AIDCCD

European Commission
Research Directorate General

AIDCCD - Active exchange of experience on indicators and development of perspectives in the context of UNCCD

Role of Information Circulation Systems in scientific and practical approaches to combat desertification

Seminar Proceedings

Edited by
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Centro Interdipartimentale di Ateneo
Nucleo Ricerca Desertificazione
Università degli Studi di Sassari

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Proceedings of the International Seminar
Windhoek and Ondangwa – Namibia
2 to 7 April 2006

Edited By:
Giuseppe Enne and Maria Yeroyanni

Permanent Interstate Committee for Drought Control in the Sahel

China National Desertification Monitoring Centre

Desert Research Foundation of Namibia

Instituto Argentino De Investigaciones de las Zonas Aridas

MEDIAS France

Observatoirse du Sahara et du Sahel

2006 – Centro Interdipartimentale di Ateneo – NRD
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AIDCCD is an Accompanying Measure supported by the European Commission DG Research under Framework Programme 5. It contributes to the implementation of the Key Action 2.3.3 "Fighting land degradation and desertification" within the Energy, Environment and Sustainable Development Programme. Contract Number EVK2–CT-2002-80018

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Preface

The United Nations Convention to Combat Desertification repeatedly emphasises the importance of the exchanging and making promptly available any information relevant to the fight against desertification while facilitating the access by local populations to appropriate information and technology.

Several articles (e.g. Articles 10, 16, 19) insists on the development of the scientific and technical international assistance, particularly in terms of technology transfer. In particular, article 16, reports that the Parties "agree, …., to integrate and coordinate the collection, analysis and exchange of relevant short term and long term data and information to ensure systematic observation of land degradation in affected areas and to understand better and assess the processes and effects of drought and desertification." To this end, the Parties are requested, inter alia, to :

"- ensure that the collection, analysis and exchange of information address the needs of local communities and those of decision makers, with a view to resolving specific problems, and that local communities are involved in these activities;
- exchange and make fully, openly and promptly available information from all publicly available sources relevant to combating desertification and mitigating the effects of drought".

The international seminar on *Role of information circulation systems (ICS) in scientific and practical approaches to combat desertification* was organised in the framework of the EU AIDCCD (Active exchange of Experience on Indicators and Development of Perspectives in the Context of the UNCCD) Accompanying Measure, that specifically addresses the issue of the exchange of information and experiences at the global level among institutions who have a relevant role in the UNCCD implementation in its regional Annexes.
In particular, this seminar besides allowing the acquisition of information on existing Information Circulation Systems relevant to the desertification issue, also allowed the identification of the key factors that seem to be most important for their successful implementation, while identifying in the need for a "system of systems" approach (i.e. an institution that coordinates the already existing ICSs) as a requirement for a functional information circulation system for combating desertification.

We are convinced that the proceedings of this second and last AIDCCD seminar can provide a valuable input to the circulation and dissemination of the incredible amount of scientific, technical and practical information generated over the years in the common effort to combat desertification and the effects of drought.

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OPENING SESSION

Information Circulation Systems – a theoretical background

AID-CCD: ACTIVE EXCHANGE OF EXPERIENCE ON INDICATORS AND DEVELOPMENT OF PERSPECTIVE IN THE CONTEXT OF UNCCD. OVERVIEW OF THE PROJECT

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1. Introduction

AIDCCD is the acronym for Active exchange of experience on indicators and development of perspectives in the context of UNCCD. It is an Enrich (European Network for Research into Global Change) Accompanying Measure funded by the Research Directorate General of the European Commission with the objective of developing and co-ordinating exchange of information and experiences across the world among institutions involved in the implementation of the regional annexes of the UNCCD (Annex I for Africa; Annex II for Asia; Annex III for Latin America and Caribbean; Annex IV for Northern Mediterranean and Annex V for Eastern Europe).
Two among the issues recognised as top priority in the fight against desertification and land degradation are desertification indicators and the Information Circulation Systems on which the project specifically concentrated. Many scientific institutions in all UNCCD Annexes have carried out significant activities related to both issues, thus generating a relevant quantity of data and results which have never been neither organised systematically nor exchanged extensively at the global level. The growing importance of sharing and exchanging experiences and information among scientists and stakeholders at international level led to the AIDCCD project which started in February 2003 and whose ending date is in June 2006. The Project involves partners from all UNCCD Annexes: the Observatoire du Sahara et du Sahel (OSS) in Tunisia, the China National Desertification Monitoring Centre in China, the Instituto de Investigaciones Zonas Aridas in Argentina in collaboration with the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) in Burkina Faso and the Desert Research Foundation in Namibia.

The AIDCCD project core activity is the realisation of two International Seminar based on the two main topics above: desertification indicators and Information Circulation Systems. Both seminars aim at:

- elaborating the state of the art on each issue;
- stimulating exchanges by offering the opportunity to meet and to discuss all collected information, usually bound to national and /or regional levels;
- identifying the development of perspectives in all UNCCD Annexes.

The seminars were preceded by a complementary preparatory activity that included three phases of work:

- elaboration of a Report on the state of the art on existing indicators and developed in the framework of the UNCCD implementation in its Annexes;

- realisation of a Think Tank among the project partners and selected experts to discuss the results achieved by the report and to propose Terms of Reference for the realisation of the seminars;
- elaboration of analytical papers on the Information Circulation Systems in use in different areas of expertise with description of their use in scientific and in practical approaches to combat desertification.

1.1 Report on the State of the art on existing indicators and CCD implementation in the UNCCD Annexes.

The Report, published in September 2005, presents the reviews on the use of Benchmarks and Indicators in the different UNCCD Annexes with specific reference to the response and impact indicators adopted in the National Action Plans (NAPs). General aim of these reviews was to make the state of the art on the indicators used by the different stakeholders at regional, sub-regional, national and sub-national levels in relation with UNCCD implementation. The reviews started from the dissemination of a questionnaire to the UNCCD Focal Points to collect information about their experiences in the utilisation of desertification B&I. The information requested focused on projects and actions through which B&I were developed in every Country. On the basis of the collected information seven regional reports were produced: two studies for Annex I, Northern Africa and Southern Africa, two studies for Annex II, on Western Asia and East Asia, two studies for Annex III, on Central America and Southern America and one study for Annex IV on Northern Mediterranean. The Report constitutes a first attempt to provide a global overview on the utilisation of desertification B&I and a valid basis to compare the level of implementation of the UNCCD in the different Annexes and the different approaches used.

1.2 AIDCCD Think Tank on Use of desertification indicators in the UNCCD Annexes

The Think Tank was held in Mendoza (Argentina) on 21 to 24 May 2004 . It was **a**ttended by a group of selected experts, among whom were members of the UNCCD Group of Experts, with the aim of analysing the results obtained by the 6 AIDCCD reports on the use of desertification B&I to highlight common gaps and priorities. Discussions during the Think Tank also led to identify the main scientific issues to be dealt with at the first AIDCCD seminar on "*Local and Regional Desertification Indicators in a global perspective*" and at the second AIDCCD Seminar on *"Role of Information Circulation Systems (ICS) in scientific and practical approaches to combat desertification"*. Among the conclusions achieved:

- Benchmarks and Indicators are always complementary; they give meaning to each other;
- socio-economic indicators must be developed as they complete the concept of indicators;
- interactions and relationships between socio-economics and biophysical indicators require further and deeper analysis;
- common set of Benchmarks and Indicators should be defined from global to local level:

- ”top-down” and “bottom-up” approaches need to be developed;
- adequate information circulation systems should be developed according to international standards;
- operational Monitoring-Evaluation should be implemented using elaborated benchmarks and indicators;
- scientific knowledge should became useful knowledge and reach decision makers;
- scientific world should elaborate indicators in response to decision makers needs.

With specific reference to ICS, the Think Tank highlighted the need:

- to develop adequate harmonised Information Circulation Systems using international standards;
- to develop Information Circulation Systems where they are not available;
- to describe how indicators are disseminated, communicated and used describing the Information Circulation Systems when they exist;

1.3 Analytical papers on Information Circulation Systems

The analytical papers on Information Circulation Systems in use have been elaborated by seven experts on selected areas of expertise. Through the description of the use of existing ICS it has been possible to set up their role in scientific and in practical approaches to combat desertification, to make the state of the art in the UNCCD Annexes and to put the basis for further reflection during the second AIDCCD Seminar on *“Role of Information Circulation Systems (ICS) in scientific and practical approaches to combat desertification”*.

2. First AIDCCD Seminar on “Local and Regional Desertification Indicators in a Global Perspective

The first AIDCCD Seminar on “Local and Regional Desertification Indicators in a Global Perspective” was held in Beijing (China) from 14 to 20 May 2005. It was organised in collaboration with the China National Desertification Monitoring Centre (Prof. Sun Siheng) and attended by about 50 participants including experts from all UNCCD Annexes, local experts and stakeholders, and representatives of international organisations (FAO, UNCCD); all participants presented their activities and related experiences on desertification B&I enabling the understanding of the progress made, the techniques used and the common knowledge obtained in this field in the different Annexes. In particular six main priorities were deeply analysed during the seminar:

- Integrated approach for the development of desertification B&I;
- Integrated approach for the use of desertification B&I;
- Data gathering for the development of the reference B&I for monitoring and assessing desertification through traditional approach and Remote Sensing;
- Climate change impact on desertification, (what B&I should be used);
- Case studies of B&I operational monitoring initiatives at various scales
- Reinforcing North-South, South-South cooperation on desertification B&I;

From this first seminar, relevant conclusions emerged. As far as the B&I are concerned it has been pointed out that it is essential to develop new integrated approaches, based on the perspective of complex systems; they should integrate bio-physical and socio-economic data, as well as ground based and remote sensing data and different stakeholders perceptions and needs. The concept of indicators has been extended: they must be intended as "tools" suited for specific and precise objectives and they are intimately linked to benchmarks. The importance of sustainable platforms and strategies has been highlighted as a requirement to create operational integrated monitoring systems based on the developed indicators and to ensure the continuity of monitoring in time. Regarding representative people, it has been recognised the necessity of consulting and involving stakeholders, decision makers and users since the definition phase of the approaches to be adopted to identify indicators and benchmarks. Concerning data it emerged that data availability both at the national and the international scales is mostly limited by institutional constraints as well as by economic and technical factors (e.g. cost and heterogeneity of soil data, too aggregated census data and too limited frequency); furthermore, quality standards and metadata are necessary to homogenize definitions and ensure interoperability.
A great value has been added to this first AIDCCD Seminar through the dissemination of the Seminar results on the Project website, and through the publication of the proceedings which have been distributed in all Annexes through the project partners and many international scientific meetings.

3. The AIDCCD Seminar on "Role of Information Circulation Systems (ICS) in scientific and practical approaches to combat desertification".

The seminar, organised in collaboration with Desert Research Foundation of Namibia, is part of the activities that EU holds to celebrate 2006 as the International Year of Deserts and Desertification. It is intended to address institutional challenges affecting information circulation within and among all levels.
As stated in several articles of the UNCCD (Articles 10, 16 and 19 in particular), the fight against desertification, and particularly the NAP implementation process, requires the control of scientific, socio-economic and institutional information. Exchange of information must occur at all levels and Country Parties must "*make fully, openly and promptly available information from all publicly available sources relevant to combating desertification and mitigating the effects of drought*".
Starting from the identification of existing experiences relating to ICS in the UNCCD Annexes, this seminar wishes to identify the main key issues and needs to propose possible common approaches and solutions. With this aim in view, seven analytical papers have been elaborated by selected experts on specific areas of expertise and presented during the seminar:

- *Experiences and lessons learnt from ICS: scientific views*, by T. Tadesse, National Drought Mitigation Center, University of Nebraska, USA.
- *Experiences and lessons learnt from ICS: long term environmental monitoring,* by J. Henschel, Gobabeb Training and Research Center, Namibia.

- *Experiences and lessons learnt from ICS: view from international and multi-lateral institutions*, by F. Perez-Trejo, WEICENT, Food and Agriculture Organisation.
- *Experiences and lessons learnt from ICS: UNCCD Annex 1,* by B. Masumbuko, Network for Environment and Sustainable Development in Africa, Cote d'Ivoire.
- *Experiences and lessons learnt from ICS: UNCCD Annex 2,* by Y. Youlin, UNCCD unit in Asia.
- *Experiences and lessons learnt from ICS: UNCCD Annex 3*, by L.Torres, IADIZA, Argentina
- *Experiences and lessons learnt from ICS: UNCCD Annex 4*, by L. Genesio, Institute of Biometeorology, National Research Council, Italy.

All papers describe and assess critically the Information Circulation Systems in use in different areas and how these systems can contribute to combat desertification through scientific and practical approaches. They also identify challenges, solutions undertaken and lessons learnt and address users of ICS and their application for decision making.

The Seminar has been attended by 21 experts from UNCCD Annexes involving project members, UNCCD Focal points and representative from international organisation such as FAO and UNCCD.

In general, all participants have contributed to provide also information on:
- Inventory on existing ICS and monitoring systems on desertification and drought;
- Use of relevant information in the decision making process
- Capacity building needs related to ICS
- Design of ICS and monitoring systems

The International Seminar on "Role of information Circulation Systems in scientific and practical approaches to combat desertification" is the second and last Seminar held in the framework of the AIDCCD project. It offers a significant opportunity of meeting, exchanging ideas, data, information and experiences and the possibility of starting new future collaborations for experts, scientists and researchers actively and deeply involved in the fight against Desertification.

CAN INFORMATION CIRCULATION CONTRIBUTE TO COMBATING DESERTIFICATION?

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Abstract
The scientific community has been conducting research concerning desertification control and rehabilitation for several decades. Great attention has been paid to establishing communication systems to support flow of this information. At the same time little if anything has improved amongst communities faced with decreasing productivity of degraded lands. The results of scientific research are generally not accessible to or being used by those who are addressing desertification, e.g. communities, extension officers, policy makers and others not usually informed about the results of scientific research. A two-pronged approach is required. Researchers need to translate and indicate ways of applying results of their efforts. Communities and their support organisations need to establish platforms for accessing, interpreting and supporting application of research results. In addition, both groups have a responsibility to establish mechanisms to engage with policy makers concerning their results, needs and actions to address desertification control. The challenges of making these essential connections, with examples from Namibia, will be explored in this presentation.

1. Introduction
In 1977, the UN Conference on Desertification brought a group of scientists together in Nairobi to discuss the issues of desertification (UNCED, 1977). This conference is taken as the first concerted attempt to define, describe and identify causes and effects of desertification. Desertification, with the more recent inclusion of rehabilitation of degraded lands, has remained on the research agenda ever since as a contentious issue (Hellden, 1991; Koning and Smaling, 2005; Leach and Mearns, 1996; Mainguet, 1994; Rapp, 1974; Rapp *et al.*, 1976; UNCED, 1977) even though negotiations for the UN Convention to Combat Desertification (UNCCD) did not make it a major focus. Moreover, scientific input into the Convention was limited, partly based on the approaches of scientists to communicate information (Corell, 1999). For different but related issues, the Committee on Science and Technology (CST), and its Group of Experts, have not been able to make the scientific input that would be required to address desertification on the ground. Application of the scientific method requires a long process of verification of results and scientists tend to write for other scientists rather than for potential application of their results. Such approaches are guided by the reward system inherent in the academic and scientific spheres (Seely and Wöhl, 2004).
Meanwhile, to make a change on the ground where desertification is taking place, application based on scientific information must be made accessible and understandable to those who are dependent on or working with natural resources and to those who make the policies affecting their use (Mouat and Lancaster, 2002; Mouat and McGinty, 1997). This requires time and a different set of skills than are usually used by scientists and are rewarded by the existing system (Seely and Moser, 2004). Communication is limited even amongst international agricultural research and technical (development) cooperation experts (Huppert, 1999) who are nominally working toward the same overall objectives on a similar level.

Consideration of communication and information circulation systems immediately brings a focus on internet-based communication. This contrasts with the situation in arid, semi-arid and dry sub-humid areas where desertification is of greatest concern and where internet usage and coverage is poor. In most countries of Africa, internet connectivity reaches less than 7.5% of the population (http://www.internetworldstats.com/ 2006). Overall usage of internet in Africa stands at 2.5% although the continent supports 14.1% of the world's population. A positive factor is the 403.7% growth rate in internet usage in Africa. How, then, can information circulation systems contribute in a practical way to combating desertification?
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World Region	**% of World population (2005)**	**% of population using Internet**	**Usage of the World (%)**	**World usage/ populaton ratio**	**Use growth 2000 – 2005 (%)**
European Union	7.1	49.8	22.6	3.2	147
Asia	56.4	9.9	35.7	0.6	218.7
Africa	14.1	2.5	2.2	0.2	403.7

Table 1. Comparison of internet usage in the European Union, Asia and Africa.
Source: http://www.internetworldstats.com/ 2006

The purpose of this keynote paper is to examine how information circulation systems can support both scientific and practical approaches to combat desertification and what these systems can do to play a relevant role.

2. Use of Information Circulation Systems for combating desertification in Namibia

For ten years, Namibia's Programme to Combat Desertification served as its National Action Programme testing and implementing a variety of approaches (Kambatuku, 2003a; Kambatuku, 2003b; Napcod, 1997; Napcod, 1999). These innovations were integrated into a number of complementary projects ranging from formation of basin management committees (Botes *et al.*, 2003; Manning and Seely, 2005; Seely *et al.*, 2003) to the Desert Margins Programme (Koala and Tabo, 2004), all integrating support to organisational development and local level monitoring contributing to decision making on all levels. Needless to say, information circulation systems were an important component of these programmes that ranged from community-based, local level farmers to high level decision makers and those in between.

Combating desertification and managing natural resources appropriately depends on action from grass roots to national level. For actions at the grass roots level to be successful, local communities require support from a variety of service providers ranging from agricultural and rural water supply extension services and government institutions to NGOs and the private sector. Service providers, in turn, require information from many sources including relevant research results. Often, to effect changes, researchers, service providers and communities need to convey their messages to policy and decision makers. In most instances, however, there is no mutual ground for any of these groups to interact and information circulation tends to remain within sectors and levels rather than serving to support inter-level communication. To successfully communicate between levels, at least two factors need to be considered. First is the necessity of 'translating' or 'interpreting' information and requests for information in straight-forward language understood by other levels or sectors. Second is the need of 'communication platforms' be it a local-level committee, a service

organisation or research institution that will facilitate communication among levels as well as within levels beyond one-on-one exchanges of ideas (Fig. 1).

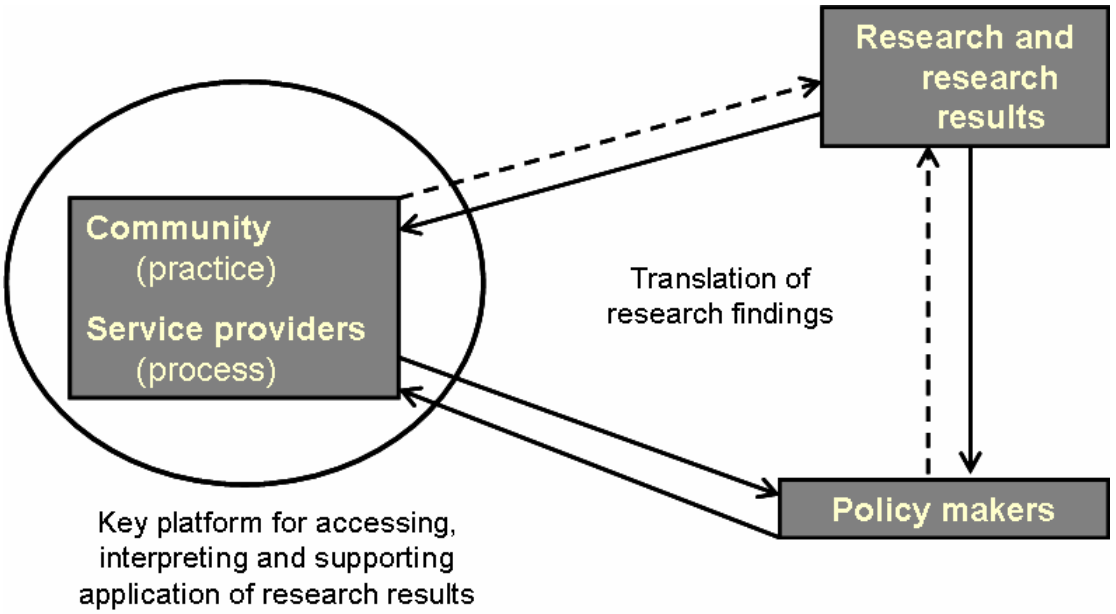

Figure 1: A conceptual model showing the three main levels, scientific community, local communities and policy makers, and the required interactions between these for successful communication.

3. Background to Namibia

Namibia covers an area of approximately 825 000 km^2. Much of Namibia consists of a wide, rather flat plateau that continues north, south and east into neighbouring countries. To the west a pronounced escarpment rises from a coastal plane (Mendelsohn *et al.*, 2002). Mean annual rainfall follows a gradient from southwest to northeast with the far northeast receiving the most rainfall and the coastal areas receiving almost none. Rainfall is highly seasonal with very well marked dry and wet seasons. In general the dry season extends from April/May to September/October, and the wet season over the rest of the year (Olszewski and Moorsom, 1995). Rainfall is naturally low with high inter-annual and intra-seasonal variability (Marsh and Seely, 1992; Seely, 1978). Temperature also shows a marked seasonality with the highest temperatures occurring just before the wet season in wetter areas and during the rain season in drier areas. Lowest temperatures occur in the dry season months of June, July and August (Hutchinson, 1995). Most soils in Namibia are unsuitable for crop growth. The most fertile soils are cambisols and calcisols, however not rating high on a world scale of soil potential (Mendelsohn *et al.*, 2002).

The total human population in Namibia is about 1.8 million, of which approximately 50% are settled in the north central regions (NPC, 2002), which comprise only 18% of Namibia's land surface. As a result of population growth and expanding human settlement during the past century, the natural resources of north central Namibia are presently under high pressure (Quan *et al.*, 1994a; Quan *et al.*, 1994b). In 1994 an estimated 68% of the Namibian population derived at least part of their livelihood from agriculture (Kruger, 2001). Due to the dry (arid and semi-arid) conditions, farmers rely predominantly on livestock for their livelihoods. Cattle dominate in central, north-central and north-east where the rainfall is highest, while sheep and goats are preferred in the western and southern parts of the country. Crop production is only possible in the northern parts of Namibia, except at a few locations with irrigation in the south

(Balarrin and New, 1996; UNDP, 1996). The more favourable natural conditions in north central and north eastern Namibia have led to dense human and animal populations in these rural areas. High pressure on land in these areas has had an adverse impact on natural resources, evident through deforestation, overgrazing and depletion of already scarce water resources (Adams *et al.*, 1990; Fuls, 1992; Quan *et al.*, 1994a; Quan *et al.*, 1994b).

4. Kuiseb Basin Management Committee

Basin management is one of the key elements of the recently promulgated Water Resources Management Act, 2004. It serves to ensure the principles of integrated water resource management including sustainable use of Namibia's limited water resources. The process is iterative, transparent to all, open to voluntary participation, information rich, enhances capacity of stakeholders and focuses on sustainable development while passing through three stages: start-up phase emphasising information exchange amongst interested parties; stakeholders' forum phase in which representatives and interested individuals from all levels are encouraged to participate; basin management committee phase leading to establishment of a formal basin management committee (DRFN, 2005a; Seely *et al.*, 2006). The process of basin formation took place over three years with the number of participants in the forum increasing with every meeting. Also increasing were the questions and requests for information based on the presence of a 'platform' for information exchange coupled with experts from various disciplines where were willing and able to provide the information (Manning and Seely, 2005). This opportunity also opened up communication among water managers who had not cooperated in such a forum previously. Although formal project funding has ended, the Kuiseb basin management committee continues it quarterly meeting and its acknowledged role as a communication platform for people using and managing natural resources in the basin.

