													
Reponse (R)	**R1**		superficies drainées	**R9**	**L**	superficies traitées en ces	*****		R10	*****		R10		**R21**	**N**	Presence et type mesures pour protéger la forêt	**R27**		budget alloué aux aménagements des zones humides
	R2		Superficies soumises à la bonification des sols	**R10**		Presence mesures pour améliorer la gestion des terres	**R15**	**L**	superficies annuelles des formations steppiques mises en défens	*****	**L**	R15		**R22**	**N**	superficies de reboisement	**R28**	**N**	nombre des zones humides protégées
	R3	**L**	superficie irriguée équipée en techniques d'économie d'eau (g. à g.)	**R11**		budget alloués aux réalisations CES	**R16**	**L**	Superficie des parcours aménagé	**R18**	**N**	Superficies protégées		**R23**		taux de régénération	**R29**	**N**	Superficie des zones humides protégées
	R4	**L**	superficies plantées en cultures résistantes au sel	**R12**		Budget alloués aux réalisations et à la sauvegarde des parcours	**R17**		subvention alimentaire accordée au bétail (amélioration du bilan fourrager)	*****		R17		*****	**L**	R15			
	R5	**N**	Présence de programmes de monitorage de la salinité des eaux	**R13**		existence de subventions pour encourager la céréaliculture				**R19**		longueur des structures de fixation de sable		**R24**	**N**	budget alloué aux réalisations: aménagement forestier			
	R6	**N**	Présence de programmes de monitorage du niveau de la nappe	**R14**	**L**	superficie des plantation arboricoles subventionnées				**R20**		extension des structures de fixation de sable par rapport aux zones ensablées		**R25**		superficies destinées à l'agroforesterie			
	R7		répartition spatiale des piézomètres	*****		R8								**R26**		amélioration de l'implication et organisation de la population forestière			

LEGEND

A **CATEGORY** COULOURS / CATEGORY CORRESPONDANCE:

LAND USE
SOCIO-ECONOMIC/ NAT. STATISTICS, INFRASTRUCTURES, Etc.
SOIL-VEGETATION-BIODIVERSITY
CLIMATE
WATER RESOURCES

B **PRIORITY** BASED ON SPECIFIC RELEVANCE AND FEASIBILITY

MAJOR INDICATORS
HEADLINE INDICATORS

(the others not included in the above classes are « secondary »)

C **ECHELLE** Two working LADA scales are considered:

N = NATIONAL
L = LOCAL
Based on a double concept:
Data availability only for that given scale
Better interpretability and feasibility at that given scale (N ou L)

CORRESPONDANCE BETWEEN SPECIFIC NATIONALINDICATORS AND INDICATORS AVAILABLE IN DI4ME/DIS4LADA
* page of LADA National manual

	TUNISIE INDICATORS	DIS4ME INDICATORS	LADA INDICATORS	
	HEADLINES INDICATORS			
	CULTURES IRRIGUEES			
P1	aridité climatique	ARIDITY		
P2	superficie totale irriguée	IRRIGATED AREA		
E1	qualité des sols: salinité des sols (conductivité électrique)		INDICATORS PLANTS; WHITISH SALT DEPOSIT.	pag.36 *
E2	qualité des sols: taux de MO			
E4	qualité des sols: structure			
E6	Salinité des eaux (conductivité électrique / dureté	WATER QUALITY	DEGRADATION OF QUALITY OF WATER	pag 40*
I4	superficies des terres abandonnées	LAND ABBANDONED FROM AGRICULTURE		
I5	niveau piézométrique de la nappe phréatique	GROUNDWATER DEPTH (CHANGE IN)		
R3	superficie irriguée équipée en techniques d'économie d'eau (g. à g.)		IRRIGATION AND WATER STORAGE TECHNIQUES	PAG.36 *
	CULTURES PLUVIALES			
P5	pluviométrie : frequence/intensité			

	phenomènes exceptionnels			
P6	superficies agricoles pluviale			
P7	% des terres cultivées en céréales	LAND USE TYPE		
P8	% terres destinés à cultures annuelles pluviale.			
P9	% cultures céréalières sur pentes.			
P10	% des terres destinées à l'arboriculture pluviale			
E7	superficie affectée par l'érosion hydrique	EROSION RISK	PRESENCEAND SPACING OF GULLIES; SURFACE HARDNESS	pag. 36 *
E8	superficie affectée par l'érosion hydrique et éoliennes			
I10	revenu agricole			
I12	envasement des barrages: bathymétrie		QUALITY OF WATER: SEDIMENT LOAD OF RIVERS/LAKES	pag.36
R9	superficies traitées en ces			
	AGRO-PASTORALISME			
P20	superficies emblavées en céréales / superficie des parcours steppiques			
P21	Charge animal: nombre d'unités de petit bétail /ha	GRAZING	GRAZING SYSTEM (% extensive/intensive system)	pag.36 *
E13	biomasse / indice de végétation			
I17	rentabilité des élevages			
	PASTORALISME			

P25	(diminution de) superficie des formations steppiques			
P28	Densité population rurale; (nmbre de habitants/ha)	POPULATION DENSITY		
	FORETS			
P37	effectif et type du cheptel/ ha de forêt			
E16	superficie forestière			
E17	densité du couvert forestier(%)	VEGETATION COVER	%TREE CANOPY COVER	pag. 36 *
E18	superficie des formations steppique		TYPE OF VEGETATION::% ANNUALS,PERENNIALS,SHRUBS, TREE CANOPY	
E19	superficies des forêts dégradées		DEGRADATION SEVERITY (LOW, MED, HIGHT	pag. 36 *
E20	superficies for. surpaturées			
	Z. HUMIDES		**Z. HUMIDES**	
E22	superficie et répartition des zones humides			
E23	superficie z. hum. affectée par assèchement		CHANGE IN WATER QUANTITY	pag. 45*
E24	superficie z. hum. affectée par pollution		CHANGE IN WATER QUALITY	pag. 45*
R29	Superficie des zones humides protégées		CHANGE IN AGRICULTURAL PRODUCTIVITY IN THE WETLAND	pag. 45*

MAJOR INDICATORS

	CULTURES IRRIGUEES		
I2	rendement des cultures		
R4	superficies plantées en cultures résistantes au sel		
R5	Présence de programmes de monitorage de la salinité des eaux		
R6	Présence de programmes de monitorage du niveau de la nappe		
	CULTURES PLUVIALES		
P11	Techniques culturales utilisés : mécanisation ;	MECHANISATION INDEX	
P16	Superficies agricoles à statut foncier collectif/incertain		
P17	Accès aux marchés: quantités et types de produits commercialisés		
E12	superficie des zones ensablées		
R14	superficie des plantation arboricoles subventionnées		
	AGRO-PASTORALISME		
P22	déséquilibre du bilan fourrager : rapport entre la production de la biomasse et la demande uf		
E14	changement de la composition des parcours en espèces palatable		PASTURE COMPOSITION (g,m,p;% shrubby/herbaceous species); pag 37*
R15	superficies annuelles des formations steppiques mises en défens		

R16	Superficie des parcours aménagé	
	PASTORALISME	
R18	Superficies protégées	
	FORETS	
P36	Superficies forestière convertie en zones agricoles	LAND USE EVOLUTION
P33	nbre incendies/ an	FIRE FREQUENCY
P34	surface incendiée/an	BURNED AREA
P35	superficie déboisée	DEFORESTED AREA
P38	densité de la population (n habitants/ ha de forêt)	POPULATION DENSITY
E21	superficies for. érodées	
I18	Production des forêts	FOREST PRODUCTIVITY
R21	Presence et type mesures pour protéger la forêt	FOREST MANAGEMENT QUALITY
R22	superficies de reboisement	
R24	budget alloué aux réalisations: aménagement forestier	
	Z. HUMIDES	
R28	nombre des zones humides protégées	