5. FIRM

Forum for Integrated Resource Management (FIRM) is an approach designed to put rural communities in the driver's seat in terms of their own development (Kambatuku, 2003a; Kruger *et al.*, 2003). FIRM is centred on a Community Based Organisation (CBO) of rural farmers, which takes the lead in organising, planning and monitoring their own development while coordinating the interventions of their service providers. These service providers may, in rural areas, take the form of traditional authorities, government extension services, non-governmental organizations (NGOs) or short or long-term projects (Kambatuku, 2003a). The FIRM approach can take many forms but was first established and piloted in the Grootberg area, Kunene region in Namibia. The Grootberg FIRM was developed to coordinate service provision by a variety of government and non-government bodies, to write its own proposals for funding, establish a Women's Desk, and to undertake integrated land-use planning and implement sustainable resource management plans at local level. In Namibia, the FIRM approach has been adopted by agricultural extension services, continues to be expanded and is being evaluated by extension personnel in Botswana and South Africa. Thus the flexibility and applicability of the FIRM approach, with the FIRM itself serving as a platform and facilitating information flow amongst individual farmers, service providers, researchers and high-level decision makers, seems to be catching on and spreading in southern Africa.

6. Local Level Monitoring

Local level monitoring is a tool designed to provide farmers with information that can support their decision making and lead to informed management of natural resources. In Namibia a local monitoring system involving local community members was first developed for monitoring of wildlife in the Grootberg conservancy in north-western Namibia (Stuart-Hill *et al.*, 2004). This approach was adopted and further developed by Namibia's Programme to Combat Desertification into a tool that can provide local farmers with relevant information to support their decision making (Kambatuku, 2003b). The methods developed are specifically designed for communal farmers and their unique requirements in mind. The local level monitoring system provides detailed, relatively immediate and useful information needed for sustainable management of rangelands based on the specific requirements of the farmers using the system (Klintenberg *et al.*, 2006a). Recording of observations made by farmers is an important part of the system. Most farmers, as part of their normal procedures, make decisions based on one or several environmental (or social) indicators. However, observations are seldom recorded and are only kept in the head of the individual farmer. Information like this is usually lost, as the memories fade and get mixed up between years. By recording his/her observations the farmer obtains a better understanding of how variable environmental conditions, e.g. amount and seasonality of rainfall, influence the state of the environment and his agricultural production. Secondly, by recording each observation in the field guide, a historical record is created, which allows the farmer to compare conditions over the years and also to compare with fellow farmers that are also recording their observations (Kambatuku, 2003b; Klintenberg *et al.*, 2006a).

The joint discussion of results amongst farmers in a community is one of the key features of the local level monitoring system, providing the community with an information base for use amongst themselves for joint planning and decision making. Information generated through this farmer driven monitoring is ideally forming a central part in planning and decision making done by FIRM groups (Kruger *et al.*, 2006). At the same time, having a record supports the farmers in their communication with service providers, other natural resource managers and policy makers.

7. Integrating traditional knowledge

Research combining scientific observations and traditional knowledge held by local farmers has been carried out in north-central Namibia (Klintenberg *et al.*, 2006b; Klintenberg and Verlinden, 2006; Verlinden and Dayot, 2000; Verlinden and Dayot, 2005). By comparing results from a national land degradation monitoring system (Klintenberg and Seely, 2004) with local perceptions of environmental change, Klintenberg *et al.* (2006) could show that local perceptions corresponded with environmental changes identified by national monitoring. However, it was also shown that information given by local farmers revealed a more complex picture of causes and effects of environmental changes compared to the variables used for natural level monitoring. It was therefore concluded that traditional knowledge held by local farmers could contribute meaningfully to improving national indicators.

A second investigation, also in north central Namibia, compared local perceptions of environmental change with field based surveys around permanent water points and hand dug traditional wells (Klintenberg and Verlinden, 2006). This study concluded that negative environmental change identified by local farmers along pipelines providing permanent water supply could be verified by analysing abundance of different grass species along sampled transects. Furthermore, the investigation showed that impact of grazing around privately owned hand-dug wells was far less compared to impact around

public permanent water points. These two examples from northern Namibia illustrate the value of integrating traditional knowledge into scientific investigations of environmental change and land degradation. Integration of traditional knowledge improved the understanding, by researchers and the local community, of the complex systems being investigated. By involving the local equivalent of a FIRM and ensuring information flow between community members and researchers, results can be used by all participants, e.g. (Seely, 1998). Moreover, as the research results are conveyed to different levels, communication pathways remain open by involving the FIRM and its members.

8. Reaching decision makers

Two approaches have been used to share information with decision makers although neither can be strictly termed an exchange of information. To convey information to the Namibian parliament, single sheets of information on topical issues are provided e.g. (DRFN, 1996; DRFN, 2003). These topics may range from 'what are the costs and benefits to Namibia of belonging to the UNCCD' to 'what is the cost of water compared to similar commodities'. Climate change, sustainable agriculture and application of resource economics represent a few of the issues that have been addressed. The success of this method is judged by the number of times information contained in these 'environmental updates' is incorporated into speeches and press releases of the politicians. A drawback to this approach is that is provides a small bit of information that must be further integrated and applied by the parliamentarians themselves.

A second approach to address information circulation involves invitations to decision makers to participate in programme activities. This may extend from local head men who participate in exposure excursions, workshops or other activities to line ministry personnel who join in similar activities. It may also involve the presence of Ministers to launch a basin management committee, e.g. the Kuiseb River BMC (Fitter, 2004), or at a livestock auction in communal farmlands. A recent example included training of sellers concerning economic benefits to be derived from livestock and needs of buyers in an area where livestock represent prestige more than economic value (Botelle, 2005).

9. Poverty

A recent endeavour in Namibia has been the process called 'participatory poverty assessment' which is designed to enable poor people dependent on limited natural resources to contribute to policy formulation (NPC, 2005). In a majority of the 36 rural and urban locations, where a week was spent in each location to understand people's perceptions, lack of cooperation was cited as one if not the key issue and formation of functioning committees was seen as a possible solution. This need was based on the poor availability of information ranging from job options to the necessity of and mechanisms for payment for electricity and water. Information circulation, based on a platform such as a village committee, is seen as a step toward alleviation of poverty by the people experiencing poverty in rural and urban areas.

10. Discussion and recommendations:

Experiences and challenges encountered suggest several approaches to enhancing information circulation systems in the service of combating desertification. First, information must circulate within levels, e.g. scientists must have good communication with other scientists. Internet and refereed journals are two recognised and well used mechanisms. Despite the application by scientists of these mechanisms for decades amongst themselves, little has been achieved to show or reverse the effects of

desertification. Equally important but perhaps more challenging is circulation of information amongst natural resource users and managers, particularly at grass roots levels. In some traditional societies, functioning organisational structures facilitate necessary information circulation. Drylands, where desertification as a problem is most prevalent, are often areas affected by drought causing, *inter alia*, civil unrest. In these instances, traditional information circulation systems are inoperable and traditional organisational structures have broken down. A major focus on organisational development is required to prepare mechanisms for information sharing under these conditions. Of equal or perhaps greater importance is the circulation of information between levels, from scientists to service providers to users and managers of natural resources on the ground and back again. For information to flow between levels, each level must have some sort of 'platform' which facilitates dissemination, receipt, synthesis or interpretation, and then further circulation of the relevant information. The constitution of such platforms may take on different forms. In Namibia, at the local level two main structures are operational. One, know as a Forum for Integrated Resource Management, consists of a grassroots level farmers' or water point associations usually connected to a higher level within the same sector. A second approach is known as a Conservancy Committee which focuses on wildlife and tourism in a particular area in a similar way (NACSO, 2004). These forums or committees serve as platforms for information circulation at the grassroots level as well as between the grass roots and service providers including government, NGOs and the private sector. They serve to reach policy and decision makers as required.

Service providers have varied approaches to information circulation, some focused on disseminating their own message to a targeted audience while others facilitate interactions amongst levels and amongst organisations. For each approach, a 'platform' for communication is required whether it be an office, regular meetings, committees, news letters or similar mechanisms. Similarly, policy makers often have platforms for one-way dissemination of information but rarely for exchange of information with their constituencies. It is often the local level or service organisation level that must find mechanisms of engaging policy makers for information exchange.

One model that can be adopted to address information circulation systems for combating desertification could reflect the supply chain integration adopted by business and industry. This requires all organisations at all levels to have full information related to their integration with other levels, e.g. (Huppert, 1999). Alternatively, while recognising that scientific products are services, the demand chain management approach could be emulated. This requires recognition that services, provided by scientists in particular, are knowledge generation and transfer requiring platforms for provider and client interactions (Huppert, 1999). This could also lead to shared service development and delivery integrating grassroots needs with scientific products to address those needs. Transaction costs related to information circulation systems must be recognised. These include the time and funding required to 'translate' information into formats understandable to those with whom communication is taking place or to 'interpret' information for other levels of actors in combating desertification. Such costs must address the 'language gaps' and differing interests amongst scientists, communities, service providers and policy makers. One recognised gap is that of the reward system at the various levels, e.g. for policy makers it is gaining votes whether or not long-term sustainability is involved and for scientists it is the 'peer-review' mechanism by which they gain funding and positions (Huppert, 1999; Seely and Wöhl, 2004).

Based on experience gained in Namibia, one approach recommended to address desertification, usually exacerbated by drought, is being proposed for consideration. Drought risk management is designed to enhance information communication between the three main levels, grassroots, service providers and scientists while including policy makers indirectly (DRFN, 2005b; UNESCO, 2004). Needless to say, this approach is based on the Namibia's Drought Policy and Strategy, elaborated by policy makers and scientists with contributions from the grassroots. Thus the information circulation system involves all levels although not directly at the same time nor at the same intensity.

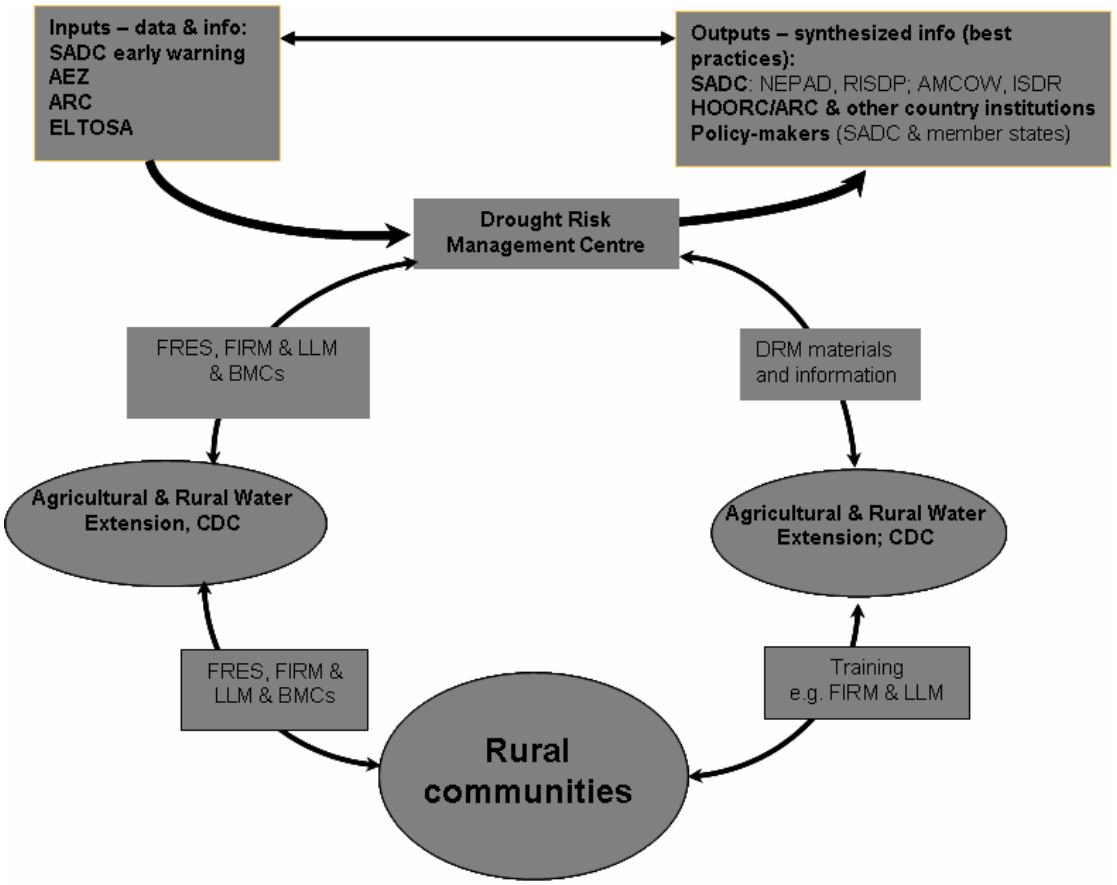

Figure 2: Information flow envisaged by the Drought Risk Management Centre under consideration in Namibia focused on testing inter-level communication for expansion to other countries with similar challenges in southern Africa (based on information in DRFN, 2005b).

(SADC = Southern African Development Community; AEZ = Agricultural Ecological Zoning, Ministry of Agriculture, Water and Forestry, Namibia; ARC = Agricultural Research Centre, Department of Agriculture and Forestry, South Africa; ELTOSA = Environmental Long Term Observatories Network of Southern Africa; AMCOW = African Ministers' Council on Water; NEPAD = New Programme for Africa's Development; HOORC = Harry Oppenheimer Okavango Research Centre; FSRE = Farming Systems Research and Extension; FIRM = Forum for Integrated Resources Management; LLM = Local Level Monitoring; BMC = Basin Management Committee; CDC = Constituency Development Committee; DRM = Drought Risk Management)

In conclusion, it is clear that information circulation systems are essential, however they must be tailored to the issues at hand and the actors required to address those issues. In terms of combating desertification, this includes a broad array of actors extending from the grassroots natural resource users to the decision makers who enact the policies or legislation that affects how natural resources are used and managed.

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SESSION I

Experiences and lessons learnt implementing ICS: scientific views

INFORMATION CIRCULATION SYSTEMS (ICS) IN DROUGHT MONITORING AND IMPACT ASSESSMENT IN THE UNITED STATES: PAST, PRESENT, AND FUTURE PROSPECTS

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Abstract

Drought and desertification are global challenges that should be considered in the context of global environmental changes and sustainable development. Drought has significant effects on the areas that are susceptible to desertification, including an increase of the depth to water table in desertification-prone areas, a decrease in stream flow, an increase in soil erosion, an increase of wildland and forest fire risks, and a change in the quality of vegetation. Drought, particularly long-term drought, is often a key trigger for desertification.

Experiences from using the Information Circulation System (ICS) in drought monitoring and impact assessment could have great importance in mitigating the effects of drought, combating desertification, and alleviating economic and social problems in drylands. In this paper, the experiences of the United States in monitoring drought, especially in the context of drought information dissemination, are highlighted. The paper focuses on the usefulness of the experiences and lessons learned in combating desertification in other countries. In the United States, the National Drought Mitigation Center (NDMC) is one of the leading institutions in drought information circulation systems. The NDMC helps people and institutions develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. Most of the NDMC's services, which include maintaining an information clearinghouse and drought monitoring websites, are directed to state, federal, regional, and tribal governments that are involved in drought and water supply planning.

The first part of this paper discusses past and current drought monitoring experiences using climatic drought indicators (e.g., Standardized Precipitation Index [SPI]). The integrated approach used in creating the U.S. Drought Monitor map is examined, and the paper also discusses the Drought Impact Reporter, a web-based tool created by the NDMC to collect and map drought impacts in the United States.

Because of the varied and potentially catastrophic losses resulting from drought in many parts of the world, both governmental and non-governmental decision makers need improved access to accurate and timely predictive and monitoring tools to assist them in dealing more effectively with drought. Technological advances and better use of available drought monitoring tools improves our ability to more effectively manage water and other shared natural resources during periods of drought. One such tool is the Vegetation Drought Response Index (VegDRI), which integrates satellite and climate data to identify and monitor drought. It is discussed in greater detail in this paper.

In general, our ability to monitor and disseminate critical drought-related information has been enhanced by new technologies such as automated weather stations, satellites, computers, and improved communication techniques (e.g., the Internet). These changes strengthen risk management capability because they allow governments on the national, state, and local level to make knowledge-based decisions. The cooperative project that

highlights the National Agricultural Decision Support System (NADSS) shows the importance of the exchange of knowledge and experience between natural sciences experts (e.g., drought experts) and computer science experts in building web-based geospatial decision support systems to assist producers and decision makers in analyzing and effectively mitigating the effects of drought.
Comprehensive drought monitoring activities and the delivery systems that provide that information to land and other natural resource managers are of paramount importance in combating desertification. Policies that promote an integrated approach to drought monitoring will result in substantial benefits in combating desertification. The identification and application of appropriate drought mitigation measures and the development of an integrated drought monitoring system are essential to reducing the impacts associated with future droughts. Regional and international networks can help to promote the dissemination of this information to other drought- and desertification-prone regions and aid the technology transfer process. The North American Drought Monitor, which includes the United States, Canada, and Mexico, is also discussed to highlight the experiences and cooperative needs of the international network.

1. Introduction

Drought and desertification are both creeping environmental hazards. Although some consider these hazards to be interchangeable, they are two distinctly different but interrelated phenomena. Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all climatic zones, but its characteristics vary dramatically from one region to another. Drought, like beauty, is in the eyes of the beholder, which explains why there are so many definitions of drought. Definitions must be region and application or sector specific. All droughts originate from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought is a temporary aberration that also differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate (Wilhite, 2000a). Desertification, on the other hand, can be defined as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities" (UNCCD, 1994). Desertification does not refer to the spread of existing deserts. It is primarily the result of human activity or intervention that leads to the degradation or loss of productivity of the arid, semi-arid and dry sub-humid lands. The primary direct causes of desertification include poor or inappropriate cultivation practices, overgrazing, deforestation, and the mismanagement of irrigated cropland (Grainger, 1990). Drought has significant effects in areas that are susceptible to desertification including an increase of the depth to water table in desertification-prone areas, a decrease in stream flow, an increase in soil erosion, an increase of wildland and forest fire risks, and a change in the quality of vegetation. Drought, particularly long-term drought, is often a key trigger for desertification.
Since the demand for water is increasing along with an increasing population in many parts of the world, water supply interruptions caused by drought exacerbate land degradation or desertification in arid, semi-arid and dry sub-humid areas. This is because the impacts of drought are determined not only by the frequency and intensity of the precipitation deficit, but also by the number of people at risk and their degree of risk (Wilhite, 2000b). For example, the increase in population in Africa and Asia increases drought vulnerability significantly. The impact of desertification when aggravated by drought can be devastating. The 1930s "dust bowl" in the United States Great Plains is a typical example of how land degradation aggravated by drought can

lead to serious soil erosion and a loss of productivity. Hence, comprehensive drought monitoring activities and the delivery systems that provide that information to land and other natural resource managers are of paramount importance in combating desertification. Because of the complexity of drought, it is not possible to characterize its severity and potential impacts by simply monitoring precipitation departures. Many other indicators of drought exist—stream flow, groundwater levels, lake and reservoir levels, snow pack, and soil moisture. There are also many climate indices that have been developed and applied throughout the world (e.g., Palmer Drought Severity Index, Water Satisfaction Index, and Standardized Precipitation Index). Because there is no single definition of drought, determining which indicators and indices to use to characterize drought poses difficulties for planners, managers, and policy makers.

Better early warning and prediction is the foundation of a new drought management paradigm based on risk management. In South Africa, the Weather Bureau issues extended outlooks for short and long periods using numerical modeling and statistical methods (Vogel et al., 2000). In the United States, recent advances in science and technology are enhancing drought monitoring capabilities and the availability of such information, which allows decision makers to make more knowledge-based decisions to lessen the impacts of drought (Tadesse et al., 2006). Policies that promote an integrated approach to drought monitoring will result in substantial benefits in combating desertification. The identification and application of appropriate drought mitigation measures, coupled with the development of an integrated drought monitoring system, is essential to reducing the impacts associated with future droughts. Regional networks can help to promote the dissemination of this information to other drought- and desertification-prone regions and aid the technology transfer process.

In this paper, the experiences of the United States in monitoring drought, especially in the context of drought information dissemination, are highlighted. Although the focus of this paper is on drought, it is hoped that the experience and lessons learned will be useful in combating desertification in other countries.

2. Background

2.1 The U.S. National Drought Mitigation Center and Drought Information Dissemination

The National Drought Mitigation Center (NDMC) is one of the leading institutions in drought information circulation systems. The NDMC, established in 1995, helps people and institutions develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. The NDMC's activities include maintaining an information clearinghouse; drought monitoring, including participation in the preparation of both the U.S. Drought Monitor and Noth American Drought Monitor and maintenance of the U.S. Drought Monitor website; drought planning and mitigation; drought policy; advising policy makers; collaborative research; K–12 outreach; workshops for federal, state, and foreign governments and international organizations; organizing and conducting seminars, workshops, and conferences; and providing data to and answering questions for the media and the general public. Most of the NDMC's services are directed to state, federal, regional, and tribal governments that are involved in drought and water supply planning. Researchers at the NDMC have expertise in drought monitoring, mitigation, preparedness planning, and policy development. These researchers have an established user community that relies on their expertise and products for drought-related decision support. Thus, access to the NDMC's website (http://drought.unl.edu) grew to more than 12 million hits during 2005.

2.2 Drought Impacts and Technological Development in Information Dissemination

Recurrent droughts and their significant impacts on societies are increasingly forcing governments to play a more significant role in drought management in many parts of the world. Given the complexity of drought, where the impacts can accumulate gradually over time and vary widely across many sectors, a well-designed decision support system is critical to effectively manage drought mitigation and response efforts (Goddard et al., 2003). The traditional mindset of government in the United States and elsewhere has been to react to drought (i.e., crisis management approach) through the provision of relief or emergency assistance to the affected areas or sectors. With this approach, drought only receives the attention of decision makers when it is at peak levels of intensity and spatial extent and when water management options are quite limited. This approach has been characterized as ineffective, poorly coordinated, and untimely (Wilhite, 2000b; Wilhite and Wood, 1994; Riebsame et al., 1991). This approach is extremely costly, and relief provided through this process is often politically driven, programmatically misdirected, and poorly targeted. Relief often serves as a disincentive for the sustainable management of natural resources because it reinforces existing management practices, practices that may not be sustainable in the long term. This reactive approach is not good policy and must be replaced by an anticipatory, preventive approach that reduces risk through the adoption of appropriate mitigation programs and policies (e.g., risk management approach). Today, nations are increasingly pursuing a more proactive approach that emphasizes the principle of risk management and sustainable development (Wilhite, 2000b).

Technological advances and better use of available drought monitoring tools improve our ability to more effectively manage water and other shared natural resources during periods of drought. These changes can facilitate the shift to risk management because they allow governments on the national, state, and local level to address some of the more serious deficiencies of the crisis management approach. For example, our ability to monitor and disseminate critical drought-related information has been enhanced by new technologies such as automated weather stations, satellites, computers, and improved communication techniques (e.g., web-delivery) (Tadesse et al., 2006).

Drought planning efforts have been hampered by a lack of adequate early warning systems and insufficient information flow within and between levels of government. However, an improved understanding of complex atmospheric-oceanic systems and the development of new computer models have improved drought forecast skills for some regions. If they become part of a comprehensive early warning system, these advancements and others can provide decision makers with better and timely information.

3. Past and Present Experiences in Drought Monitoring and Product Dissemination

Because of the varied and potentially catastrophic losses resulting from drought in many parts of the world, both governmental and non-governmental decision makers need improved access to accurate and timely predictive and monitoring tools to assist them in dealing more effectively with drought. In the following sections we discuss the past and present experiences of the drought monitoring indicators and drought information circulation systems in the United States. In the last section (section 3.7), the North American Drought Monitor, which includes the United States, Canada, and Mexico is also discussed to highlight the experiences and cooperative needs of the international network.

3.1 Monitoring with Climate-based Drought Indices

Meteorological observations are traditionally the primary source of information used for drought monitoring. Drought indices calculated from meteorological observations are indicators often used to support decisions in planning and to trigger mitigating actions. Many drought indices are currently being used in different parts of the world (Hayes, 2006). Indices typically characterize the intensity of dryness as compared to the long-term average (normal) condition and are usually calculated based on one or more of the following variables: rainfall, temperature, snow pack, stream flow, soil water holding capacity data, and other water supply indicators. There are several drought indices that measure how much precipitation for a given period of time has deviated from historically established norms. Although none is inherently superior to the rest in all circumstances, some indices are better suited than others for certain uses (Hayes, 2006). Thus, the selection of an index may depend on the region and application (i.e., meteorological, agricultural, hydrological, or economic) as well as its ability to be incorporated into a decision support system. In the following sections, we focus on two widely used drought indices, the Standardized Precipitation Index (SPI) and the Palmer Drought Severity Index (PDSI). Since these indicators are based on measurements collected at station locations, they are limited in the spatial dimension. One of the chief limitations of meteorological observations is that the stations are not evenly distributed over the landscape and are spatially sparse, especially at higher elevations.