AUTRES INDICATEURS

P3	type de culture irriguée			
P4	taille des exploitations	FRAGMENTATION OF LAND PARCELS		
P12	Techniques culturales utilisés : labour, direction, profondeur			
P13	Techniques culturales utilisés : assolements pratiqués, type de rotation			
P14	fréquence de labours et semailles	LAND USE INTENSITY		
P15	Type de pratiques pastorales			
P18	investissement pour la mise en culture			
P19	Accès à l'eau difficile: distance moyenne/points d'eau;	WATER AVAILABILITY	ACCESS (DISTANCE/ TYME TO REACH)	pag 37 *
P23	Superficie surpaturée		EVIDENCE OF DAMAGE TO TREES,SHRUBS, PASTURE; EXTENT/SEVERITY OF TRAMPLING/OVRGRAZING DAMAGE	pag 37 *
P24	statut foncier/vocation des terres de parcours			
P26	distribution spatiale cheptel			
P27	Nmbre infrastructure (point d'eau, zones d'ombrages, pistes)			

P29	Distribution spatiale de la population selon les usages des ressources naturelles	
P30	Population tirant une part de leur revenu des parcours	
P31	sédentarisation/nomadisme	
P39	distribution spatiale de la population en zone de forêt selon usages des ressources naturelles	
P40	volume de bois utilisé/ famille/an	
P41	volume de bois prélevé / potentiel de production	
P42	Volume des prélèvements illicites de bois	
P43	superficie surpaturée à l'amont	GRAZING INTENSITY
P44	superficies intéressées par aménagement agricoles à l'amont	
P45	entité du prélèvement faunique en z. humide dû à la chasse	
E3	qualité des sols: taux de fertilité	
E5	qualité des sols: Présence /absence de conditions de hydromorphie	
E9	pertes en sol/ha	EROSIVITY
E10	densité du couvert végétal	
E11	Densité couvert végétal steppique	
E15	Inventaire des espèces indicatrices de dégradation irreversible	

I1	productivité des terres		
I3	nombre de familles abandonnant les exploitations	DEPOPULATION CAUSED BY DEGRADATION OF NATURAL RESOURCES	
I6	débit des puits		
I7	degré de satisfaction des besoins en eau		
I8	qualité de l'eau d'irrigation de surface et souterraines		
I9	quantité d'engrais totale utilisée/ ha/an		
I11	taux de chômage		
I13	fréquence inondations	FLOODING FREQUENCY	INCREASED DOWNSTREAM FLOODING (FLOOD INCIDENCE AND SEVERITY
I14	qualité de l'eau de surface		
I15	% de substances chimiques de l'eau des barrages en relation au standard de loi	WATER QUALITY	
I16	biodiversité animale et végétal	BIODIVERSITY CONSERVATION	LOSS OR THREATENED PLANT AND ANIMAL BIODIVERSITY AND HABITAT
I19	qualité de l'eau en z. hum.: oxygénation		CHANGE IN WATER QUALITY BOTH IN THE WETLAND AND LEAVING THE WETLAND
I20	qualité de l'eau en z. hum.: turbidité		
I21	abondance faune		
R1	superficies drainées		
R2	Superficies soumises à la bonification des sols		
R7	répartition spatiale des piézomètres		

R8	nbre de regroupement d'intérêt collectif dans le secteur de l'eau en milieu rural		
R10	Presence mesures pour améliorer la gestion des terres		
R11	budget alloués aux réalisations CES		
R12	Budget alloués aux réalisations et à la sauvegarde des parcours		
R13	existence de subventions pour encourager la céréaliculture		
R17	subvention alimentaire accordée au bétail (amélioration du bilan fourrager)		
R19	longueur des structures de fixation de sable		
R20	extension des structures de fixation de sable par rapport aux zones ensablées		
R23	taux de régénération	ECOSYSTEM RESILIENCE	
R25	superficies destinées à l'agroforesterie		AGROFORESTRY: TECHNIQUE AND EXTENT % AREA (e.g.alley cropping, contour planting, improved fallow, scattered
R26	amélioration de l'implication et organisation de la population forestière		
R27	budget alloué aux aménagements des zones humides		