3.1.1 The Standardized Precipitation Index (SPI)

The SPI was designed to quantify the precipitation deficit for any location (for example, a weather station) based on the long-term precipitation records for a desired time interval (McKee et al., 1995). The SPI calculates the precipitation deficit for specified time periods (e.g., 1-, 3-, 6-, 9- and 12-month SPI). Measurements on multiple time scales reflect the impact of drought on the availability of different water resources. For example, soil moisture and vegetation conditions respond to precipitation anomalies on a relatively short time scale, while groundwater and reservoir storage are tied to longer-term precipitation deficits (Hayes, 2006).

To calculate the SPI, the long-term record of precipitation is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero (Edwards and McKee, 1997). The value of SPI is positive if it is greater than mean precipitation and negative if it is less than mean precipitation. Because the SPI has temporal flexibility, it can be used to monitor both short-term agricultural and long-term hydrological applications.

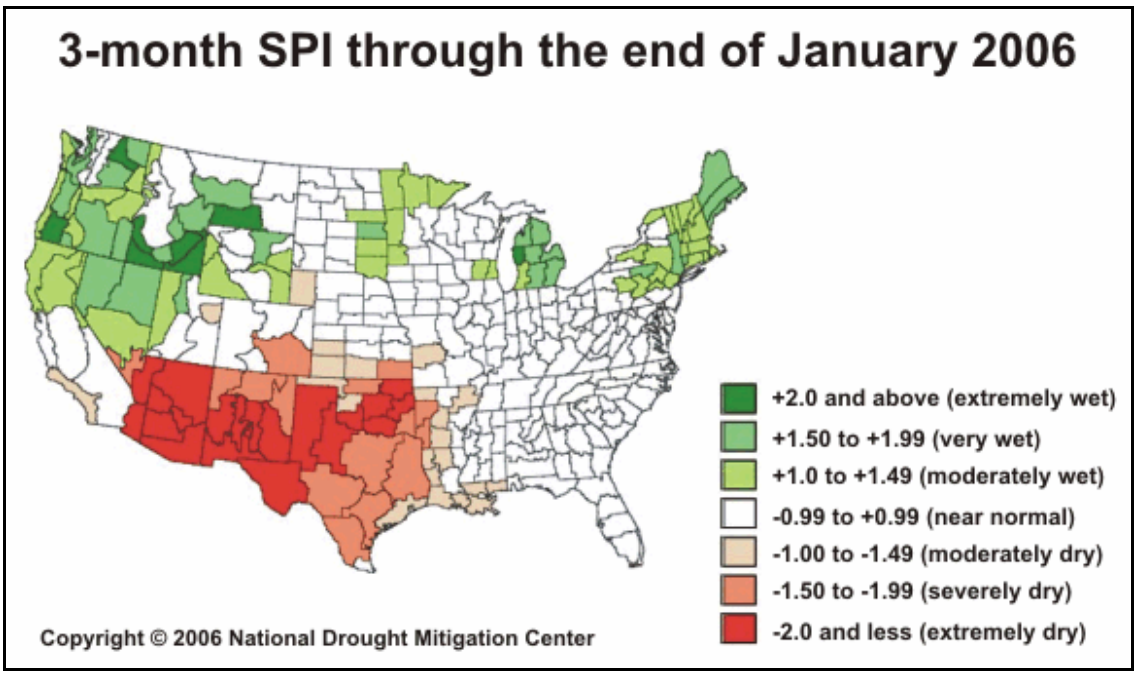

Figure 1: The 3-month SPI map of the United States.

3.1.2 The Palmer Drought Severity Index (PDSI)

The PDSI is an index that represents the soil moisture departure for a region by implementing a simple supply-and-demand model for a water balance equation (Palmer, 1965). The PDSI value is an indicator of how the soil moisture compares with normal conditions. Unlike the SPI, this index is calculated based on input parameters including precipitation, temperature, and soil moisture conditions. Also, the PDSI calculation builds on the past values of precipitation and temperature so that a given PDSI value is usually a combination of the current conditions and the previous PDSI value. Thus, this drought indicator reflects the progression of climate trends--whether it is a dry or a wet spell. The PDSI values may lag by some weeks or months from emerging droughts as compared to the SPI (Hayes et al., 1999). However, this index provides a measure for the long-term intensity and duration of drought conditions derived from the precipitation and temperature anomalies and their combined effects on soil water availability to plants. A new and updated Self-Calibrated Palmer Index is now available. This new version of the popular Palmer Index utilizes the advancements in computer technology that have taken place since its original inception to determine location-specific constants, allowing better drought severity measurements over time and space while maintaining the original intent of the index (Wells et al., 2004).

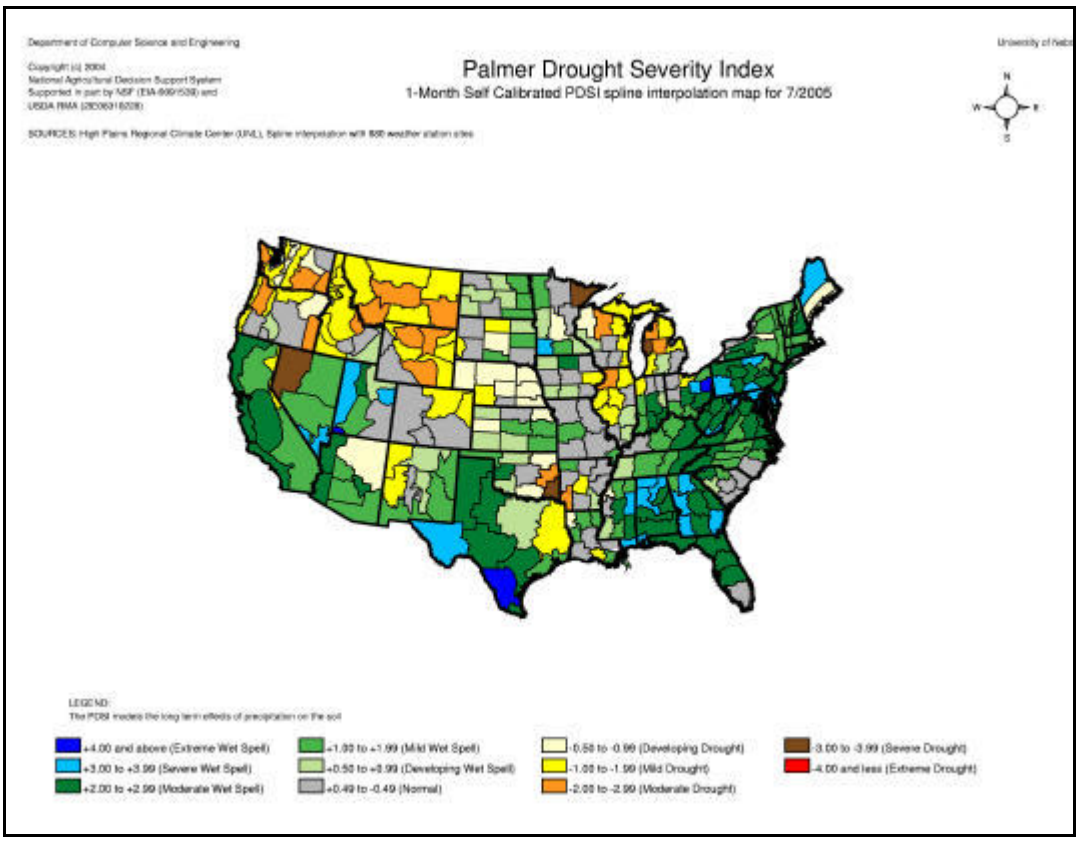

Figure 2: The Palmer Drought Severity Index (PDSI) of the United States.

3.2 The U.S. Drought Monitor

Decision makers and planners need to understand the impacts related to various levels of drought severity and what conditions are associated with drought in order to take appropriate actions in proactive management of water and other natural resources during drought (Svoboda et al. 2002; Wilhite 2000b). The *U.S. Drought Monitor (USDM)* provides a weekly overview of where drought is emerging, lingering, or subsiding. The USDM is produced jointly by the National Oceanic and Atmospheric Administration's Climate Prediction Center *(CPC*) and National Climatic Data Center (*NCDC)*, the U.S. Department of Agriculture (*USDA*), and the National Drought Mitigation Center at the University of Nebraska-Lincoln (*UNL)*. This weekly map can be accessed from the website of the *NDMC*.

These partners are responding to the need for accurate, centralized drought information by developing a map that summarizes information from numerous drought indices and indicators on a single, easy-to-read color map. To create the map, the authors blend current information from numerous sources, including the National Weather Service, National Climatic Data Center, Regional Climate Centers, USDA's Joint Agricultural Weather Facility, USDA's National Water and Climate Center, Department of Interior's U.S. Geological Survey and Bureau of Reclamation, as well as many other sources.

The USDM map combines key indicators and indices of climatic conditions to produce the final drought intensity rating that reflects the probability of occurrence. These key indicators include the PDSI, the SPI, the Percent of Normal Precipitation, the CPC Soil Moisture Model Percentiles, the USGS Weekly Streamflow Percentiles, and the Satellite Vegetation Health Index (Svoboda et al., 2002). The map uses a classification system to show drought intensity and type, similar to the schemes currently in use for hurricanes and tornadoes. The USDM (Figure 3) categorizes drought intensity from D1 drought (moderate) to D4 droughts (exceptional). D0 (abnormally dry) indicates

drought watch areas that are either drying out and possibly heading for drought, or are recovering from drought but not yet back to normal, suffering long-term impacts such as low reservoir levels. The final drought category is based on what the majority of the indicators show. Since drought often affects various activities differently, the map differentiates areas where drought is affecting agriculture and water supplies. The USDM is intended to display broad areas of dryness. The drought partners (particularly the authors) work with the National Weather Service (NWS) offices, the state climatologists, and local experts in producing map.

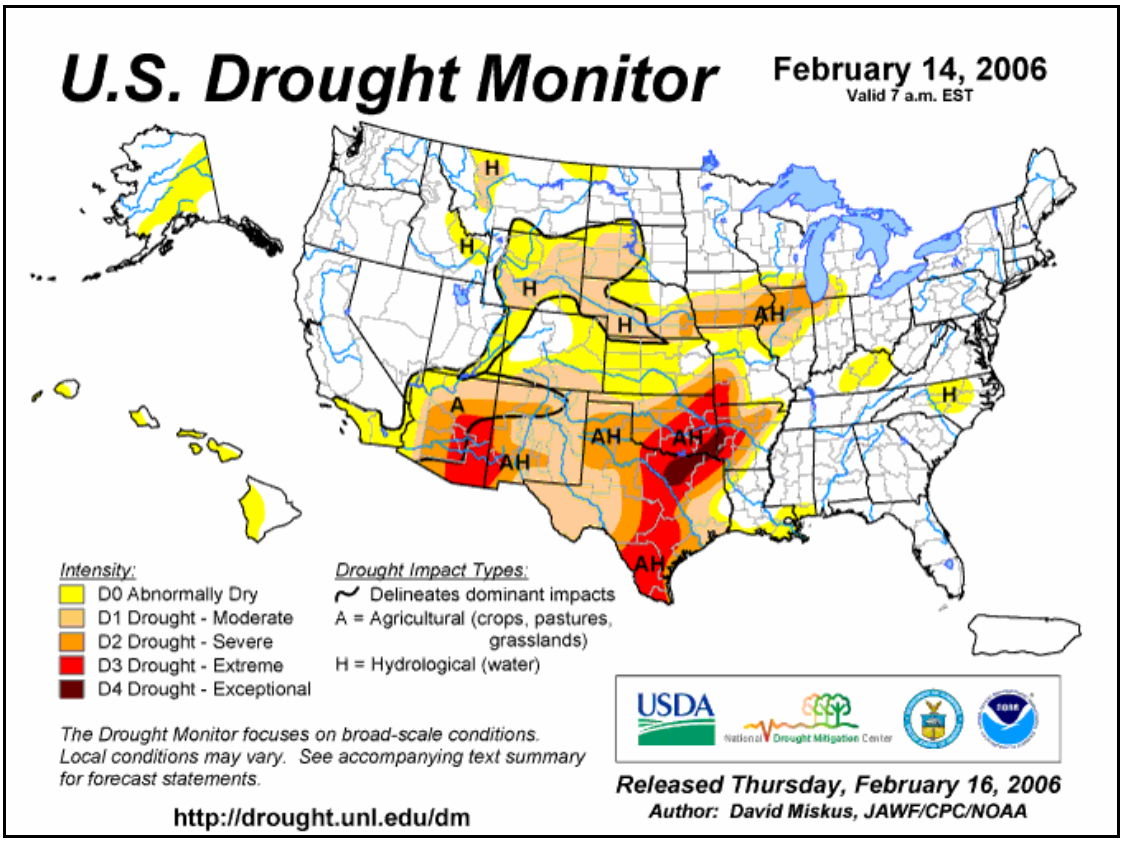

Figure 3: The U. S. Drought Monitor (USDM).

3.3 The U.S. Drought Impact Reporter

Drought impacts are inherently hard to quantify. Therefore there has not been a comprehensive and consistent methodology for quantifying drought impacts and economic losses in the United States. The Drought Impact Reporter (DIR) is an interactive tool developed by the National Drought Mitigation Center in 2005 to collect, quantify, and map reported drought impacts for the United States. The DIR is intended to be the initial step in creating a comprehensive nationwide database of drought impacts. The need for the Drought Impact Reporter and its comprehensive database becomes clear when one considers that drought is a normal part of the climate for virtually all portions of the United States. In addition, all evidence suggests that the impacts of drought are increasing in magnitude and complexity. A risk management approach to drought management, which strongly emphasizes improved monitoring and preparedness, requires more timely information on the severity and spatial extent of drought and its associated impacts. Improved information on drought impacts will help policy and decision makers identify what types of impacts are occurring and where. In addition, the Drought Impact Reporter will aid them in understanding the magnitude of

the impacts by providing access to reported drought impacts. More precise estimates of drought impacts will aid the government in instituting programs before drought occurs, as opposed to incurring high expenditures on post-drought relief.
Information for the impact report database comes from a variety of sources, including on-line drought-related news stories and scientific publications, reviewed by NDMC staff; members of the public who visit the website and submit a drought-related impact; members of the media; and members of government agencies such as the National Oceanic and Atmospheric Administration (NOAA) and U.S. Department of Agriculture (USDA). All impact reports submitted via the website are reviewed by NDMC staff members. After a new entry is reviewed and accepted, its impact report will be posted on the map.

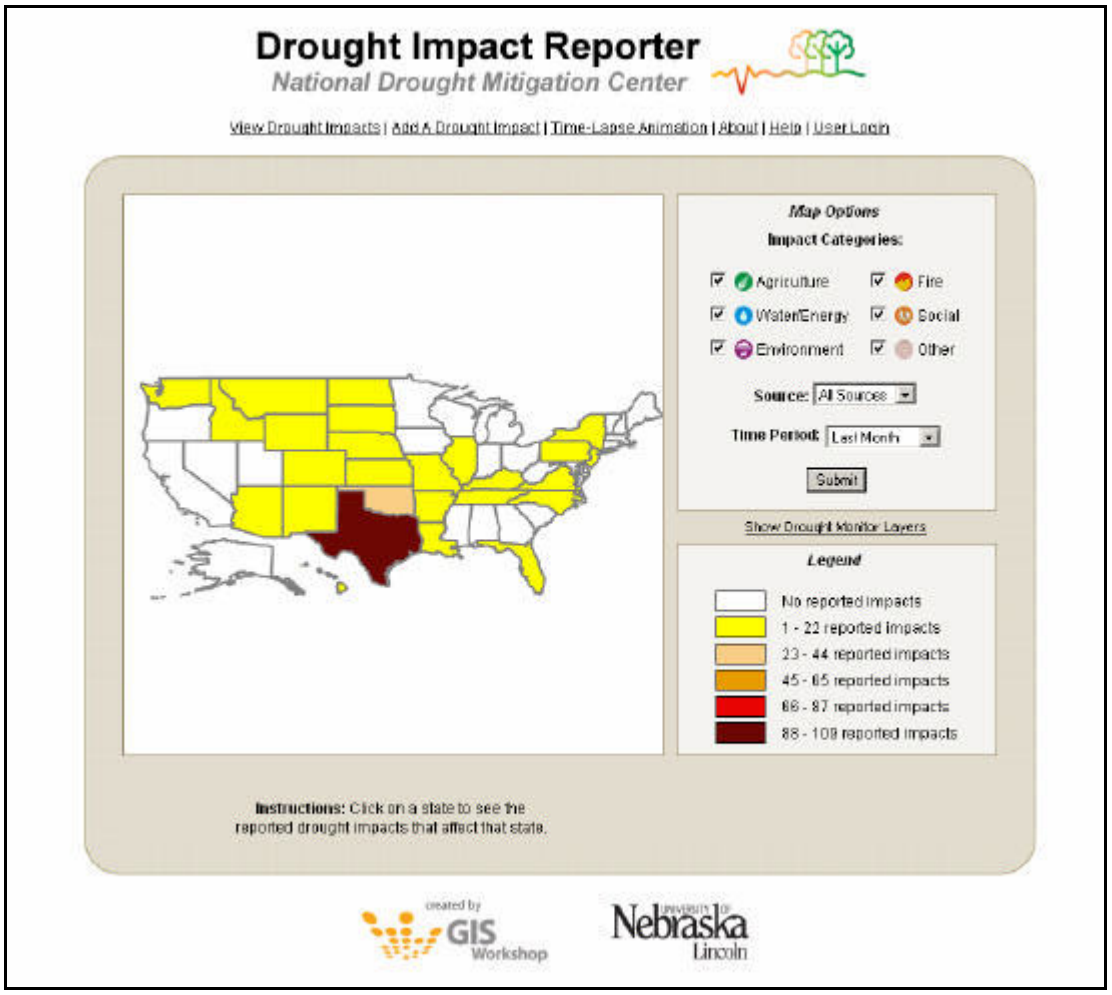

Figure 4: The Drought Impact Reporter (DIR).

Figure 4 shows the DIR map. This interactive map displays the reported drought impacts over a specified period of time. The default view displays the reported impacts from all sources and all impact categories for the last month at the national level. At the national level, states are shaded in colors based on the number of reported impacts in each state. To view a state in more detail, users can click on the state. At the state level, the counties are also shaded in colors based on the number of reported impacts in each county. To the right of the map, several settings can be changed under Map Options. The user can select various impacts to map, change the timeframe for the map, change

the reporting source, or turn on the Drought Monitor shapefiles, which have been imported into Geographic Information System (GIS) software such as ArcGIS.

3.4 The National Agricultural Decision Support System (NADSS)

The National *Agricultural Decision Support System (NADSS)* is a web-based geospatial decision support system used to aid producers and decision makers in analyzing and effectively mitigating the effects of drought. [These web-based climate and risk assessment tools have been developed through collaboration between the NDMC, the Computer Science and Engineering Department (CSE), and the High Plains Regional Climate Center (HPRCC), all located at the University of Nebraska-Lincoln. Additionally, the National Center for Earth Resources Sciences (EROS) has been involved in certain aspects of the project dealing with remote sensing tools and drought assessment. The NADSS application provides information about drought using web-based implementations of commonly used drought indices including the Palmer Drought Severity Index (PDSI) and the Standardized Precipitation Index (SPI). By combining information that is generated by the drought indices and agricultural data, NADSS is able to define parameters to analyze risks associated with drought.
The objectives of NADSS include: 1) timely risk assessment with automation, 2) enhancing risk assessment with increased spatial and temporal resolution and additional input variables, and 3) extending risk assessment to forecasts and economic analyses. Accomplishing these objectives requires basic computer and science research in constraint databases, data mining, information retrieval, geospatial information analyses, and distributed computing (Cottingham et al., 2004). The project integrates ongoing research in these areas in advanced development of a Geospatial Decision Support System (GDSS) for drought risk management.

Figure 5: The National Agricultural Decision Support System (NADSS) webpage.

3.5 The Vegetation Drought Response Index (VegDRI)

Recent studies have applied data mining techniques to understanding drought characteristics in the central United States (Tadesse et al., 2004; Harms et al., 2002). Harms et al. (2002) developed data mining algorithms that identify the drought episodes separate from normal and wet conditions. Tadesse et al. (2004) used rule-based association technique with the global oceanic indices as antecedent episodes and drought as consequent episode to find the relationships between climatic and oceanic parameters within the state of Nebraska. This study indicated that there is a strong relationship between the global oceanic condition and drought occurrence in mid-western United States (i.e., Nebraska). This information is important in helping to predict future drought occurrences. Studies in ecological research have also introduced data mining techniques and found that they are powerful tools to address complex ecological problems involving both numeric and categorical data (De'ath and Fabricius, 2000). In another drought monitoring research study, Brown et al. (2005) focused on simple regression-tree modeling of drought using a combination of seasonal satellite vegetation metrics and climate and geophysical variables. In order to extract patterns from these variables, they used a data mining technique known as regression tree modeling to develop models to monitor drought during the growing season. These rule-based models are collections of rules, each of which is associated with a linear expression for computing a value called the Vegetation Drought Response Index (VegDRI), which is used to identify drought conditions. The VegDRI provides a unique and detailed source for monitoring drought conditions over natural and anthropogenic landscapes. Tadesse et al. (2005) expanded the study to predict future drought conditions (based on vegetation stress) by integrating data mining and satellite image processing techniques to assess vegetation conditions. The study indicated that drought information for vegetation stress can be delivered up to six weeks in advance and in a finer spatial detail (1 square km) than other widely used drought monitoring maps such as the U.S. Drought Monitor map, which uses climate division data with roughly a 100 square km spatial resolution.

A quasi-operational seasonal (i.e., summer) drought monitoring web delivery system is available at the *USGS Drought Monitoring* website. This interactive web mapping application was developed by USGS to support visualization of drought information (e.g., VegDRI maps). The map viewer includes other layers such as satellite-derived vegetation greenness data, climate data, biophysical data (e.g., land cover), and digital elevation data that may provide relevant geospatial information for decision makers. Such web delivery provides large amounts of information efficiently and rapidly to interested users. Feedback from potential users of the VegDRI is an important mechanism to improve the product and the delivery system. To this end, two workshops were held with potential users of VegDRI in South Dakota and Nebraska. These discussions identified a wide range of potential applications for the product. State and federal agricultural agencies cited the potential use of VegDRI in helping to verify drought disaster claims on range and croplands and in making other rangeland and forestry management decisions. For example, federal managers responsible for determining appropriate livestock grazing numbers on federal lease lands could use VegDRI maps to help decision making. Forestry personnel recognized the potential value of VegDRI in fire planning efforts such as scheduling prescribed burns and identifying high-risk fire areas. Similarly, individual producers also identified the potential use of VegDRI maps for filing disaster insurance claims and making farm marketing decisions. Finally, environmental management agencies noted the benefits of VegDRI for monitoring wildlife habitat quality. The availability of this and other new

drought monitoring tools with relevant geospatial data enables a wide range of decision makers to act timely and efficiently to reduce the impacts of drought. National and international disaster assistance and relief organizations and government institutions can benefit from fast and user-friendly delivery of information for effective planning and management of available resources (Tadesse et al., 2006).

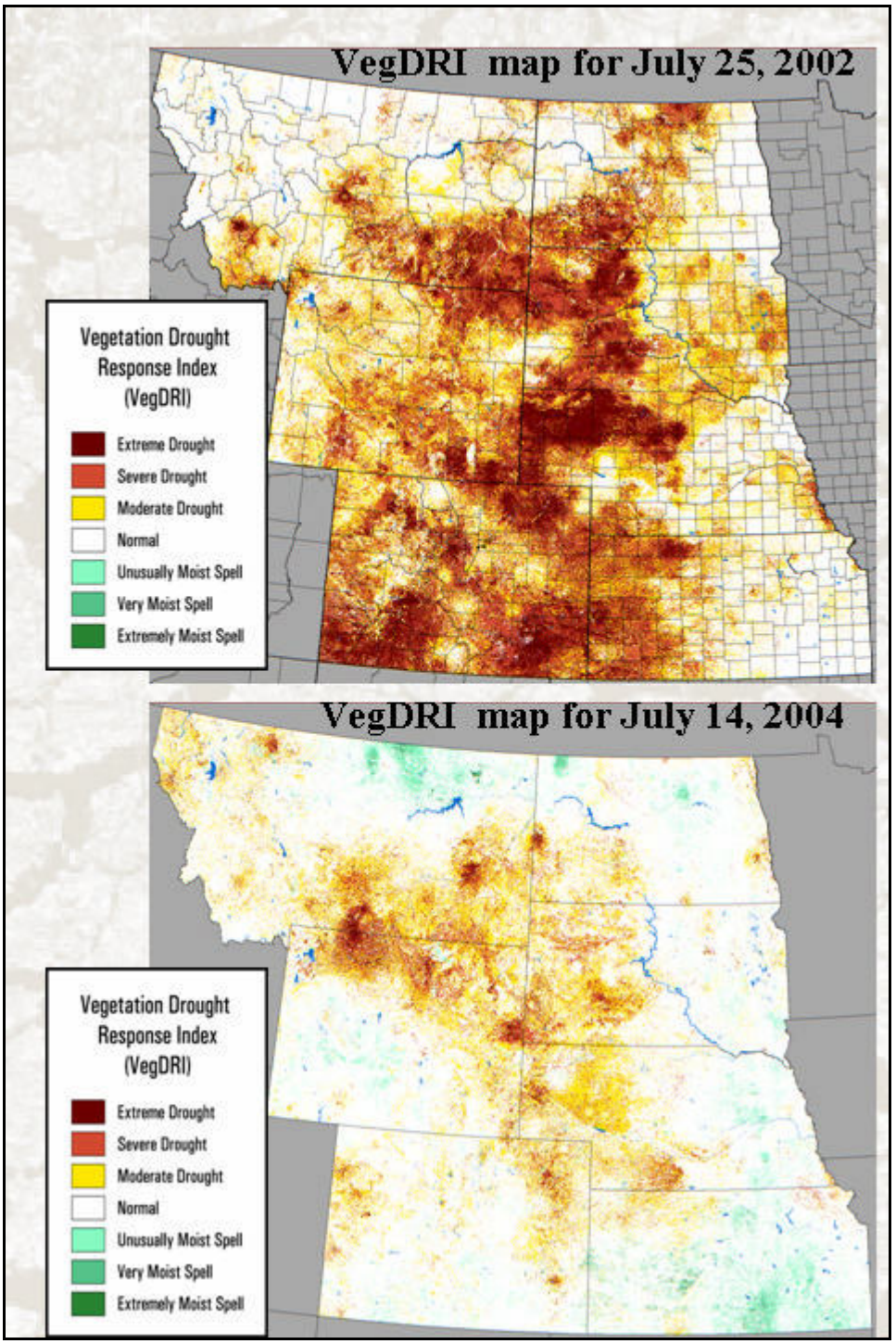

Figure 6: The Vegetation Drought Response Index (VegDRI) for 25 July 2002 and 14 July 2004, respectively.

3.6 Other Drought Information Centers in the United States

There are other drought information centers in the United States besides the NDMC such as the National Oceanic and Atmospheric Administration (NOAA)'s website on drought information. *NOAA's drought information center* provides a list of the various NOAA websites and information on drought and climate conditions, including the NOAA's Climate Prediction Center's the *U. S. seasonal drought outlook;* the *United States Statewide/Regional Moisture Status* using precipitation ranks and Palmer Indices; the *Drought Calculator*, which calculates the amount of rainfall needed to end droughts around the country; and the weekly graphics that show the *Crop Moisture Index* of the United States. The United States Department of Agriculture (USDA) also provides information on drought-related agricultural performance. *The USDA drought* website includes drought risk management and policies, drought assistance information, and other related natural disaster assistance. Moreover, drought information is also provided at the state level in many states using web-delivery systems.

3.7 North America Drought Monitor (NA-DM)

The impacts of drought often extend beyond international boundaries. Building international drought monitoring networks can help in reducing the magnitude of economic, environmental, and social impacts associated with drought. The *North America Drought Monitor (NA-DM)* is a cooperative effort between drought experts in Canada, Mexico and the United States to monitor drought across the continent on an ongoing basis. Major participants in the United States include NOAA's National Climatic Data Center and Climate Prediction Center, the U.S. Department of Agriculture, and the National Drought Mitigation Center. The main participants from Canada and Mexico include Agriculture and Agrifood Canada, the Meteorological Service of Canada, and the National Meteorological Service of Mexico (SMN - Servicio Meteorologico Nacional). Figure 7 shows the NA-DM map. This drought monitoring tool is a good example of the importance of working with global and regional partnerships from different nations and regions to be able to improve drought coping capacity collectively.

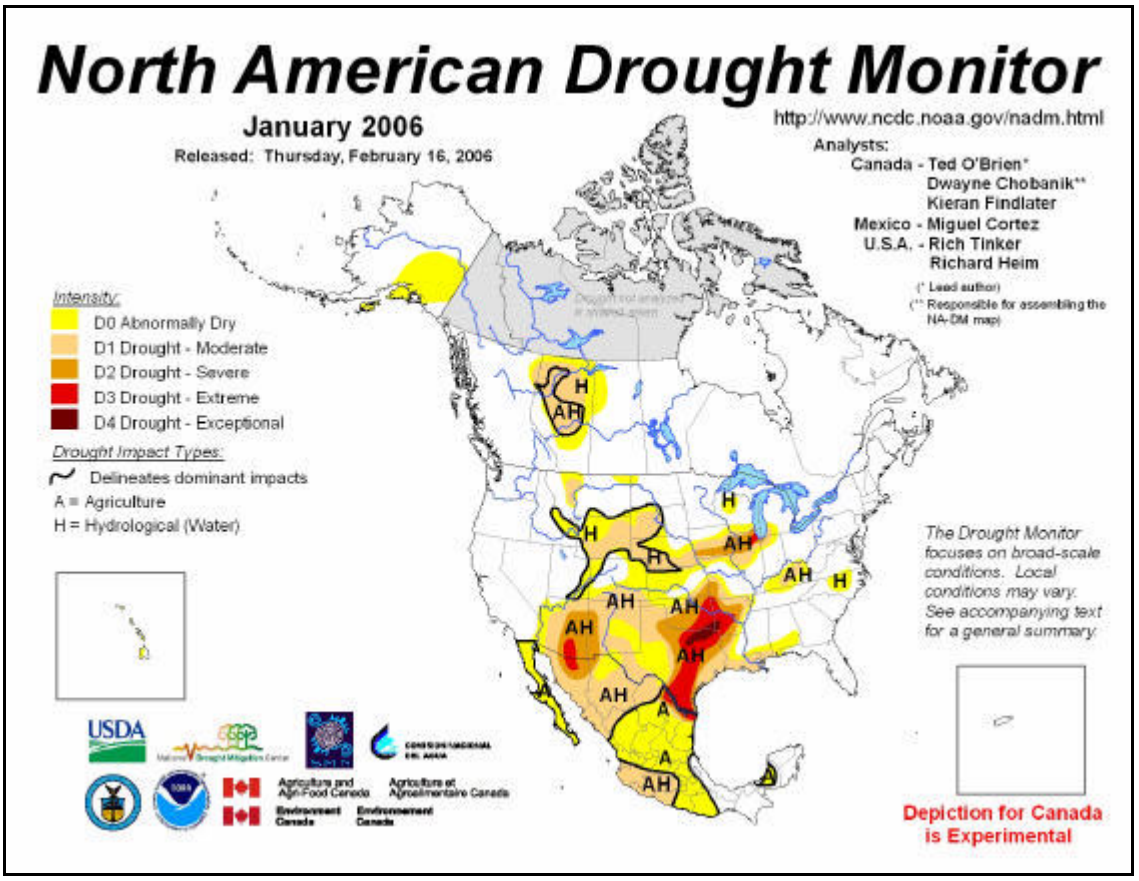

Figure 7: The North American Drought Monitor (NA-DM).

3.8 Global Drought Preparedness Network (GDPN)

Because of increasing concern over the escalating impacts of drought and society=s inability to effectively respond to these events in the past, developing and developed countries are now placing greater emphasis on the development of national policies and plans that emphasize the principles of risk management. In addition, global initiatives, such as the U.N. Convention to Combat Desertification (UNCCD) and the U.N. Framework Convention on Climate Change (UNFCCC), are emphasizing the importance of improving drought early warning systems and seasonal climate forecasts and developing drought preparedness plans. A AGlobal Drought Preparedness Network@ (GDPN) can provide the opportunity for nations and regions to share experiences and lessons learned (successes and failures) through a virtual network of regional networks. For example, information on drought policies, emergency response measures, mitigation actions, planning methodologies, stakeholder involvement, early warning systems, automated meteorological networks, the use of climate indices for assessment and triggers for mitigation and response, impact assessment methodologies, demand reduction/water supply augmentation programs and technologies, and procedures for addressing environmental conflicts could be shared within and between regions through the GPDN. The IDIC/NDMC is well positioned to provide the leadership for this initiative.

The IDIC/NDMC is working in partnership with key U.N. agencies, U.S. federal agencies, NGOs, and appropriate regional and national institutions to build a Global Drought Preparedness Network (GDPN) that will promote the concepts of drought preparedness and mitigation with the goal of building greater institutional capacity to cope with future episodes of drought. Dr. Wilhite launched this network concept in

2001. Since 2002, Dr. Wilhite has been chairing the Drought Discussion Group of the U.N. Secretariat for the International Strategy for Disaster Reduction (ISDR).
The Drought Discussion Group produced a report in April 2003, *Living with Risk: An Integrated Approach to Reducing Societal Vulnerability to Drought* (www.unisdr.org), which identified the key issues associated with drought risk reduction.
The recommendations included in this report were presented to and endorsed by the ISDR Inter-Agency Task Force. The IDIC/NDMC is now working in partnership with ISDR to promote regional drought networks and enhance the web-based drought information clearinghouse currently maintained by the NDMC. In essence, this global drought partnership will enhance current national and regional institutional capacities for drought preparedness by building regional drought preparedness networks and partnerships. Working individually, many nations and regions will be unable to improve drought coping capacity. Collectively, working through global and regional partnerships, we can achieve the goal of reducing the magnitude of economic, environmental, and social impacts associated with drought in the 21st century.
Increasing society=s capacity to cope more effectively with the extremes of climate and water resources variability, i.e., floods and droughts, is a critical element of integrated water resources management. Historically, more emphasis has been given to flood management than drought management. With increasing pressure on water and other natural resources because of increasing and shifting populations, it is imperative for all nations to improve their capacity to manage water supplies more efficiently. A network of regional drought preparedness networks, with coordinating and technical support from the University of Nebraska=s IDIC/NDMC can help to accomplish this goal.
The objectives of the GDPN for the period 2006 through 2008 are:

1. To initiate, within drought-prone areas, regional drought preparedness networks that will bring together people and institutions with the goal of increasing interactions and linkages for sharing information on regionally and locally appropriate strategies to improve drought preparedness and mitigate the effects of drought.
2. To identify regional institutions to coordinate regional networks and identify potential funding sources for these networks. The goal is for regional networks to be funded through regional organizations and initiatives.
3. To identify key global partners and potential funding sources for the GDPN.
4. To enhance the NDMC=s drought information clearinghouse web site to provide more information on drought monitoring, mitigation, and preparedness techniques and methodologies and linkages to the principal institutions in each region. This step will require additional financial resources to enhance and maintain the NDMC=s web site.
5. To assist regional networks in the development of comprehensive drought-related web sites which link the principal national and regional institutions.
6. To organize and conduct, with the assistance of regional institutions, regional organizational and launching workshops and longer-term training opportunities at the regional and global levels on various aspects of drought preparedness.

3.8.1 Progress to Date

The concept of a regional network on drought preparedness has been discussed with regions in the Mediterranean, Latin America, North America, Sub-Saharan Africa, Asia, Australia, and Eastern and Central Europe. It is anticipated that the regions identified above will be redefined as networks evolve. It is also anticipated that countries may elect to become members of more than one network.
Progress to date is highlighted below:

- *Mediterranean/Near East/Central Asia Region*. A network has been established within this region as a direct result of interactions between Dr. Wilhite and regional organizations. The network, NEMEDCA is being sponsored by ICARDA, FAO, and CIHEAM. Two advanced short courses, Management Strategies to Mitigate Drought in the Mediterranean: Monitoring, Risk Management, and Contingency Planning, have been held and another is planned tentatively for June 2006 in Aleppo, Syria. A regional project funded by the European Commission (MEDROPLAN) is supporting development of drought preparedness guidelines for countries in the region and a regional network.
- *Asia and Pacific***.** The concept of the GDPN and regional networks on drought preparedness was presented by Dr. Wilhite at the DESA/ESCAP/NOAA Interregional Symposium on Water-Related Disaster Reduction and Response in Bangkok, Thailand, in August 2001. Since that time, Dr. Wilhite has been in contact with ESCAP, UNDP, WMO, ISDR, and the Asian Disaster Preparedness Center (ADPC) on the development of a regional network. A proposal will be submitted by ESCAP in support of the development of an Asian network.
- *Sub-Saharan Africa*. The UNDP=s Drylands Development Center (DCC) and the ISDR African Office have agreed to work with the regional drought monitoring centers in the development of a network for Sub-Saharan Africa. The DCC has developed a drought portal in response to recommendations emanating from the African Drought Policy Forum held in Nairobi in January 2005.
- *North America*. The Prairie Farm Rehabilitation Administration, Agriculture Canada has agreed to work with the IDIC/NDMC to organize a North American regional network. Potential areas of collaboration are currently being identified. The IDIC will work with the Institute of Ecology in Xalapa, Mexico, and the Mexican National Water Commission (CNA) to determine their interest in participating in this network. Based on the success of the U.S. Drought Monitor, the U.S., Canada, and Mexico are already cooperating on the preparation of a web-based North American Drought Monitor.
- *Australia.* The concept of a regional/global drought preparedness network has been discussed with the Australian Bureau of Resource Sciences and the Bureau of Meteorology. BRS is interested in providing technical support for this network, especially in the Asian and Pacific Island regions.

4. Future Prospects

The successful implementation of these drought monitoring tools, along with increasing technological improvements, may provide an opportunity to extend their application across the United States and abroad. But the development of new techniques and drought monitoring tools is only part of a decision support system. An integrated and systematic approach in using modern tools is of paramount importance in decision making. Thus, a comprehensive decision support system for drought monitoring is an important factor that should be developed and implemented if governments plan to meet the challenge of mitigating the impacts of drought. Moreover, the drought monitoring tools need to be organized and expressed in an easily understandable format using data visualization and GIS techniques. The information can be disseminated in near-real time using a web-delivery system that may be easily accessed by decision makers, government and non-governmental institutions, and individual users such as farmers and ranchers.

The NDMC is involved in a partnership with the USDA Risk Management Agency (RMA) to enhance the drought monitoring tools and make them user-friendly so that

they can be used by producers. One future project will focus on the "rangeland and forage geospatial decision support system for drought risk management." Another project is the enhancement of the NADSS information delivery and decision support system. With new funding from the USDA, the NADSS is expected to enhance and extend its existing service and further develop its "Framework for Agricultural Risk Management (FARM)" through the partnership of the University of Nebraska-Lincoln's *Computer Science & Engineering* Department and National Drought Mitigation Center and the USDA's Risk Management Agency. Future improvements will include implementing all GIS functionality, allowing for interoperability of results with industry standard GIS toolkits; a totally new user interface designed to make finding the tools and data needed by producers and researchers less complex as part of a more natural workflow; and brand- new risk assessment tools with enhanced GIS functionality.
These successful projects and partnerships between experts and government officials in developing and extending the information networks to monitor and mitigate drought could serve as models for other countries and regional and international institutions in monitoring drought and combating desertification. International experiences and cooperation and regional and international networks should be strengthened in the future. Undertakings such as the North American Drought Monitor partnerships and the Global Preparedness Network should be encouraged to facilitate exchange of information, knowledge, and experience.

5. Summary

Drought and desertification inflict severe pain and hardship on society. They are serious global challenges that should be considered in the context of global environmental changes and sustainable development. Monitoring desertification presents unique challenges because of desertification's distinctive characteristics. In this paper it is assumed that the lessons learned from monitoring drought and information circulation systems provide a basis for building an effective strategy to combat desertification, mitigate the effects of drought, and alleviate economic and social problems in drylands.
The lessons learned from the National Drought Mitigation Center and other leading institutions in drought information circulation systems in the United States have been discussed in the context of combating desertification in other countries. The NDMC's information clearinghouse and drought monitoring websites are directed to state, federal, regional, and tribal governments, with the goal of helping them develop and implement measures to reduce societal vulnerability to drought by focusing on preparedness and risk management.
Both governmental and non-governmental decision makers need improved access to accurate and timely predictive and monitoring tools to assist them in dealing more effectively with drought. The Palmer Drought Severity Index and the Standardized Precipitation Index were discussed to highlight the contrast between drought monitoring using early climatic indices and more recent indicators such as satellite observations, developed in the last few decades. The United States Drought Monitor (USDM) is a big step in providing comprehensive information about drought to decision makers. Since its inception in 1998, the USDM has improved both in its quality and its delivery of information to a wider circle of users, policy makers, and government officials. The other interesting tool discussed in this paper is the Drought Impact Reporter. This web-based tool collects and maps drought impacts in the United States.
New drought monitoring tools are being developed to manage water and other shared natural resources more effectively during periods of drought. The Vegetation Drought Response Index (VegDRI) is one of these tools. The VegDRI integrates satellite and

climate data to identify and monitor drought. The web-based delivery of this seasonal drought monitoring tool has tremendous advantages for agricultural and rangeland producers. In the future, this tool will further integrate other oceanic and other atmospheric indicators to build prediction models. These kinds of tools provide vegetation condition outlooks (projecting 2-3 weeks ahead) that can improve our ability to make efficient risk assessments and better decisions. Web-based geospatial decision support systems such as the National Agricultural Decision Support System (NADSS) assist producers and decision makers in analyzing and effectively mitigating the effects of drought.

Finally, comprehensive drought monitoring activities and the delivery systems that provide information to land and other natural resource managers are of paramount importance in combating desertification. Policies that promote an integrated approach to drought monitoring will result in substantial benefits in combating desertification.

The identification and application of appropriate drought mitigation measures and the development of an integrated drought monitoring system are essential to reducing the impacts associated with future droughts. Regional and international networks can help to promote the dissemination of this information to other drought- and desertification-prone regions and aid the technology transfer process. The North American Drought Monitor, which includes the United States, Canada, and Mexico, is also discussed to highlight the experiences and cooperative needs of the international network.

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NATIONAL AND REGIONAL SCIENTIFIC NETWORKING FOR SUPPORTING THE IMPLEMENTATION PROCESS OF THE UNCCD – THE EXAMPLES OF DESERT*NET GERMANY AND THE EUROPEAN DESERTNET

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Abstract
At the Third Session of the Committee for the Review of the Implementation of the Convention (CRIC 3, 2-11th May 2005 in Bonn, Germany), the German Scientific Network to Combat Desertification (Desert*Net, www.desertnet.de) together with representatives of the French Comité Scientifique Francais de la Désertification (CSFD) and the Belgian Expert Group held informal talks to develop a European network on Desertification to enhance the political awareness for the desertification issue at the European level, and to support the implementation process of the UNCCD.
In June 2005, the European network was created. The interim secretariat is located at the German Desert*Net office in Hamburg, Germany. In the Year of Deserts and Desertification (IYDD 2006), the further structuring of the European DesertNet will start creating a scientific platform for sharing and discussing initiatives and research related to combating and preventing desertification, and thus, to identify up-scaling and multiplier affects for best practice solutions.

Key words: Scientific networking, knowledge sharing

1. Summary

Solving today's ecological and socio-economic problems in drylands cannot be undertaken without the integration of science at all levels of policy making for sustainable development. Besides identifying the problem on the basis of mostly mono-disciplinary excellence, the eminent problem of desertification also requires a more marked and stronger commitment of science towards finding mechanisms to rehabilitate or to restore degraded lands, and to actively examine cost-efficient and implementable prevention strategies. Where land use rights, and thus the regulation or non-regulation of human activities in the utilisation of natural resources are concerned, interdisciplinary research is required in order to create tools for preventing and combating desertification.
Pooling and communicating existing data, knowledge and scientific expertise on best practices or success stories is such a major tool.
The addressees of integrated scientific results on sustainable development lie beyond the scientific community. They are development agencies (governmental and non-governmental), ministries and local administrations. Much of the existing research for sustainable development usually does not reach the level of policy making. It is thus important to create outreach mechanisms in scientific networks. The dissemination of results to non-scientific stakeholders also creates a better visibility of the importance of science for sustainable development.
The implementation of measures to prevent desertification and restore degraded lands will only be successful if they are firmly embedded in the social, cultural and economic realities of the affected areas. A participatory approach in research on sustainable development is

indispensable, and must be firmly embedded in the planning, field and implementation phases of research projects.
The creation of such communication platforms with numerous interfaces will be exemplified by the German Scientific Network to Combat Desertification (Desert*Net Germany), and the recently emerged European Scientific Network on Research to Combat Deserification (European DesertNet).

2. Interdisciplinarity

Already, in 1977 at the United Nations Conference on Desertification (UNCOD, 29th August to 9th September 1977) in Nairobi, Kenya, a plan of action to combat desertification was formulated which comprised 26 recommendations that discuss the various and complex issues of desertification (Mensching, 1977). Three decades later, desertification has continued to spread, and has destabilised the economic situation of rural households. The Millenium Ecosystem Assessment (MA, 2005) estimates with medium certainty (65-85% probability) that about 10-20% of the drylands is currently degraded. The Millennium Ecosystem Assessment Desertification Synthesis Report (2005) predicts a further expansion of this creeping environmental disaster.
So has science failed to convey deliverables to safeguard environment and support sustainable development in drylands?
Decision-makers usually require concrete and simple answers for implementation. Inter-disciplinary research continuously poses sets of new questions during field research. Thus, interdisciplinarity can slow the pace of finding answers on how to use a region's natural resources in a sustainable manner. In fact, inter-disciplinarity can boost competition for competence between the different disciplines, thus hampering co-operation. Despite the down side to interdisciplinary communication, the evaluation of a questionnaire on how interdisciplinarity is perceived in the interdisciplinary BIOTA AFRICA[1] project showed that the researchers considered interdisciplinarity as a way to consider all factors which are part of the ecosystem processes, thus greatly increasing predictive capabilities of ecosystem behaviour, and hence, enabling extrapolation to similar ecosystems elsewhere (compiled by Akhtar-Schuster, 2004).
Co-operative interdisciplinary networking requires the delineation of common scientific interests, and also the agreement on common date sharing codes (ethics) on the basis of transparent and thus trustworthy data communication structures. The development of interdisciplinary scientific networks need a well-structured, however, flexible communication forums for discussions and data exchange.
In early summer 2005, at the Third Session of the Committee for the Review of the Implementation of the Convention (CRIC 3, 2-11th May 2005 in Bonn, Germany), these issues were discussed between the Belgian, French and German networks on research to combat desertification. There was consensus that national and regional topic-based scientific networking is indispensable for identifying success stories or best practices for the sustainable utilisation of natural resources. Currently, the European research community sees this step as a structural indispensability in order to achieve information on cost-efficient and implementable strategies for sustainability and in order to identify up-scaling measures (i.e. multiplier effects) of realistic options for sustainable development and the safeguarding of natural resources.

[1] The BIOTA AFRICA Project is funded by the German Federal Ministry of Education and Research.

Thus, science should not restrict its activities to diagnose desertification. Scientific and technical information have to be translated into implementable measures to combat and to prevent desertification.
Such a scientific network has to be accepted as a trustworthy broker with transparent communication mechanisms for the policy level and also for civil society. Although a close contact to the policy level is necessary, the scientific network should remain an independent body, representing scientific excellence for sustainable development.

3. Participation

In order to translate research for sustainable development in to locally acceptable, cost efficient implementation plans, scientific projects for sustainable development have to encourage the integration of local social, economic and cultural realities in its work. The lack of participatory approaches in research projects on sustainable development has to be defined as a crucial blockade for combating or preventing desertification.
A participatory approach does not have a unique value of its own. It has to be continuously judged during development concepts, how much involvement of local affected groups is required, and at what stages of the planning phases. Structuring these communication pathways can often only be facilitated by a close co-operation with non-governmental agencies, which often have already created trustworthy communication structures at the local, community level.

4. The German Scientific Network on Research to Combat Desertification (Desert*Net Germany)

In order to support the development of applicable sustainable land use systems in degraded areas, in 2000, the German Scientific Competence Network for Research to Combat Desertification (Desert*Net) was established to form a binding link between different scientific fields, policy makers, development agencies, public institutions and stakeholders. This interdisciplinary network recognises mono-disciplinary excellence as the pre-stage for aggregating reliable information for inter-disciplinary research. Desert*Net identifies pressing desertification-related issues at the social, economic and political level. The network scientifically supports innovative research concepts that are feasible and applicable to the local realities in desertification-prone or desertified areas. For this reason, the 27 German scientific institutes of Desert*Net co-operate with countries stressed by desertification in the line of technical and methodological training, scientific knowledge transfer and applied field research.
Training programmes for local land users, as for instance developed by the Desert*Net member project "BIOTA AFRICA", help to disseminate ecological information for developing and supporting self-help mechanisms. The courses and training on the job comprise general skills to facilitate workshops, to conduct interviews, to share research activities and objectives with local communities, to promote environmental awareness in local communities, and to strengthen self-help mechanisms. Participants from rural households are also trained to use technical equipment (e.g., GPS, maps, cameras, computers), and to collect and identify plants and animals. They are trained to assess socio-economic information and to document data on flora, fauna and soils. Communities thus have the chance to independently monitor risks and changes to their natural environment. (Krug et al., in review).

Photo 1: Community-based work on sustainable resources management in South Africa.
Photo Courtesy: Julika Doerffer

The collaboration of scientists and individuals from rural communities in affected areas help create information exchange in two directions. Scientists receive invaluable traditional knowledge on ecology and land use strategies. Members of local rural communities increasingly understand and accept scientific research for land rehabilitation and conservation, and they develop ownerships for research and results, thus strengthening links between science and local land users at the local level.

*4.1 How does Desert*Net work?*

The network is open to all research institutes, who work in the field of desertification and desertification-relevant topics. These research institutes can become permanent members of the network. Representatives of member institutes can be elected into the advisory board. Elections take place after every two years. Recently, the advisory board was extended to 10 representatives of different institutions and disciplines, so as to better capture the interdisciplinary character of the desertification issue. Individuals with the highest votes are nominated for chair and co-chairs. The coordination office rotates and is established at the institute of the chair. Information transfer and exchange are organised and carried out by the Desert*Net coordination office. Two electronic distribution lists regularly circulate relevant research news, publications and events to the member institutes and to other individuals, research and development agencies, policy makers, NGOs and UN bodies.
Although Desert*Net Germany has no monetary budget, voluntary donations from scientific institutions, ministries or the private sector allow annual scientific conferences and exhibitions on desertification. Desert*Net Germany performs advisory functions and collaborates closely with the UNCCD and the German Agency for Technical Co-operation, GTZ CCD Project (under the Federal Ministry for Economic Co-operation).

5. The Creation of the European DesertNet

Mechanisms for up-scaling and mainstreaming best practice mechanisms to combat desertification are not only missing at the national levels, but also at the regional levels. In Europe, well-established scientific networks on desertification exist in many countries (e.g. German Scientific Network to Combat Desertification, Desert*Net, Comité Scientifique Français de la Désertification, CSFD, Belgian Expert Group on Desertification to support the Ministry for Development Cooperation). However, until May 2005, there was little or now communication or knowledge exchange between these different national networks.

First informal discussions to create a regional European Scientific Network for Research on Desertification (European DesertNet) were carried out between scientists from Belgium, France and Germany, who were official members of the national delegations to the Committee on Research for the Implementation of the Convention (CRIC3) in Bonn, Germany, in May 2005. The motivations for creating a European Network are a) the pooling and dissemination of European research knowledge on best practice systems, b) enhancing the visibility and the position of science and research for sustainable development c) strengthening scientific commitment for exploring mechanisms to rehabilitate or to restore degraded lands d) creating more general public awareness for the desertification issue in Europe, and e) supporting the creation of similar scientific networks to combat desertification regions of the world. The European DesertNet will not generate redundant scientific structures for the UNCCD. Rather, it sees itself as a scientifically independent body that supports the work of the Committee on Science and Technology (CST).

In order to proceed with the development of a European Network on Combating and Preventing Desertification, scientists from Belgium, France and Germany met once again on the 24th of June 2005 in Bonn, Germany, and compiled a European Declaration. On the 6th of September 2005, the Declaration of the European Desert*Net was sent to European focal points of the UNCCD and was thus opened for signature. The network is open to scientists and research institutions from Europe who are interested in the topic, and who share the vision delineated in the Declaration of European DesertNet. In March 2006, scientists from over 60 European research institutes from 12 European countries (Austria, Belgium, France, Germany, Greece, Hungary, Italy, Romania, the Slovak Republic, Spain, Switzerland and The Netherlands) had signed the Declaration. UNCCD, UNESCO, national ministries and the European Commission have been informed of this initiative, and have signalled keen interest for the creation of European DesertNet as a science-based initiative to support the UNCCD/CST, and to stimulate and promote European research on desertification. The European Scientific Network for Research on Desertification is seen by the European Commission as a very, quotation, "timely and appropriate" measure that "…could play an important role in stimulating and promoting European research on desertification".

A first constitutional meeting of the European DesertNet will take place in October 2006, thus, in the International Year of Deserts and Desertification (IYDD 2006) in Bonn, Germany.

5.1 Declaration of the European Network for Research on Desertification (European DesertNet)

Mitigating the effects of drought, combating desertification and alleviating poverty in drylands are challenges whose importance should be sufficiently recognized within the context of global environmental changes and sustainable development.
We, members of European interdisciplinary groups of scientists, active in basic and applied research on land degradation/desertification, directly related to poverty alleviation, intend to coordinate our activities in view of possible collaboration at national and international level.
Our major objectives are:

- To *identify and analyse the pressing problems* with regard to drought, land degradation/desertification and poverty;
- To review *the state of the art* of European scientific knowledge and know-how concerning this global problem;
- To identify, through networking, *success stories and best practices* resulting from scientific research, and to create multipliers and accelerators for their implementation;
- To identify gaps and develop *innovative basic research* in these areas;
- To develop *applied research* in view of its use in arid, semi-arid and dry sub-humid areas, thereby focusing on users' needs, interdisciplinarity and integration;
- To strengthen and support *European research capacities* in order to promote scientific cooperation;
- To structure and facilitate the *communication and transfer* of know-how and technologies within the European DESERTNET and towards affected countries;
- To establish and intensify *linkages with research partners* inside and outside Europe;
- To stimulate *application of appropriate research findings* in the drylands through participatory processes, involving civil society, NGOs and CBOs;
- To establish a *mechanism for effective and successful policy advice and for public awareness raising*.

For this purpose, the European DesertNet is open to all European scientists wanting to join our association and collaborate with us. We support the UN environmental conventions, in particular the UN Convention to Combat Desertification (UNCCD). We intend to strengthen the cooperation with its scientific body, the Committee on Science and Technology (CST) and are open to collaborate with all other UNCCD panels or groups, in need of scientific input. We are also looking forward to collaboration with international organisations, programmes and agencies in need of scientific information or advice. We are prepared to put our knowledge and understanding to the service of combating desertification and creating sustainable livelihoods in drylands through sound scientific work.

6. Conclusions

Creating national and regional scientific networks is immensely important to pool and disseminate knowledge and data on success stories to combat and prevent desertification. These scientific networks, however, have to create communication interfaces to the policy makers and to the stakeholders in affected countries. Accordingly, scientific information has to be processed in a manner to make it implementable for sustainable development. Whereas policy makers have to recognise that scientists are indispensable for formulating sustainable land use practices, scientists have to acknowledge that a "splendid isolation" attitude in the research community will marginalise the role of science to face the affects of global environmental change on human well-being.

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SESSION II

Experiences and lessons learnt implementing ICS: ICS and long term environmental monitoring

EXPERIENCES AND LESSONS LEARNT FROM ICS AND LONG TERM ENVIRONMENTAL MONITORING

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Abstract
LTER is a research platform and information management system for multi-disciplinary, multi-institutional and participatory ecosystem studies geared towards improving understanding of ecosystem function and change through long-term monitoring. It is a mechanism for effective early warning and can guide prevention of or recovery from environmental degradation. Long-term monitoring required long-term continuous commitment by many individuals, institutions and support agencies for research and development, including training and institutional capacity development especially in developing countries. The costs of maintaining LTER are far less than the costs of desertification that could have been prevented by LTER.

1. Introduction of LTER

LTER (Long-Term Ecological Research) is a well-established concept involving site-based monitoring of the ecological and socio-economic environment through networks of individual scientists, institutions, provinces, countries and continents over time periods longer than the careers of participating scientists (Risser 1995; Gosz 1996). The fundamental goal is to detect change and study long-term processes through cooperation across these scales of space and time. Both continuity and networking are thus fundamental to LTER.

Monitoring the environment and related factors at multiple fixed sites is fundamental to this kind of long-term data acquisition. Monitoring sites have therefore been referred to as Observatories, and their interconnection as Environmental Observatories Network (EON) (Henschel & Pauw 2003; Henschel *et al.* 2004). 'Network' expresses the interdisciplinary, multi-institutional synergy and large-scale ('big science') scope and the challenge of elucidating events across landscapes, different communities and aeons.

LTER is a research platform and information management system for multi-disciplinary, multi-institutional and participatory ecosystem studies with strong local, national, sub-continental and global linkages. LTER tackles the formidable task of improving understanding of ecosystem function and change, as well as agents of change, so as to promote wise use and management of ecosystem goods and services via policies, strategies, public awareness and environmental education. Although environments are complex and dynamic with many interacting factors that vary at different scales, LTER can provide a mechanism for effective early warning systems and for the prediction of deleterious environmental change. Data obtained at different times and different sites can be compared across space and time. Typically, the time scale of LTER monitoring extends from decades to centuries (with predictions extending into millennium-scale probabilities). However, they do also capture episodic events, environmental phenomena that may be short, rare and unpredictable, but extremely important (e.g., extraordinary rainfalls or droughts, heat-waves or deep frosts, freak storms or extensive hot fires). Spatial scales typically extend from the size of a plot or patch (e.g., 1-m^2, 1-ha, 1-km^2), across landscapes to biomes.

Networking stretches the scale across subcontinents, continents and the globe. LTER endeavours to provide baseline data and information on changes, including how changes are affected by and affect people. Good time-series data are necessary to address some of our most important questions concerning the environment. To obtain these requires strategies to electronically capture past data, make new observations, and incorporate them into accessible, understandable and shared data archives that build up a legacy of information that is independent of the whereabouts and welfare of its contributors. This, in turn, makes it possible to obtain data that no single individual or institution or generation can accumulate, while it simultaneously minimises data loss and redundancy. These strategies towards institutional, national and regional environmental information systems must be non-profit oriented and require synergy and good co-ordination among many scientists and institutions (Van Jaarsfeld & Lombard 1995). LTER therefore concerns monitoring, data archiving, data accessibility and sharing, and ensuring continuity of such programmes.

2. Scientific and practical approaches to combat desertification through LTER

Long-term and large-scale monitoring conducted through LTER should be a key component for combating desertification, as it provides the information required to guide decisions concerning natural resource management. It is also a key to recognise degradation in the first place (Klintenberg & Seely 2004), since desertification is by definition a change and a long-term process (Walker *et al.* 2002). Resistance of environments to change under pressure and their resilience to return to their original state (Carpenter *et al.* 2001) require observations over many years that track these changes. LTER is also required to detect when certain thresholds of environmental condition have been exceeded and changes of state occur, as in desertification. Similarly, efforts to restore (Barac *et al.* 2004) require close monitoring.

LTER is the appropriate platform to examine complex processes such as desertification, land transformation, climate change, episodic events (pulses) and nutrient loading in terms of such response measures as primary and secondary production, biodiversity, disturbance, nutrient fluxes, human welfare and effects of technological advances (Van Jaarsveld & Biggs 2000). To understand processes such as desertification, natural and social sciences need to combine their outlook. While in the past LTER was conducted by ecologists rather than social scientists or economists, the "human dimension" is becoming a second core component and multi-disciplinary approaches are called for (Table 1). This cross-sectoral approach provides more relevance in the context of the need to address issues relating to sustainable development (e.g., combating desertification), but it also provides scientific strength by being more inclusive, although it remains an academic challenge to master and to evaluate. The key for LTER is synergy, where co-operation produces greater products than the sum of the outputs by individual participants working alone.

In order to address complex environmental problems it is necessary for boundaries of disciplines to become indistinct. Ecologists need to delve into history, religion, philosophy, geography, economics, and political science (Ludwig *et al.* 2001). Sustainable natural resource management inextricably links the natural environment and the socio-economic environment. Changing conditions for natural environments supporting larger and increasingly consumptive populations of people and livestock in developing countries imply that questions of natural and socio-economic sustainability and its indicators are currently dominant factors (Klintenberg & Seely 2004). Indices of population pressure,

livestock pressure, rainfall and erosion hazard – all obtained from long-term monitoring – can provide a short-cut and can give a first approximations of the risks of degradation across landscapes (Klintenberg & Seely 2004). Furthermore, such research is very closely linked with the need to raise awareness, and to transfer relevant knowledge to resource managers and incorporate it into policy. Particularly in developing countries, environmental scientists are gaining experience in using multi-disciplinary and simultaneous basic-applied approaches and can therefore be influential in the growth of this approach in other regions of the world.

3. Institutional focus of LTER

Benefits of LTER increase through its functional networking at many levels. Synergy and co-ordination of many scientists, institutions and other stakeholders, adds context and continuity, and provides LTER programmes with a broad, dynamic and adaptive outlook.

While research programmes conducted at specific sites managed by LTER centres form the basic ingredients, they are nested at various levels (Table 2). The International Long-Term Ecological Research Network (ILTER) promoted the idea that countries are appropriate levels for institutions to co-ordinate local LTER programmes (Risser 1995; Gosz 1996). Countries form networks, endorsed by their own governments, and this facilitates their effectiveness and durability. Country networks are members of regional networks, groups of nations with common interests and in geographic proximity. Country and regional networks, in turn, are affiliated to ILTER, which guides by mutual consensus.

An LTER centre, or institution, is a local network where fieldwork is conducted (Table 3). An effective LTER centre requires networking and agenda setting by local LTER programme managers, to make their centre known, its data accessible and useful, to attract expertise from elsewhere, and to promote information exchange between professionals and local resource managers. It functions through co-ordination of research and monitoring at specific places, managing, archiving and analysing data, disseminating information, and education and outreach programmes. An LTER centre operates permanent field sites that serve as nodes for affiliated sites that may either be external to the core LTER area and/or based on temporary projects. LTER centres are typically associated with field stations operated by national (rather than foreign) institutions that can give permanence and relevance to a succession of research and monitoring programmes and house the data archive. Through their connection to the LTER centre, partner institutions increase capacity, support the data archive and gain access to previous data and information, which enhances synergy and relevance. Well-funded projects from foreign institutions, particularly industrial nations, can (and are often necessary to) supplement - LTER sites in return for guidance and access to data archives of their hosts. It is the role of local institutions to co-ordinate foreign-local collaborations and to ensure that data and information are archived at the LTER centre.

Of several hundred LTER centres world-wide, the Gobabeb Training & Research Centre serves as a good example of what kind of institution operates LTER in a developing country (Henschel *et al.* 2000). Gobabeb is a SADC Centre of Excellence with a focus on drylands natural resource management and desertification. Its purpose is that policies and strategies of key actors for sustainable natural resource management in drylands are improved, particularly within the concept of the UN-CCD in synergy with other UN-Environmental Conventions in Namibia and within the SADC region.

Gobabeb was initiated in 1962 as a field research station in the Central Namib Desert to host researchers and students. A range of environmental training opportunities and programmes were developed. In 1998, the Gobabeb Training and Research Centre became a Non-Government Organisation under a Joint Venture between Government, represented by the Ministry of Environment and Tourism, and an NGO, Desert Research Foundation of Namibia (Seely *et al.* 2000). In 1999 Gobabeb EON became the lead centre at the founding of the Namibian Environmental Observatories Network (NaEON) and the Namibian membership of ILTER.

In the course of four decades, data and detailed records of methods and study sites of resident and visiting scientists accumulated at Gobabeb. Continued monitoring by Gobabeb staff followed some projects that were originally conceived with short-term goals.

The monitoring programme includes climate; dynamics and management of natural resources; socio-economic status of rural communities; renewable energy; surface and ground water availability, use and hydrologic processes; natural and anthropogenically-affected geomorphological processes; productivity, growth, population dynamics and diversity of trees, shrubs and grasses, riparian forest, and several vertebrate and invertebrate populations. Sites of the Gobabeb EON centre are situated across the Namib Desert and adjacent areas such as an ephemeral river basin. Gobabeb EON sites cross an extremely steep rainfall gradient (10-400 mm per annum over a distance of 300 km), ideal for monitoring and addressing questions concerning biodiversity, desertification and climate change. Data and research findings are incorporated into an electronic data archive, while the extension of physical facilities enables Gobabeb to increase services to research and training clients and partners. Indeed, most of the research needs to be conducted by visiting scientists, as there are only few resident researchers.

At Gobabeb data and understanding gained from EON form the basis for field courses, in-service training, environmental education programmes, and are fed into policy-making via projects of the Desert Research Foundation of Namibia such as Parliamentary Environmental Updates and Decision-Makers' Guides. Today the Gobabeb Training and Research Centre is connected to an extensive network of researchers and students. Training opportunities include in-service experience and courses concerning a range of disciplines. In this respect, Gobabeb is geared towards training potential future EON practitioners for NaEON and ELTOSA (Environmental Observatories Network of Southern Africa).

The Gobabeb EON programme is largely funded through income from professional services and project overheads. Training programmes as well as enhancement of institutional capacity relies on donors. Gobabeb is striving to become financially self-sufficient to eventually be supported mostly by projects and service provision for training and research. This challenge faces many field stations in developing countries without the prospect for government funding for LTER programmes.

LTER centres exchange information with each other to form a national network. It is at the country level that LTER meta-databases really come into play, as it combines information contained in several data archives of LTER centres and strengthens the data policy of the institutions managing these sites. This gives practitioners access to information on who is managing which data and what the data access conditions are. Metadata provides context and effectiveness to networking by LTER on national and international levels.

It is at the level of country networks that the commitment for LTER is most crucial for programmes to be effective, as the kinds of institutions associated with LTER operate most effectively within the context of national objectives and are affected by commitment by

national decision-makers. In other words, without country networks to bind inter-institutional connectivity through objectives and common vision, LTER would not be assured to have the fundamental characteristics of compatibility and continuity. Country networks can either operate with a national office, as in USA and South Africa, or have a lead centre in their network that co-ordinates country activities, as in Namibia and the UK.
Country networks are members of regional networks, encompassing geographic groups of nations. Currently there are regional LTER networks in Asia and Pacific, Central Europe, Western Europe, Middle East, North America, South America, and Southern Africa (ELTOSA: Environmental Long-Term Observatories Network of Southern Africa). The ROSELT network, not yet affiliated to ILTER, interconnects countries with LTER networks in West Africa and North Africa.
Regional networks comprise countries with LTER centres. Countries in this case are each represented by a national chair, who is attached to either a national network office or an institution operating an LTER centre. The regional network can facilitate the establishment of LTER centres and country networks in the region where requested. It can improve connectivity between country networks and can co-ordinate regional planning of LTER, for instance by making best use of multi-national programmes, e.g., concerning transboundary parks/ecosystems, river basins, and atmosphere. Regional networks should facilitate collaboration, high quality research, and standardisation of methods where possible and appropriate. Such regional collaboration is the best way for LTER centres to complement each other, rather than duplicate. Fundamental to LTER is the sharing of data and dissemination of information, and it is an important role for the regional networks to ensure this. Regional LTER networks help increase the visibility of LTER programmes within the region and globally, assist with advising funders, facilitate the distribution of funds, as well as assist with feedback and review processes to funders.
There are many benefits for country networks and the regional networks to affiliate with ILTER, which guides by mutual consensus. Designation as a member network increases visibility of the member nationally and internationally and strengthens the justification for it to monitor sites. By being included in a global network, the opportunities for co-ordinated observations and scientific collaboration will be much improved and the network can become a better focus for coordinated, multidisciplinary measurements and programmes. Individual networks will learn from the experiences of other networks for science operation and data management. ILTER member networks enhance their contributions towards meeting the political and scientific objectives of the UN environmental conventions and the responsibility taken on by their respective countries. In most cases, the effectiveness of a network's operation will be enhanced if others use the collected data. Also, a network's programme will benefit by having structured access to data from other similar networks. The availability of comparative data from a wider range of sites will improve the interpretation of a particular site's data. The leverage provided by ILTER can be very helpful to endorse a network's fundraising efforts.
ILTER has over 30 country members and 7 regional members (Gosz *et al.* 2000; ILTER 2000). ILTER provides information, advice, and also facilitates co-ordination of global programmes. It specifically avoids being prescriptive, avoids the design and use of standard templates for fieldwork methods, but does encourage standardisation where possible. ILTER emphasises that projects be designed for local conditions in order to provide effective indicators. ILTER collaborates closely with other global networks such as GTOS,

IBOY, DIVERSITAS, and IGBP. Metadata management is a major thrust of ILTER (Michener & Brunt 2000), and it can help countries to develop this capacity.

4. Institutional and legal challenges of LTER

The main challenges facing LTER are of the organisational kind. There is a need to maintain local leadership with regards to foreign funded long-term environmental research programmes on the subcontinent. Potential contributions by foreign funded programmes are well appreciated but these programmes are sometimes insensitive towards local agendas, intellectual property rights and systems and put additional demands on the already limited capacities of developing countries.

Institutional and human capacity development are strong challenging factors for conducting LTER in developing countries, and it is a priority for each country LTER programme to promote this and to give recommendations for best practices in this regard. LTER can only have a future with good recruitment from within countries. Students, starting at school levels, should be trained to become practitioners and leaders to continue LTER into the future. Governments and the public should be made aware of the valuable contribution LTER is making to inform natural resource management policies and to facilitate the incremental accumulation of knowledge. The UN-CCD has yet to formally adopt long-term monitoring, as conducted by LTER, as one of its fundamental activities to meet its objectives concerning early warning and guiding the efforts to avoid or combat desertification. Indeed, the availability of knowledge from scientific research is too weakly connected to the application of such knowledge (Seely & Wöhl 2004).

Ongoing long-term monitoring is not regarded as a new approach, and can therefore become unfashionable for funding-agencies to maintain their long-term commitments of for new funding agencies to be attracted. Lack of funding is therefore one of the greatest challenges faced by many monitoring programmes world-wide. However, this greatly underrates the importance of LTER in being able to address the very problems that new, short-term, expensive and very visible programmes can often only unsuccessfully grapple with, namely detecting and measuring environmental change. The site-based focus and long-term continuity gives LTER empirical power required to validate predictive models. LTER institutions are partly at fault for not promoting this strongly enough, and many monitoring programmes were discontinued for lack of funding, albeit not lack of relevance. Data sharing is still in its infancy, and individual scientists or institutions often resort to keeping data to themselves, or not explaining them adequately. Some data are therefore never used, or at least not available for comparison. LTER cannot function without an adequate source of long-term data from previous data-gatherers. Along the same lines, data archives are often ignored by their host institutions or funding agencies as not being attractive enough to fund, or of immediate importance to ensure keeping. However, data archives should be major contributors of the very kind of information that new programmes again and again set out to gather anew without having access to previous data. By contrast, well managed data archives can become building blocks that can usefully serve exponential growth of knowledge. It has sometimes become unfashionable for programmes concerned largely with the human dimension, such as those relating to desertification, to have environmental data-based research other than demographic surveys as a cornerstone. A fundamental problem is that scientists traditionally do not communicate their findings to laymen at the grass-root level as well as top managers. Data and its interpretation have often become divorced from policy making. Fickle opinions on the state of the environment have therefore often dominated, and such opinions can shift with latest policies following

them. The latter situation has weakened the ability to manage natural resources sustainably. The relationship between the need to improve environmental policies and the ability for institutions to deliver data and appropriate interpretation needs to be restored. Many developing countries do not have national research councils or science and technology ministries mandated to fund or otherwise directly support research institutions. Even government research departments operate in conditions of serious financial shortages. Where fully-fledged councils do not exist, as in many developing countries, networks tend to be based on associations between institutions. Furthermore, there are often so few scientists in these countries that collaboration and innovation are inevitable in order to achieve the challenging goals set by the agenda. Government does support research, but this is largely by recognition and endorsement. Besides that, Government does play an important role in planning and outsourcing commitments resulting from the ratification of environmental Conventions, largely donor-funded. Such funding focuses on directly furthering sustainable development, underlining the importance of stressing the fundamental role of LTER in monitoring the effects of such support.

The great need to meet basic human requirements, especially food security, gives this top priority in developing countries and research needs to support this priority. This requirement for relevance and applicability does not diminish the need for research to be academically sound, based on sound data and scientific analyses. Dependence on natural resources in rural areas is not only a challenge for resource management, but also provides opportunities for resource users to participate directly in research, including recording data and assisting with its interpretation. Participation at the grass-roots level provides learning opportunities and can greatly facilitate the fulfilment of recommendations resulting from research endeavours (Seely & Moser 2004). Users of natural resources, including some of the poorest people, become directly involved in monitoring and interpretation processes. At the same time, top-level decision-makers need to be informed and become involved. The relatively small Government Departments and short hierarchies make this relatively easy for research institutions to achieve.

Currently human and institutional capacities in environmental research in developing countries are still relatively low compared to industrial nations. This must be overcome through proactive training programmes that focus on skills for local environmental researchers and environmental awareness for resource managers and decision-makers. While institutional capacity growth will require more concrete support from government and funding agencies, institutions will ultimately become more self-sufficient when more highly skilled research and training staff increase income-generating abilities of institutions through professional service provision and large projects.

5. Solutions undertaken

LTER centres require real prospects of continuity to be effective in providing long-term data with reflective and predictive capabilities. This requires security of tenure and commitment to keep monitoring programmes going and to keep them relevant. To ensure success of LTER, yesterday's and today's data and information should be available and understood in future. Skilled practitioners must be recruited to ensure the succession and growth of LTER. LTER requires several levels of networking to continue to be operational and adaptive. Lastly, improved prospects for funding research and training will be required for field stations to have a real chance to continue collecting, archiving, sharing, and interpreting data and disseminating information.

LTER banks on data. LTER centres require physical and technical facilities and expertise to give data a future. Good data management mechanisms need to ensure the availability and correct interpretation of data beyond the professional life-span of individual LTER practitioners. For data to be useful for analyses and interpretation, the location and method of collection must be known and the data must be accessible, as documented in metadata. LTER centres should archive original field data books and manage electronic data and metadata. LTER sites elsewhere in the world have extensive experience and software for these functions (Michener & Brunt 2000), which can either be adopted or guide local adaptation. Mechanisms must be in place to facilitate access and understanding by persons and projects other than those collecting data, so that data can serve several purposes by different users now and in future (e.g., comparison over space and time). Data sharing policies must be in place to guide access by multiple users.

Technical and professional staff is required to operate LTER centres. Although there are some LTER centres in developing countries, several require further personnel development to reach the capacity to become fully-fledged LTER centres, typically comprising a director, resident researcher(s) and students, data manager, field and data assistants, and educators. A regional pool of future practitioners needs to be developed on an ongoing basis. Training courses and programmes of in-service training should be developed and held at formal training institutions (universities, colleges) and at existing LTER centres, and can involve experienced foreign practitioners (e.g., through ILTER). Various training initiatives in the region should develop partnerships and co-ordinate with each other. Training should focus on field techniques, data management, analyses and interpretation, and application, using a multi-sectoral approach by combining socio-economic and bio-geophysical aspects. This training should be directed at post-graduate students as well as upgrading LTER centre staff. Multidisciplinary courses would further the broad experience required. Principal investigators will in future continue to be recruited from masters or doctoral graduates, some of whom may have done their thesis work at LTER centres as part of programmes co-ordinated expressly for that purpose. The success of LTER programmes should help to provide job opportunities and to attract good students, but recruitment can also be improved through bursaries, and good publicity through environmental education and the professional advantages of gaining multi-disciplinary experience through LTER.

The basic building blocks of LTER are LTER centres, local networks of sites, researchers and IT technology. However, centres are most strongly dependent on funding for actual activities and cannot on their own secure the pathways for obtaining funds; networks at country and regional levels are required to achieve this and to guide the overall direction. Country networks define the characteristic of LTER in their country and they have a powerful influence on the ability of LTER centres to operate in the long-term. Members can affect the character of country networks, but the regional and global networks can also affect the country character. As countries, rather than institutions, are the smallest units for LTER to operate, this is the first node that needs to be considered. For small countries, it may not be affordable to have separate LTER country offices, and it would be more cost-effective to conduct these functions through LTER centres. Regional networks would ultimately benefit from a regional office, either residing at an LTER centre or country office. However, LTER practitioners must remain key players in the development of regional LTER for it to be effective. In other words, funders should first be guided through the bottom-up discussions in order to strengthen LTER in the region, although some funding for regional networking will also be required.

Based on actual experience, to operate the programmes of a basic LTER centre in developing countries requires in the order of US$150,000 per annum. This funding is for small programmes with a hand-full of staff, field transport, equipment maintenance, data management, and communication for the LTER programme, and does not cover major new acquisitions for establishing LTER programmes nor for establishing and maintaining infrastructure of the field station itself (which requires many times this amount). Satellite sites operate with less funding, but these sites do also incur additional managerial costs to their parent institutions (funding at such sites depends on many factors, but US$30,000 would be a reasonable estimate). Funding is also required for country networking activities, which includes communication, transport, and attendance or convening of meetings. Given the chronic shortage of funding for research in developing countries, funding can in some cases come through training programmes linked to LTER. Also, much of the funding needs to come from international sources. Active collaboration with foreign scientists can help to sustain LTER projects. Furthermore, it should be possible to obtain donor funding based on the important function LTER has for improving the global knowledge base, the critical ability to evaluate and predict factors affecting sustainable development.

6. Users of LTER

LTER and its related programmes (including ILTER and the Global Terrestrial Observation System, GTOS) are crucial for nations and the international community to meet the goals of the United Nations Agenda 21. LTER represents a network of programmes and field stations that monitor environments and can provide data on baseline conditions, changes/trends, or lack of changes. This provides input of time-series data and reflection on the conditions in which the Conventions operate, including their successes and failures. Such monitoring is therefore an important element in the implementation of the UN Convention to Combat Desertification (CCD) as well the UN Convention of Biological Diversity (CBD), the UN Frame Convention for Climate Change (FCCC), the Ramsar Convention on Wetlands, Convention on International Trade of Endangered Species (CITES), and numerous global programmes, such as the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP) and DIVERSITAS. Another major kind of user of long-term large-scale data are scientists, who use the data to understand the environment, natural resources, and people, and how they interrelate. Although scientists are a user-group in their own right, they, together with local people are the ones to provide the interpretation required by policy-makers and natural resource managers.

7. Application of LTER for decision making

LTER promotes the development by countries of the interest, understanding and political will to incorporate the environment into informed development planning. LTER focuses on parameters that are good indicators of the state of the environment. This knowledge is fundamental for appropriate responses when combating desertification. Are efforts to improve soil, land-cover, water, atmosphere, or basic living conditions of people and biota working or not? At which scale? How can we make predictions? What chronic changes may affect people and the environment in the future and how can one obtain early warning? Most reliable answers can be gained by examining well-documented lessons extending over time, space and ecosystems, lessons learnt from quantitative data obtained through monitoring and synergy among compatible institutions and data archives. LTER is able to

provide this. Fresh water is arguably the most important of all terrestrial resources, and its sources, pathways, requirements, uses, abuses and conservation need to be monitored and studied intensively, as it is fundamental to human and ecosystem health. Current land transformation and land-use changes provide important opportunities to capture and understand its environmental implications. Climate change will affect both water and land conditions. It is therefore important to continuously monitor climate, as, indeed, all LTER sites do. Wide-spread realisation of Global Climate Change was only brought about by actual current field data that demonstrated its occurrence; as important as palaeo-climatic data was for confirming this conclusion, primary data obtained from LTER programmes world-wide were important to detect the change and to validate the many different models that have been applied. The fundamental decision whether degradation has natural or anthropogenic causes (Mainguet 1991, 1999) can only be based on analysable, comparable long-term observations. Decision-making processes concerning natural resources and viability of land to continue to support people's needs are strengthened through long-term spatial data that provide improved information that support predictive models and policy-makers. It is imperative for costly intervention or mitigation measures to implement monitoring that generates data to indicate whether or not these measures are helping.

Rural people in developing countries depend on natural resources, and many of these people are poor and in dire need of improved livelihood security. These people are subject to the vagaries of an already harsh environment and the shortage of resources and education that they have to cope with render then even more vulnerable in the face of potential extreme events caused by climate change. Socio-economic-ecological research is required to address this – indeed, participatory monitoring and research with poor rural communities, coupled with awareness and information exchange, are a good way of promoting sustainable development (MacDevette 1994; Seely & Moser 2004). LTER captures the main factors involved in natural resource management, provides objective data on changes, increases the ability to learn from the past and improves prediction of environmental developments. This should benefit the livelihoods of rural communities through education and improved environmental quality resulting from mitigation or preparation for chronic change.

LTER is therefore not only an important tool for scientists to understand long-term large-scale processes, but also for decision-makers to make better decisions.

8. Lessons learnt

LTER endeavours to improve the understanding of the environment and simultaneously improve the application of this knowledge for sustainable development, making best use of two powerful scientific approaches – basic and applied research. This greatly promotes informed policy-making and wise environmental management.

Lessons learnt include:

- Desertification is a long-term process (change of state) and long-term research is required to address it.
- LTER serves as an early warning system, and can help distinguish between actual (permanent) vs. apparent (temporary) land degradation and between natural and anthropogenic causes. LTER needs to be maintained in threatened areas so as to provide information on approaching thresholds. Baseline data and knowledge of natural processes for comparison are required from non-threatened areas.

- LTER can deliver sound knowledge because it is cooperative, multi-disciplinary and covers large spatial and long time scales. One of its core functions is maintaining access to past data for comparison. LTER is therefore one of the best ways of understanding environmental pressures and thresholds of environmental factors that can lead to desertification. This knowledge can be effectively used to guide problem-solving.
- LTER is required to determine whether efforts to combat desertification by prevention and restoration are effective.
- LTER requires commitment by many individuals, many institutions and funding agencies over long periods of time. This commitment is easily overlooked when faced with the need for crisis management of immediate problems. The commitment required to monitor is minor in comparison to the risks and costs of not monitoring.
- Human and institutional capacity for LTER is inadequate world-wide and especially in developing countries where it is most urgently required to address potential problems of desertification. Proactive training programmes in environmental problem solving and technical skills of field monitoring and data management are essential to overcome this. Furthermore, institutions need to be further developed to be able to employ trained people and effectively implement LTER.
- LTER also needs to involve people at the grass-root level, those that would be directly affected by desertification. It also needs to involve policy-makers at local to global levels. However, currently LTER is mainly well-established among scientists. This gap needs to be bridged.

Acknowledgements
This paper has benefited from a process that helped establish ELTOSA, and the current article has been adopted from reports that resulted from this (Henschel & Pauw 2003; Henschel *et al.* 2004). This process was facilitated with funding from ILTER, National Science Foundation (NSF of USA), the National Research Foundation (NRF of South Africa), and the Gesellschaft für Technische Zusammenarbeit (GTZ of Germany via the Namibian National Biodiversity Programme). We obtained much information and inspiration from colleagues, in particular Jim Gosz, Bill Michener, Bob Waide and Steve Hamburg (US-LTER), Henry Gholz (NSF), Hen-Biau King and Holly Kaufmann (ILTER) and Johan Pauw (SAEON). Many other colleagues from Namibia, Southern Africa and LTER programmes world-wide have contributed to the development of the concepts outlined here.

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TABLES

Climate Episodic events	precipitation, temperature, humidity, wind, solar radiation, ocean currents high rainfall, long drought, high flood, heavy storm, deep frost, extensive hot fire, landslide, volcanic eruption, algal bloom/red tide, tornado/cyclone, political strife, pandemic, economic depression/boom, disastrous pollution
Primary productivity	Nett Primary Productivity (NPP), Leaf Area Index, forest biomass, NDVI, phytoplankton
Natural resource use	water abstraction, grazing, type and intensity of land use, water, firewood and timber, yield of harvest of marine and terrestrial plants and animals
State of Environment Indices	consumption, emissions, waste production, income from particular natural resources, poverty index, welfare, health, education levels, marketing of natural products, employment rate, bio-indicators
Human demography	density over time and space, age structure, life expectancy, birth rate, emigration and immigration, economic and educational status
Application of appropriate technology	solar energy, conservation farming techniques, genetically modified crops, clean production technologies
Ground truthing	for remote sensing, e.g., NDVI, biomass, precipitation
Long-term population dynamics	local & spatial changes in abundance and demography of wild and domestic plants and animals
Growth	juvenile development rates, lifetime growth of individuals
Phenology	seasonality, development patterns, reproductive output
Biodiversity	species richness, alpha & beta diversity, biogeography, status of threatened species
Community composition	ecosystem changes, alien invaders, bush encroachment
Decomposition	rate of consumption of standard substrates, amount of detritus & dead wood
Weathering	erosion, corrosion, sediment mobility
Water levels	runoff volume, dam level, groundwater depth, water quality
Greenhouse and ozone-depleting gases	background level, local volume
Carbon stocks (gains and losses)	standing crop, combustion of fossil fuel, fire prevalence
Soil nutrients	organic carbon, nitrogen & phosphorous, light fraction
Implementation of environmental policies	environmental impact assessments, water management, pollution and waste, invasive alien control

Table 1: Typical kinds of parameters measured at LTER sites

Aspect / Scale	**Site or Centre**	**Country**	**Region**	**Global**
Network	LTER centre at study sites	several cooperating institutions in a country	Asia & Pacific, Central Europe, Middle East, North America, South America, Southern Africa, Western Europe	ILTER
Operated by	local resident institutions	national committee with lead institution	regional committee	ILTER members & coordinating committee
Networking	among researchers and trainers	among centres and country collaborators	between countries & regional collaborators	between countries and regions
Most important functions	monitor and conduct field research, collect & archive data, provide data & information, conduct training & outreach	facilitate continuity & operation of centres, define & review common goals, co-ordinate site activities, data sharing, policy relevance	facilitate country networks, define common vision, co-ordination of country activities, maximise regional complement of sites, researcher exchanges, ILTER relations	international collaborative programmes, guide and facilitate country and regional networks, international profiling
Fieldwork	conduct research & training, interpret, publish	enhance standardisation & quality verification, cross-centre activities	enhance standardisation, facilitate training, transboundary activities	enhance standardisation, facilitate training, global programmes
Data management	data archive, centre metadata	country metadata connecting centre metadata	information via common ICT connection	guide data management
Data sharing policy	centre-specific, guided by country policy	country-specific to guide centres	guide countries	guide countries & regions
Researchers	core of local resident researchers, foreign collaborators,	training of young scientists from country, collaboration among national	training of young scientists from region, regional & international	international collaboration

	training of young scientists	& foreign researchers	collaboration	
Training	fieldwork and data management, of researchers & technicians	promote training at centres & identify appropriate candidates, facilitate availability of future practitioners	conduct training in data management, exchange students between countries	facilitate regional training programmes, particularly in data management
Funding required for	core monitoring, data management, research projects, training, information dissemination	communications, metadata, information dissemination	communications, workshops, information dissemination	communication, conferences, AGM
Current principal funders	international collaboration, fund-raising not through research, government & industry	Donor and government-funded networks	ILTER, South African government	ILTER
Planning for future potential funders	donors, local programme funds (national science foundations)	national science foundations, National EON offices	regional programmes via SADC, ILTER	ILTER
Institutional capacity building	strategy for future human capacity & organisational development	identify & promote institutions, guide provision of national support, national training workshops	synergy between institutions in the region, researcher exchanges	international collaboration that promotes institutional capacity, visiting researchers

Table 2: Four scales of LTER

- locally responsible environmental research institution that co-ordinates research and training at study sites under its jurisdiction
- scope of long-term tenure of site (decades to centuries)
- member of national LTER network
- overall goals, and research and monitoring projects serving these goals
- a core set of monitoring activities with commitment to continue these
- updated detailed documentation of all field and data procedures
- management of shareable data archives and metadata housed within the local institution based on documented data policy and procedures
- long time horizon of monitoring and research goals/outputs based at specific study sites
- a legacy of data and data-derived products at the centre, with good growth potential
- strategy and scope for long-term funding security
- training strategies and activities for capacity building, primarily targeting national and regional future professionals and secondarily globally
- strategy and activities towards ongoing institutional capacity building
- national and international collaboration
- appropriate information exchange with scientists and students, policy-makers and local communities

Table 3: LTER Centre Characteristics

ECOLOGICAL NETWORKING IN SOUTHERN AFRICA: THE ELTOSA EXPERIENCE

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Abstract
The multi-country ELTOSA network hinges on the common observation that ecosystems and environmental issues permeate political boundaries. Within ELTOSA, countries are joining efforts to increase the effectiveness of environmental research and information, particularly of processes that cannot be understood with short-term small-scale ecological research, e.g. climate change, land degradation and desertification. Knowledge of long-term processes and episodic events is gathered through site-based long-term monitoring and large-scale processes can be elucidated by comparing data from distributed sites. This knowledge and its dissemination will strengthen national environmental policies. The information and understanding obtained through ELTOSA will support regional environmental and natural resource management and thereby stabilise and enhance sustainable development in southern Africa. Effective environmental policies resulting in productive environments will in turn strengthen the economy of the southern African region. ELTOSA has been making substantial progress in the context of regional economic depression. It must continue to work for human capacity building and establish continuity and coordinating capacity for it to deliver on its promises.

Keywords: long-term monitoring, environmental policy, capacity building, information management.

1. Introduction
The emerging Environmental Long-Term Observatories of Southern Africa (ELTOSA) is a facilitating regional forum for the national Environmental Observation Networks (EON) in southern Africa was established in 2001 to create synergy among them and to create sufficient critical mass in terms of intellectual and infrastructural capacity. ELTOSA's vision is one where knowledge and understanding of important regional long-term large-scale environmental processes (e.g. desertification, climate change) and episodic events (e.g. droughts, floods) are providing adequate information for appropriate environmental legislation and policy frameworks needed to maintain productive ecosystems and underpin sustainable development on the Sub-continent.
Ecosystems and environmental issues are not constrained by political boundaries. Within ELTOSA, countries are joining forces to increase the effectiveness of regional ecological research and information, particularly of processes that cannot be understood with short-term small-scale ecological research. Knowledge of long-term processes and episodic events is gathered through monitoring of critical indicators at EON sites (Environmental Observatory Network) and large-scale processes can be elucidated by comparing data from different regional EON sites. This knowledge and its dissemination may contribute to the strengthening of national environmental policies and decision making for sustainable

development (Seely, Henschel and Zeidler, 2004). Such policies will be informed by pervasive environmental issues in the region.

The information and understanding obtained through ELTOSA will support regional natural resource management and contribute to the battle against land degradation and desertification. Socio-economically it will serve to stabilise and enhance livelihood opportunities in Southern Africa. Effective environmental policies resulting in productive environments will in turn strengthen the economy of the southern African region and will help to achieve stability and security.

Southern Africa has been revealed by the 3rd Assessment Report of the IPCC to be vulnerable to the impacts of climate change. Climate change is a global environmental force and its impacts cannot easily be discerned from those of local forces such as land degradation. More importantly, when and where these forces manifest together, land degradation and climate change will have the potential to accelerate the pace of desertification in the sub-region and to exponentially increase the impacts of episodic events. To manage complex and dynamic environments with many interacting factors that vary at different scales it is necessary to have mechanisms for effective detection and prediction of environmental change. The Environmental Long-Term Observatories of Southern Africa (ELTOSA) was established as a scientific forum to fulfil this function by facilitating the understanding of long-term (decades to centuries) and large-scale (ecosystem, biome, continental, global) environmental processes. It involves the identification of appropriate indicators, documentation, analysis and information dissemination concerning long-term large-scale (ecosystem, biome, continental, global) ecological and socio-economic processes. These are elucidated through comparative multi-disciplinary research and monitoring over a network of institutionally operated field observation sites.

Southern Africa has particular conditions of water, land and atmosphere that require monitoring to detect patterns of change and to contribute to the knowledge base of ecosystem understanding. Land degradation ultimately occurs within the key natural resources of water, soil and vegetation (Hoffman, *et al.*, 1999). Pressures on available resources in Botswana, particularly during drought periods, impede the regenerative capacity of the natural vegetation cover (Ringrose, *et al.*, 1996). The Limpopo River flood of 2000 ravaged mangrove forests and coastal thickets in Mozambique resulting in large-scale mortality, as well as up to 1m of sand deposition (Sitoe, et al., 2000). In Malawi, poor vegetation cover and high rainfall kinetic energy causing soil loss and sedimentation are driven by increasing deforestation and conversion of agricultural land to homestead development, in the catchments of Lake Chilwa. These physico-chemical and hydrological changes affect the migratory and reproductive behaviour of migratory, ecologically and economically important fish species in the lake (Jamu, Chimphamba and Brummett, 2003).

Climate change coupled with land degradation would thus affect both water and land conditions. It is therefore important to continuously monitor climate in relation to observed environmental changes. Fresh water is critically important to society and environment alike and its sources, pathways, requirements, uses, abuses and conservation need to be monitored and studied intensively, as it is key to understanding the respective roles of climate change and human-driven local changes. Current land transformation and land-use changes should be studied to capture and understand the environmental context in which climate change is occurring. Additionally, aerosol emissions from biomass burning and industrial activities, and its transport via the atmosphere, are also impacted by climate

change (Swap, *et al.* 2005) and hence land-atmosphere exchanges must be included in monitoring programmes. Studies should develop and test monitoring variables and techniques particularly suitable to African conditions, with a view to establishing low-tech cost-effective methods.

Rural people in Southern Africa largely depend on biological resources, and many of these people are living in poverty and in dire need of improved livelihood security. These communities are subject to the vagaries of an already harsh environment and the shortage of resources and education that they have to cope with render them even more vulnerable in the face of potential extreme events caused by climate change and exacerbated by land degradation. In many instances solutions are required for politically sensitive trans-boundary issues, e.g. water management in the Limpopo, Orange, Kunene, Zambezi and Okavango systems; elephant metapopulation distribution, dynamics and management; ecology and control of alien invasive species; sustainable agro-ecological systems; and ecological and social impacts of climate change. Socio-economic-ecological research is required to address this – indeed, participatory monitoring and research with poor rural communities, coupled with awareness and information exchange, are a good way of promoting sustainable development.

ELTOSA's approach is to identify and monitor the main indicators involved in natural resource management, to provide objective data on changes, to increase the ability to learn from the past and to improve prediction of environmental developments.

2. Organisational Design and Challenges

ELTOSA follows the core design of the International Long-Term Ecological Research (ILTER) network. Membership is at the country level and requires endorsement by the national government and at least a conceptual framework for the establishment of environmental observatories or field research sites. The chair rotates every second year and a forum meeting is held annually. ELTOSA depends on grant funding for its rotating forum meetings but other inputs are either voluntarily or as a result of opportunistic advantage being taken of meetings organised by others.

ELTOSA adopted a constitution and draft strategic plan (Anon 2005) at its third meeting held in 2005. These documents evolved from a Position Paper published in 2003 (Henschel, et al. 2003). As put forward in its vision statement ELTOSA desires to make a major contribution to the *improvement of knowledge and understanding of important long-term large-scale environmental processes and episodic events*. It will achieve this by being a regional forum for the national Environmental Observation Networks (EON) in southern Africa, by facilitating interaction among them and by increasing their capacity to further sustainable development in the region.

Capacity development is a cornerstone of the ELTOSA draft strategic plan. This is to ensure sufficient technical and professional staff to conduct environmental observations. A regional pool of future technologists and researchers needs to be developed on an ongoing basis by presenting training courses focusing on field techniques, data management, analyses and interpretation to describe the forcing of long-term large-scale processes by climate change. Furthermore, training will also focus on the appropriate application and interpretation of research findings for policy-makers. This training will serve as orientation for masters and PhD projects that will focus on specific observation indicators and requirements concerning long-term large-scale environmental processes. It is the aim to eventually recruit future principal investigators and technologists for EON programmes

from these trainees. ELTOSA continues to struggle to maintain its cohesion and momentum as it is still largely driven by the voluntary efforts of a few individuals supported by *ad hoc* sponsorships from a variety of sponsors. This is evident from its failure to hold its annual meeting in 2004 and to have adequate representation at the 2005 ILTER annual meeting. The threats to its survival stem from uncertain funding sources despite government support, deficient infrastructure, bureaucratic government systems, limited capacity and haphazard network coordination, mostly as a result of economic depression, and in some areas due to political strife. ELTOSA requires annual general meetings, project planning meetings and a coordinating office, if it is to gain momentum. But for South Africa, members have not yet been able to adequately fund the running of their own networks or representation at ELTOSA meetings. In order to advance network functionality and coordination it requires core operational resources for the organisation of an annual forum, regular planning meetings and the stimulation of national networks.
The deliverables will be functioning national networks, regional research and training projects, a growing pool of regional ecologists and shared ecological observational infrastructure that will deliver reliable long-term ecological datasets for the region.

3. Objectives and Strategies

It has been recorded in the ELTOSA's strategic plan that in the longer term the aim is to facilitate:

- the establishment of country EONs and connectivity between them
- the coordination and promotion of comparative and joint research among EONs
- the security of long-term research sites and datasets
- the sharing, accessibility and dissemination of data and information
- the development of common methods and data management protocols
- the sharing of infrastructure and technical expertise
- capacity building, through training and education
- innovation and the application of new knowledge
- the improvement of long-term career prospects for African environmental scientists

A primary strategy of ELTOSA is that the membership is national, not individual. Although this initially slows down the growth of the network is has the advantage that government recognition endorses the relevance of the network and, once established, facilitates continuity and resilience. Membership of ELTOSA ultimately requires endorsement by ILTER and this provides the member with immediate access to an international body of expertise and data.
ELTOSA already comprises four ILTER accredited national networks and has a substantial list of correspondents in other countries. A number of other countries have either been represented at an ELTOSA meeting or responded with interest to meeting invitations.
A strong relationship will be developed with the ICSU regional office for Africa that was recently established at the National Research Foundation in South Africa. The Africa office has identified among others two relevant priority research areas, namely: Natural and Human-Induced Environmental Hazards and Disasters, and Global Change. This association will widen ELTOSA's networking reach by linking it to numerous relevant global research programmes. Networks - local, national, regional, and global - are rewarding interest-bearing investments, as they promote coordination of resources and infrastructure, greatly facilitate synergy, and maximize the legacy of data (Henschel, *et al.,*

2003). Success with ELTOSA will result in greater competitiveness of the southern African environment and ecological science. This longer term strategy is to provide direct benefits for the sustainable economic and political development of SADC countries.
Being a network connected to, but not competing with, historical and ongoing scientific initiatives in the sub-region, ELTOSA also recognises the strategic importance of gaining from the strengths and experience of those initiatives, including its own members, to name a few:

- HOORC Headstreams project – experience in cross-country research coordination
- Kalahari Transect of the Global Terrestrial Observation System - science planning and cross-country research management
- BIOTA South - site management, biodiversity measurements, multi-institutional programme management
- SAFARI 2000 – cross-country research management, data management and policy
- SAEON - internet-based data management
- ILTER - regional and national networking, information and site management, LTER approaches and experimental research
- GOBABEB Research and Training Institute - training courses, fund raising
- SAfMA - regional environmental issues and assessments
- TIGER – data management and regional collaboration

4. Current Status of ELTOSA

Individual ELTOSA member countries and participants are independently conducting site-based multiple scale monitoring programmes in most of the major ecosystems in Southern Africa. In order to facilitate the convergence of these ongoing and potential future programmes, the initial focus of ELTOSA was on its definition and organisation. Reasonable conceptual progress has been made and ELTOSA has been constituted over a 5-year period. Thus far ELTOSA has managed:

- to publish a position paper in the South African Journal of Science (Henschel, *et al,* 2003) and a chapter in a book (Henschel and Pauw, 2002).
- to expand its membership to four and with two more applications pending,
- to produce a Constitution and a Strategic Plan,
- to publish a website,
- to hold 3 Annual General Meetings in three different countries, made possible by funding from the NSF (USA), BMBF (Germany), and the South African, Mozambican and Malawian governments
- to achieve the status of a regional network in ILTER,
- to be represented on the steering committee of the Global Environmental Change network of ICSU.

Namibia, Mozambique, South Africa and Zambia are full members of ELTOSA. Malawi and Botswana has already gone some way to establish national networks. Most other Southern African countries have either attended ELTOSA meetings or they have corresponded with ELTOSA.
Namibia – Its national network is operational and active in both ELTOSA and ILTER, at the time of writing it was preparing to host the 2006 ILTER and ELTOSA meetings. The core driver of the network is the Gobabeb Training and Research Centre, which was established in 1962. Research and monitoring programmes have been conducted by the

centre resulting in over 1600 institutional publications (Henschel, et al. 2000). In 1998 the Centre was designated as Centre of Excellence of SADC (Southern African Development Community) in terms of research, capacity building and networking concerning climate change, desertification, and biodiversity. The Namibian Government nominated Gobabeb lead institution in the establishment of the Namibian Environmental Observation Network (NaEON) in 1999 and new infrastructure to handle research and training at the sub-regional levels was constructed (Anon 2004). NaEON has held five meetings thus far, established its lead site at Gobabeb, is a founding member of ELTOSA, and chaired ELTOSA from 2001-2005. A data sharing facility is being established for NaEON. Students trained at Gobabeb come from international universities, resulting in 80 MSc and PhD theses. It has excellent lecturing and accommodation facilities that incorporate renewable energy and energy efficient systems in its design. Gobabeb is however struggling financially, having come to the end of the funding cycle of its biggest sponsor, the GTZ of Germany, and not yet receiving any government funding.

Mozambique – Its network has been established as RIEAM (Rede de Investigacao Ecologica e Ambiental de Mocambique) after obtaining endorsement by the Ministry of Education, Science & Technology and receiving donor funding via the government. Even before the establishment of RIEAM, Mozambique hosted the first ELTOSA conference and information management training workshop in 2002. Inhaca Island was its first research site and further sites are being considered, e.g. at Chokwe (agricultural site in the Limpopo Basin), Gorongosa National Park and Chimanimani (Niassa/Nampula Miombo forest). Mozambique was elected ELTOSA's vice-chair for 2006 and 2007.

Zambia – Its network is very vulnerable and not funded at present but was recently reconnected with the Zambian government through ELTOSA's intervention. The network seeks to build on partnerships that was established through SAFARI 2000, and from which it inherited a flux tower located in the Mongu Forest, which is considered as a potential network site. A further site is considered for the Kafue wetlands.

South Africa - A Long-term Data Series Conference held in South Africa in 1987 under the auspices of the Foundation for Research Development and the International Geosphere Biosphere Programme resulted in the first call for a comprehensive national environmental monitoring scheme (MacDonald & Crawford, 1988). Due to major changes in the South African research and education system this call was not heeded until an ILTER representative visited South Africa in 1996 to introduce the concept of an LTER network with a view to develop a network in an African country (Pauw, 1996). In 1998, representatives of organised scientific societies concerned with the environment unanimously endorsed the concept of an equivalent but improved South African LTER programme. An open national workshop held in 1999 endorsed the need for the establishment of a long-term environmental research capacity and infrastructure and accordingly mandated an organising committee to proceed with developing such a programme in a system of imbedded observatories (Van Jaarsveld & Biggs, 2000).

A concept proposal for the establishment of SAEON was endorsed by the relevant South African government departments in 2001. Since 2002 the initiative has been managed by the National Research Foundation with funding from the Department of Science &

Technology. SAEON partner institutions consist of all the relevant universities, science councils, environmental agencies and government departments, as well as the mining and energy business sector. SAEON is establishing a national data management system to deliver information for researchers and policy makers. SAEON's main scientific themes are water, substrate and sedimentation, nutrient cycling, biodiversity, disturbance regimes and climate change. SAEON is the only ELTOSA member with a dedicated National Office that coordinates and implements its further development. The National Office is advised by several committees composed of partner organisations representatives. It operates on three pillars of work, namely observation, information and education. SAEON is furthermore a business unit of the South African National Research Foundation, a statutory science management agency of government, with sound financial management and granting making systems. SAEON is growing exponentially and established two sites with four more pending. A second national conference was held in early 2006 which resulted in broad based support for the initiative from within the science and government domains. SAEON is the current chair of ELTOSA and active in ILTER.

Botswana – Having held three preparatory meetings it has formed a provisional network called BENRON (Botswana Environmental and Natural Resources Observatories Network). Government endorsement is being sought but was still pending at the time of writing. The Okavango Delta has been very well developed, inclusive of a flux tower, over many years by the Harry Oppenheimer Okavango Research Centre (HOORC) of the University of Botswana, from where the headwaters project of SIMDAS is being lead. Further sites are considered in the Central Kalahari and Limpopo Basin. Botswana hosted the second ELTOSA conference in 2003.

Malawi - Several meetings were recently held with a view to establishing MEON (Malawi Environmental Observatories Network). The emerging network launched a steering committee that has obtained funding from the National Research Council of Malawi and hosted the third ELTOSA conference in 2005. MEON's lead institution is the University of Malawi. At the time of writing it was preparing to apply for ILTER membership and considering potential sites at Lake Malawi, Lake Chilwa and Mount Mulanje.

Other countries - ELTOSA has had varying success in reaching out to several other countries and they are listed here in alphabetical order: Angola, Democratic Republic of Congo, Kenya, Lesotho, Madagascar, Seychelles, Tanzania and Zimbabwe. Most of these countries had representatives attending one or more of the ELTOSA meetings.

5. Current Status of Information Management

The USLTER organised a first information management training course for ELTOSA in Mozambique in 2003. One delegate from SAEON has since established a permanent collaboration with the National Centre for Ecological Analysis and Synthesis (NCEAS) in the USA and has become the leading Information Management practitioner in the environmental science environment in Southern Africa. SAEON subsequently organised two national Information Management workshops in 2005 and 2006 respectively, whereas NCEAS presented a training course on metadata open source software, also in 2006. A SAEON representative participated in a further two international workshops under the auspices of ILTER in 2005.

In the interim, a head start was made by SAEON with establishing both an online database of longitudinal metadata and a geo-spatial internet portal with analytical capability. The portal will establish interoperability among distributed data holdings and has unique built-in technology allowing the system to partially overcome local bandwidth limitations. This development has the potential to partially serve the information management needs of ELTOSA members. However, specialist data managers remain to be generally scarce and seldom dedicated to specific ELTOSA sites.

6. Capacity Building

The recent Gleneagles Plan of Action calls for improving capacity in the scientific and educational arenas, particularly in relation to Africa and climate change, and improving access to scientific information, managing the impacts of climate change, promoting research through networks, and ensuring environmental sustainability. ELTOSA has started the planning of and fund raising for a series of training courses to be presented at Gobabeb, a desert location that has implemented renewable energy and energy efficiency standards in its operations. The multi-disciplinary training programme sets out to increase regional ecological research and monitoring skills and experience. Training will focus on field techniques, data management, analyses and interpretation, and observations on long-term large-scale processes. This training should also serve as orientation for MSc, PhD and post-doctoral projects that will focus on specific elements concerning long-term large-scale environmental processes. The following modules are on the agenda:

EON Field Technicians: A-Z of field data, climate, nett primary productivity, plant growth, tree and shrub phenology, animal abundance, population structure, community composition, biodiversity indices, water availability, soil condition, geomorphological processes, atmospheric composition, experiments, planning new data sets, instruments and their care.

EON Data Management: data book management, data computerisation, metadata management, quality assessment and control, electronic data archiving, data sharing policy, internet publication management, managing computer hardware and software upgrades.

Environmental Indicators: what to indicate, choosing good indicators, monitoring over time and space, determining thresholds, detecting change of state, spatial data analyses, trend detection over time, data display, publications, information dissemination.

Education is a lifelong benefit, not only to the individual but also to society at large. The planned training programme will produce new environmental scientists with a thorough understanding of the impacts of climate change and land degradation and the monitoring thereof. It is expected that most of these students would already be employed by relevant organisations and departments in the participating countries and that they will transfer these skills back into their own work environments.

7. Conclusions

ELTOSA has the potential and is well-designed to become the major provider of observational data in support of the objectives of international conventions (e.g. UNCCD, UNFCCC, and CBD) and State of Environment Reporting. Due to serious constraints it remains an uphill battle to bring ELTOSA to fruition. Certainly, the availability of funding is one of the constraints but capacity limitations will persist for long despite any amount of money thrown at it.

Training is a form of capacity development and so also is the sharing of experiences, ideas, information and projects that result from having regular network-wide meetings. Capacity development must be based on local expertise and models, if it is to gain the political buy-in to be supported. At the same time ELTOSA has significant international links through among others the International Long-Term Ecological Research (ILTER) network which will hold its annual meeting in Namibia, in 2006, and previously held its first meeting on African soil in 1999, in South Africa. These international linkages must be used to strengthen ELTOSA in the same way that ELTOSA aims to strengthen its country members. Additionally, ELTOSA should continue to find a home within the ICSU-fold by collaborating with its regional office in Pretoria.

ELTOSA is based on a long-term approach to ecological research. The science itself is therefore inherently long-lived. The organisation is that of a regional network with national network membership and it is therefore resilient and not dependent on the urges of a single country, organisation or researcher. Full membership is furthermore dependent on accreditation by the respective national government. Establishing membership can therefore be a tedious process but with long-lasting effect.

Joint planning for and implementation of research and capacity building must become the main feature of the next phase of ELTOSA's development. This will require regular network communications as well as annual planning meetings of ELTOSA participants, including researchers, supervisors, students, and course lecturers. Since lack of continuity has been identified as the critical shortcoming that prevents ELTOSA from delivering on its promise of growing regional ecological capacity, it would be crucial to pursue the establishment a coordinating infrastructure. It is clear that because of the economics and government priorities in the region, ELTOSA will continue to be dependent on core donor funding for a very long time. However, with the benefit of a core grant ELTOSA should be in an advantageous position (continuity, administrative capacity and credibility) to leverage more support from different sources.

List of Acronyms

BENRON	Botswana Environmental and Natural Resources Observatories Network
BIOTA	South – Biodiversity Monitoring Transect Analysis in southern Africa
BMBF	German Federal Ministry of Education and Research
CBD	Convention on Biological Diversity
ELTOSA	Environmental Long-Term Observatories of Southern Africa
EON	Environmental Observatories Network
GTZ	Gesellschaft für Technische Zusammenarbeit
HOORC	Harry Oppenheimer Okavango Research Centre
ICSU	International Council for Science

ILTER	International Long-Term Research network
IPCC	Intergovernmental Panel on Climate Change
MEON	Malawi Environmental Observatories Network
NaEON	Namibian Environmental Observatories Network
NCEAS	National Centre for Ecological Analysis and Synthesis
NRF	National Research Foundation
NSF	National Science Foundation
RIAEM	Rede de Investigacao Ecologica e Ambiental de Mocambique
TIGER	Earth Observation for Integrated Water Resource Management in Africa Initiative
SADC	Southern African Development COmmunity
SAEON	South African Environmental Observation Network
SAFARI 2000	Southern African Regional Science Initiative
SAfMA	Southern African Millennium Ecosystem Assessment
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
USLTER	United States Long-Term Ecological Research Network

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AN ICS FOR DESERTIFICATION MONITORING IN AFRICA CIRCUM-SAHARIAN ZONE : FOCUS ON ONE OF ITS COMPONENTS, THE SIEL-ROSELT

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Abstract
Under the context of UNCCD, using its regional network of local observatories the ROSELT/OSS program aims to contribute to the assessment of the environmental changes in order to understand and predict the desertification process, through the installation of an enduring device of environmental monitoring, useful for the decision-making process. For this challenge, the french research institute for the development and the network established, decided to develop and implemente a common Information Circulation System, based on regular exchanges between its members, on a scientific consensus gradually and increasingly adapted. The ROSELT ICS is organised around technical, scientific and institutional tools in the circum-saharian area. It is structured in three interlocked levels: local, national and regional.
Within the complete schema of the ROSELT approach, our paper focus primarily on the explanation of one of its components, called SIEL. It is an original tool coupling GIS and models, integrating data collected from biophysical and socio-economical origins, to be able to establish a complete diagnostic of natural resource use allowing prediction of future evolutions. We explain its contributions towards desertification monitoring devices and desertification ICS.

Key words: Environmental modeling, observatories, durable monitoring, information system.

1. Introduction

The desertification process is defined as the land degradation in arid, semi-arid and sub-arid zones due to various factors including climatic variations and human activities (UNCCD). Natural resources degradation as a consequence of desertification is considered as a major obstacle to development in tropical and Mediterranean zones with strong drought constraints, leading to a wide range of possibly irreversible catastrophes: famine, land neglecting and migration. This process comes from a combination of different modes of resource management from different actors at different scales, interacting with strong climatic constraints in arid and semi-arid zones (Loireau et al, 2005).
However, «Desertification» has to be clearly distinguished from «desert encroachment», which is linked with the romantic idea of a desert (erg and reg) encroaching irreversibly upon green areas. Different thresholds of land and soils degradation have been used to assess the lost of natural resources, and differ considerably according to the idea of «irreversibility» of the ultimate stage of degradation (which is the «desertification» on a 25 years basis). We have no evidence to say that the drought period has ended, neither we can say that there is a global trend towards a drier climate since the last century. So that the «greening Sahel», following the «yellowing Sahel» of the 70's is just an expression of this climate variability: the desert did not (already) encroached upon the arid Sub-Saharian regions.

Are land use changes (towards less range pastures, more fields and fallow fields, less time of fallowing, etc) responsible or not for soil and land degradation cannot be assessed just through a global survey at regional scale: the degradation (loss of soil material, decreasing in production) depends notably upon the way populations are using their space and resources (human density, technology, etc.).
Examples from North Saharian countries, where animal pressure increased during the drought period, due sometimes to national actions taken to mitigate the effect of the drought, show that we have to differentiate between «land degradation and/or desertification» (which correspond to the loss of production capability) and «resources degradation», which express a decreasing in man-useful resources. (d'Herbès & Loireau, 2003).
Combining bio-physical and socio-economical assessment and monitoring, using functional models at local scale and structural monitoring at local, national or regional scale, could help understanding the trends in desertification.
Under the context of UNCCD, using its regional network of local observatories and these methodological fundamentals, the ROSELT/OSS (Long Term Ecological Monitoring Observatories Network / The Sahara and Sahel Observatory) program aims to contribute to the assessment of the environmental changes in order to understand and predict the desertification process, through setting up a durable device of environmental monitoring, useful for the decision-making process (ROSELT/OSS SD2, 2004).
For this challenge, the scientific and specific competence of the french research institute for the development (IRD), specifically its Service Unity called "Desertification" *("Évaluation et surveillance des causes, des mécanismes et des conséquences de la désertification dans les zones arides et semi-arides")* in Montpellier, and the network established, decided to develop and implement an Information Circulation System. This approach is based on regular exchanges, working sessions, between its members. The whole process took over a 5 years period, building concepts, methods and tools gradually and increasingly adapting them according to a scientific consensus.
Within this complete schema of the ROSELT approach and the currently existing Information Circulation System(ICS) in Africa, our paper focuses primarily on the explanation of one of the components, the SIEL,. As an original tool coupling GIS and models to be able to establish a complete diagnostic of natural resource use allowing prediction of future evolutions, this integrating information system contributes towards desertification monitoring devices and desertification ICS.

2. Components and structure of the ROSELT ICS

The ROSELT Information Circulation System is composed of three main technical, scientific and institutional tools (Desconnets et al., 2003, cf. Fig.1)

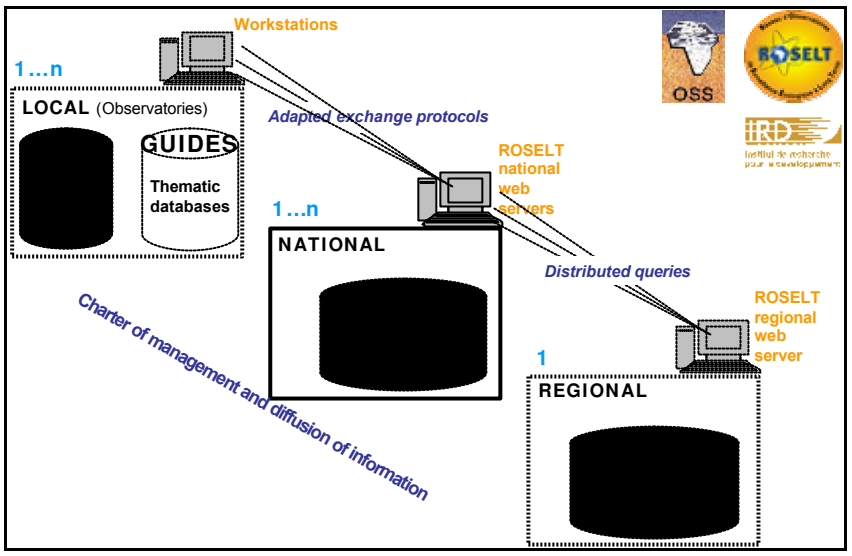

Figure 1: Structure of ROSELT Information System

One of them is a the interdisciplinary processing system of environmental data, called SIEL (*Système d'Information sur l'Environnement à l'échelle Locale*), connected to thematic guides for the assessment and monitoring. Data specified within thematic guides feed the SIEL database, and similarly SIEL organizes thematic data. Both, SIEL and thematic guides feed the ICS, *stricto sensu*, which is composed of a Data Base of Metadata, called MDweb , and a Charter for management and diffusion of information
This Information System is structured in three interlocked levels. The first one is at the local scale, the observatories scale, with thematic databases, elaborated according thematic guides. These thematic databases feed the specific database of SIEL. SIEL is an original tool coupling GIS and models, integrating data collected from biophysical and socio-economical origins, to be able to establish a complete diagnostic of natural resource use allowing prediction of future evolutions. At the moment, 8 countries out of 11 within the network are adapting gradually a device of monitoring compatible with the integrated space approach of the SIEL, three of them carried out their first diagnoses and prospective SIEL.
These local databases and their specific adapted processing are on workstations in the scientific institutions involved within ROSELT Programme (ROSELT/OSS SD2, 2004). At the national level, with adapted exchange protocols which have been specifically elaborated (little tool building the XML file from GIS database), they feed each national data catalogue, through a metadabase web tool, called MDweb . It is an open source generic metadata tool, with a server-side application for cataloguing and locating environmental datasets based on ISO geographic metadata standard (ISO 19115). It makes it possible to input and update metadata, import ISO 19115 XML, to manage metadata publication and the confidentiality. The locating user interface is based on data type search or a multi-criteria search (keywords, thematic and spatial index). This way, the list of data and their characteristics are consulting through a Roselt national web, preferentially implemented in the main national institution in charge of Roselt programme, indicated by the Ministry in charge of the environment and desertification combat.

At last, at the regional level, a metadata MDweb server (http://mdweb .roselt-oss.org/) allows to make a distributed and simultaneous request on the national metadabases. It is currently implemented in the French research institution for the development (IRD). Using the multi-search catalogues, this regional web portal allows to locate environmental datasets giving a global view with a distributed and simultaneous queries on national data catalogues. Using the on line catalogues, it gives a link to consult each national data catalogue. This way, all information can be consulted either through the national ROSELT websites or through the regional ROSELT website. At the moment, 7 MDweb have been installed in 7 countries; 6 out of them have a consulting catalogue on line.
The rules to feed data into this IS, then to manage and diffuse them, are defined within one common charter of management and diffusion of information. This document exists currently but it is still not entirely shared within the network.

3. The ROSELT Local Environmental Information System

3.1 SIEL: Scientific challenges, objectives and spatial interdisciplinary approach

Focusing now on SIEL (ROSELT/OSS DS3, 2004), this Information System has been conceptualized according to two main scientific challenges: 1) the understanding of land degradation mechanisms, causes and consequences, 2) while working out useful information for decision-making process. Under this context, the SIEL aims to assess vulnerability of the natural resources in interaction with the practices of exploitation on the rural territories on a local scale in the circum-Saharan dry zones by establishing a landscape diagnosis and forecasting its dynamic through spatialized balances between resources and uses.

The landscape structures of these zones are the result of a large space and time variability of the interactions between climate, nature and society. They are also characterized by a multi-use of the multifunctional ecosystems. The SIEL model (Loireau, 1998) aims at restructuring the landscape in a stable space units (during one given monitoring period), resulting from the crossing between two separately built geographical plans (cf. Fig. 2

Figure): 1) the spatial allocation of resources in landscape units, thanks to traditional cartographic methods (GIS) and 2) the spatializing of practices, thanks to models, which identify homogeneous areas on which different practices are combined. These models run in fact with a quantification of the "artificialization degree" adapted to the local scale (Loireau et al., 1997; Loireau, 2005; ROSELT/OSS TC2, 2006). Whatever the data collection date(s) may be in this period, these data must represent a functioning that is as much biophysical as socio-economic, and that is relatively stable over this period. *A priori*, without exceptional events being observed, the duration of this period has been fixed at 4 years within the network. If there are exceptional events, climatic or social, we must be able to measure them and to monitor the consequences during the next monitoring period.

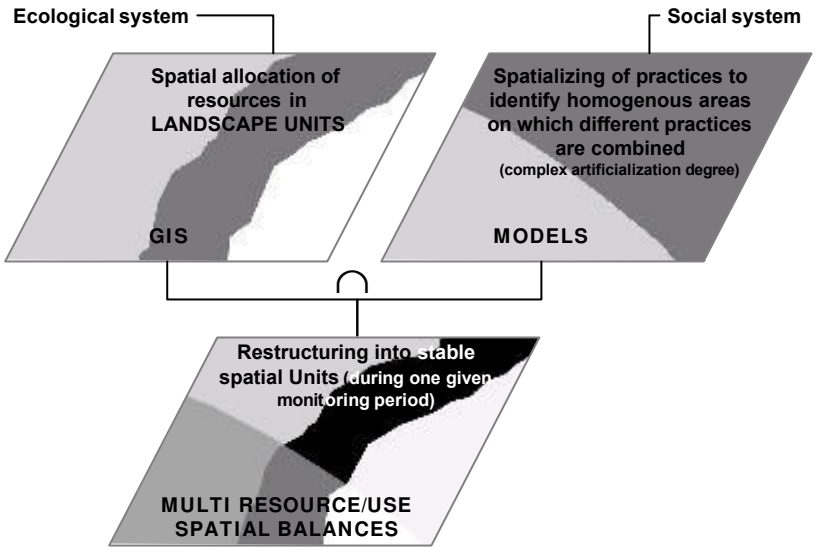

Figure 2: Spatial interdisciplinary approach of SIEL

Using biophysical and socio-economical data stored in the SIEL database, this modelling of the landscape functioning allows to establish a diagnostic, with a spatial description of the uses and resources interactions into spatial references units (SRU) and quantitative estimation of vegetation pressure spatialised on these SRU. Being based on a modelling procedure using models and parameters, this diagnostic enables some prevision to be made when setting a scenario of evolution of the parameters involved or driving them.

3.2 SIEL: an original tool elaborated and implemented within the network

In this way, the SIEL is currently an original tool elaborated and implemented within the network (Loireau et al., 2005). Implemented under the same GIS software platform, the SIEL tool couples a geographic Database and spatializing models.

The geographic database is organised in a relational database management system. Its general menu, specifically developed in Access interface, is organized in three service modules: "managing data of a modelling", "modelling parameters" and "specific tools" to manage the database. The structure of this relational database, or the links between each main geographic data unit or "object" and their specific data tables, derives from the formalization of the spatial area-resource-usage interactions at local scale using an United Modelling Language (UML) diagram, a "class diagram". The Figure 3

Fi shows three levels of complexity of the currently SIEL class diagram, version 1.5.

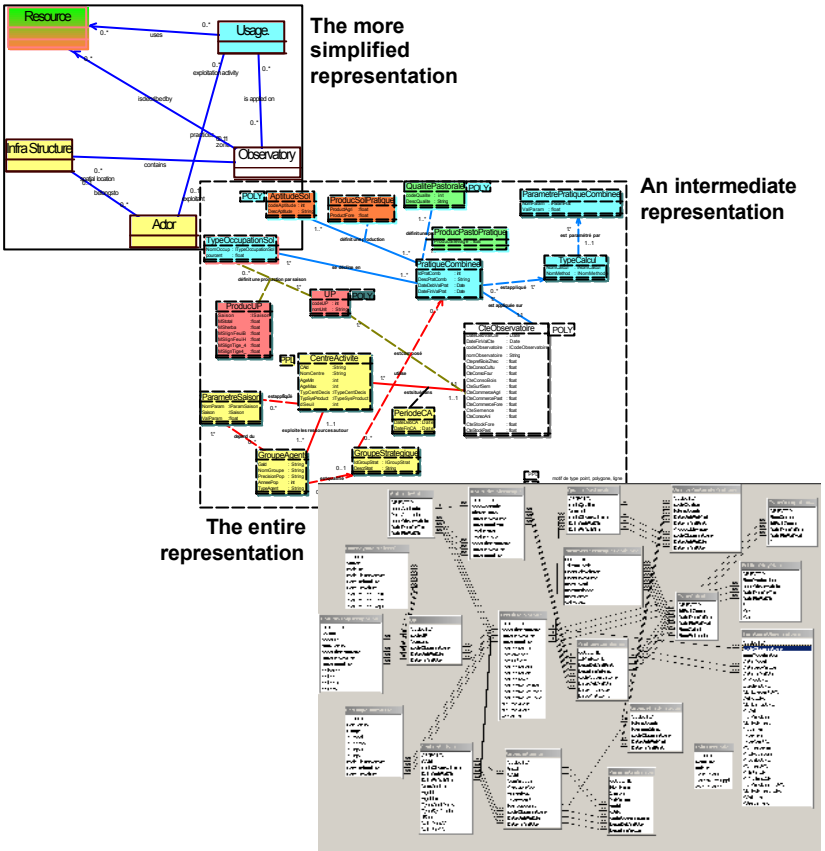

Figure 3: SIEL geodatabase through its UML class diagram

Each square represents a class of objects in the system (becoming tables) with their own attributes and operations ; the lines represent conceptual associations (becoming either other tables or references from one table to another one).
About the spatializing models (ROSELT/OSS DS3, 2005), a SIEL extension module menu is developed within ArcMAP (ArcGIS) with its main steps (cf. Fig. 4).

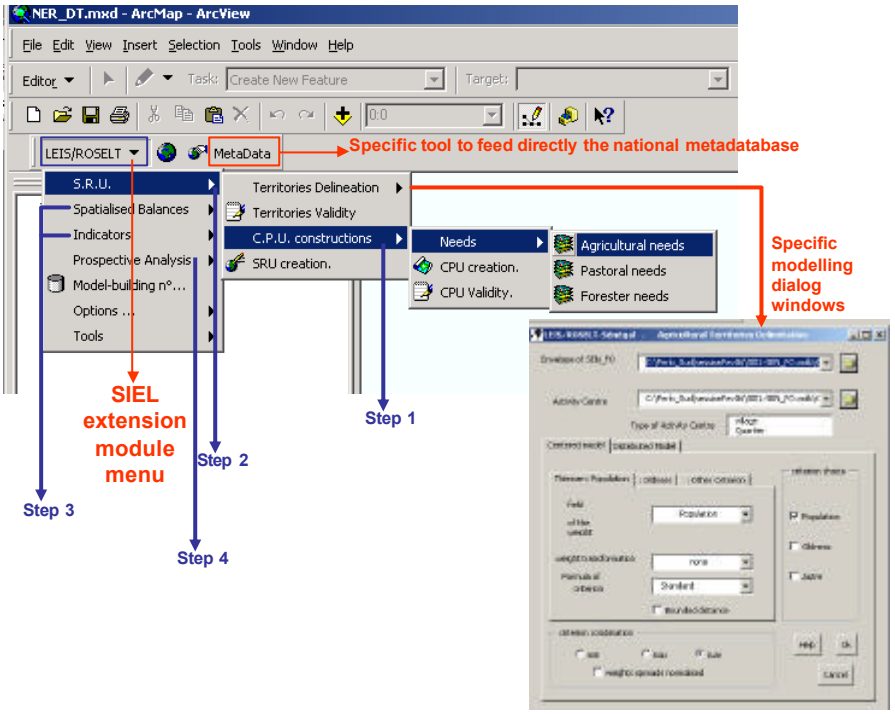

Figure 4: SIEL extension module menu within ArcMAP (ArcGIS) with its main steps of modelling

In a simplified presentation, the first step is the spatialisation of the combined practices (Combined Practices Units: CPU). The fundamental principle consists in applying potentially the practices which are associated to a given location by one or more exploitation groups (strategic groups), linked to one or several selected activity centres, according to the local biophysical characteristics at this location and the expectation that the production of exploitation at this location will contribute to the satisfaction of a type of need. This modelling principle runs in arid and semi-arid agro-pastoral zones. It is adapted when the area is only pastoral.

The second step is the definition of the Spatial Reference Units (SRU). The intersection of CPU and Landscape Units (LU) is done once the Landscape Units are built following some guidance on choosing the different physical, biological and land use maps expressing the landscape.

The third step is the balances and index computation. For each usage, according to a simple model of extraction linked to LU preferences around selected activities centres, availabilities and extractions are spatialised on the SRU. In reference to the same SRU, Multi-use balances on vegetation are established.

At last, after modelling one can go to the scenarios building interface to set the driving parameters evolutions such as population, productions (natural vegetation and or agricultural production). Because for each step and specific models choices of parameters and data collection are needed, specific dialog windows exist to be able to define them and to run the models. Despite the friendly general user interface, SIEL is a tool dedicated to scientists of the domain.

4. Contribution of SIEL to a durable device of environmental monitoring

(ROSELT/OSS SD2, 2004; ROSELT/OSS, 2004; Jauffret et al. 2005)

4.1. A kit minimum of biophysical and socio-economical data

The SIEL operates with a kit minimum of biophysical and socio-economical data: data linked to landscape units, data linked to Combined practices units, and data linked to Spatial Reference Units (cf. Table 1). All those data are elaborated data thanks to an adapted monitoring device on observatories progressively harmonised.

LANDSCAPE UNITS	COMBINED PRACTICES UNITS	SPATIAL REFERENCE UNITS
CARTOGRAPHIC DATA (MAPS): • Physical : geomorphology, topography, pedology, hydrography • Vegetation & land cover • Soil aptitude for agro-pastoral zones • Pastoral quality for pastoral zones OTHER : • Phytomass per landscape units and land use allocation	CARTOGRAPHIC DATA (MAPS): • Administrative limits • Activities centres: Cities, villages, encampment, isolated farmehouse, water points • Land law OTHER : • Human population: census, actors, history, spatial distribution (link to activities centres) • Typology of exploitation units , their strategies & resources access (strategic groups) • Livestock : link to water points in agro-pastoral zones, link to strategic group in pastoral zones • Typology of exploitation practices	• Resources extractions per usage • Available Resources per usage

Table 1: The SIEL kit minimum of biophysical and socio-economical data

4.2. A shared objective with common aimed products

Through the SIEL, there is a shared objective with common aimed products within the network. With its kit minimum of data collected during a given monitoring period on the observatories, the SIEL provides a landscape diagnostic with spatialized balances by usage. Indexes are developed from SRU attributes, in order to take account of the risk of natural resource degradation in relation to each activity, or in relation to all the activities (multi-usages). Figure 5 gives an example in the observatory of Dantiandou, in Niger, for the data period 1991-1995. The spatialized balances on vegetation are just expressed with the availabilities minus the extractions. The multi-use balance on vegetation is expressed through human pressure indices on vegetation obtained from the combination of the indexes (different types of ratio between extractions and availabilities: ROSELT/OSS DS3, 2004) linked to the different usages. It allows to estimate the spatial relative land degradation risk by silvo-agro-pastoral activities. In this figure, near the red and grey colour, the risk is maximum, and we know causes, near the green colour, the risk is lower or doesn't exist.

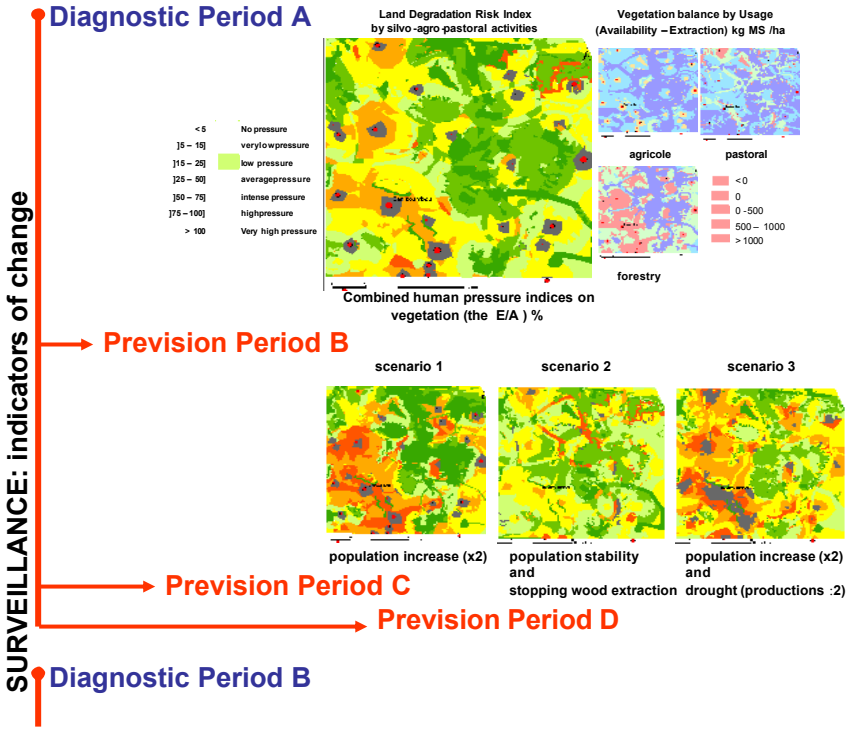

Figure 5: SIEL diagnoses and previsions as common aimed products within ROSELT network. Dantiandou observatory (1991-1995)

To this regard, one must remember that a single isolated activity (e.g.: agricultural over-exploitation) can, by itself, lead to the degradation of the resources used, even possibly to land degradation (decrease in biological production capacity) and to desertification. Multi-usages can increase the risk of degradation or, on the contrary, improve the management of resources and therefore decrease this risk.

For the other resources (water, soil, etc), the impact of usages is seen in terms of degradation risk, applied to each SRU according to its own characteristics. The risk indexes are inferred from the knowledge of systematic processes generated by related studies. The combination of these indexes on the SRUs is made possible by their construction method; Spatial Reference Units, referencing different thematics: geomorphologies, pedology and ecology (LU), agrarian systems, demography, etc. The calculation and integration methods of these indexes must be subject to further detailed consideration within the ROSELT network, throughout the application of the LEIS in the different observatories.

For each given monitoring period, a new diagnostic is elaborated, indicators of change are calculated and the ecosystem surveillance is facilitated. In this way, results can be compared in time (diachronic analysis), and in space (from one observatory to another: synchronic analysis, ROSELT/OSS CT9, 2004). Before being communicated to local or national authorities, as useful information for a better evaluation of desertification risks, balances maps can then be aggregated according to administrative units or to some biophysics units depending on a specific interest.

In the mean time, for each given period, prospectives are elaborated changing the driving parameters of the modelling. The interpretation of trends towards degradation, either local or generalised over the whole territory constitutes in itself an assisted decision-making tool. The exploration of these tendencies increases the capacity to aid in decision making, through forecast simulations, and in particular in response to the

question: what happens if…? The evolution of these environmental and social changes as well as desertification risks is evaluated using two procedures:

1) a snapshot simulation of the given period, based on a simple change in the value of driving force parameters (population, climate, etc.).
2) a dynamic simulation, over several iterations (for example by 4-year periods), based on the evolution curves of the driving force parameters.

Long-term monitoring will enable us to compare the results of simulations with collected data, and thus to validate or readjust the models implemented in the SIEL.

Nowadays, the first procedure is tested within three ROSELT observatories. On Dantiandou territory (cf. Fig. 5) the pressure on vegetation increases only because of a human factor in the scenario 1 (population multiplied per two) and because of the combination between human and biophysical factors in the scenario 3 (the same population increase plus a critical drought: production divided per two). However, the pressure on vegetation is reduced in the scenario 2 because of the combination of human factors: a stable population plus a stopping wood extraction. Those prospective simulations should feed the dialog with resources managers.

4.3. A shared adapted methodology progressively harmonised

As a federative tool, the SIEL allows to share, within the network, a same methodology to study nature and society interactions on a territory representative of a region at sub-national scale to describe desertification processes at circum-saharian scale. Indeed, specific methodology are defined to delineate the territory of observatory on which the monitoring device is installed for a long term, adapted to the local modelling of systems in interactions, with a relative homogeneous human and biophysical functioning. In those territories, in order to follow specific thematic indicators of change, to feed the SIEL through its spatial approach, and to define the kit minimum of data necessary to reach those common aimed products, the sampling, collecting and processing methods are progressively harmonized for each thematic domain and for their integration. A ROSELT/OSS collection of technical and scientific documents is published to set up the operating fundamentals of the monitoring and also to illustrate this progressive harmonization.

More precisely, the adoption of harmonised methodologies being a progressive process, the ROSELT programme Regional Coordinator has been putting in place a strategy since the year 2000, based on the following steps.

- A regional workshop in June 2000 brought together all the ROSELT/OSS members in Bamako (Mali) and marked the beginning of the programme's operational phase. It showed the necessity for harmonisation of data collection and processing methods in all the network's countries and observatories.
- Two sub-regional workshops took place, centred on specific themes. The first in Ouarzazate (Morocco) in November 2001 for Africa in North Sahara, and the second in Dakar (Senegal) in February 2002 for West Africa. For each theme linked to the understanding of environmental changes, a facilitator was identified and given the role of putting together, leading and coordinating a work group. Each person was also implicated in the writing of a technical contribution document, specifying the sampling, data collection and data processing methods in his personal discipline (phyto-ecology, biology, hydrology, pedology, anthropology, law, economy, etc.).
- The scientific exchanges led by the facilitators were helped along by email, and effectively led to the writing of the first work documents.
- The facilitators of the Africa in North Sahara sub-region, were able to meet up several times during 2003 at organised scientific workshops in Montpellier. They

were thus able to conduct discussions about the contents of their methodological contributions in progress, define the importance of cross-referencing between the different thematic contributions, and programme the steps to needed in order to finish the methodological booklets for each theme.

- This set of booklets, still under development, was communicated to the ROSELT countries' institutions as a working document. The most well-developed booklets (vegetation and resource exploitation practices) were tested on a few observatories. More accurately, an initial version of the present document was tested on the Ferlo observatory in Senegal (under the supervision of Magatte Ba) and on the Menzel Habib observatory (under the supervision of Mongi Sghaier).
- The 'vegetation' booklet, adapted from the African regions of North Sahara, was discussed with a view to its extension to the context of sub-Saharan regions during a West African sub-regional workshop in 2004 (Praïa, Cape Verde, September 2004). It has now been tested in Mali and Senegal.
- Two 'pillar' booklets for environmental surveillance in the ROSELT/OSS framework were finalised in 2005/2006 by the IRD Regional Operator: one on the assessment and monitoring of ecological systems (landscape, vegetation, flora, and surface features), and one on the assessment and monitoring of natural resource exploitation techniques. They are written for those responsible for the collection of data in each theme covered by ROSELT. Each theme is dealt with in turn, for integration into the general schema of environmental data collection and processing (cf. Fig. 6), with a view to creating products for decision-making (ROSELT/OSS, SD2, 2004).

At the left of Figure 6 the data concerns specifically the ecosystem understanding and monitoring, and at the right of the figure, the data concerns specifically the spatial integrated approach of SIEL to understand the landscape and its dynamic. Both systems are interrelated.

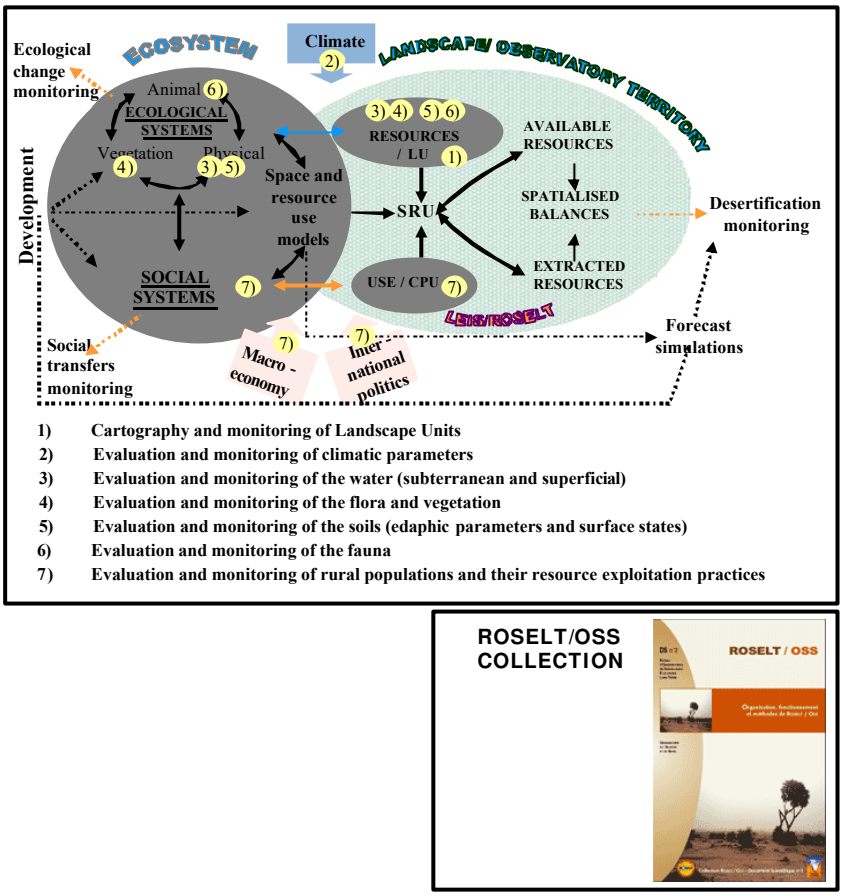

Figure6: The ROSELT common integrated schema of data progressively harmonized

In this way, to summarise, the SIEL is a complete interdisciplinary proposal, a platform in term of an organised enabling environment. It is a tool to contribute to a durable device of environmental monitoring within an observatories network, useful to understand desertification, to follow environmental changes at local scale, to give information to nourrish a dialog with resources managers at local or national scale.

5. Conclusion

So far the entire ROSELT ICS has succeeded in various achievements:

- A complete structure of an operational ICS is built.
- The scientific appropriation is generally acquired at the national level.
- The scientific and technical problems are never true barriers to the process: they are gradually solved. A scientific dynamic is growing up. For example, the IRD researchers who has elaborated the metadabase web tool, called MDweb , are confirming and reinforcing their role in those specific scientific and technical aspects with formalised collaborations with other dedicated French institutions. Their objectives consist in dividing what exists, their human and financial means, through a data-processing platform, in order to develop and maintain a whole of generic software components intended to build services of metadata. More generally, ROSELT network is opening and sharing its experience to improve its technical and scientific aspects.
- Methodologies are shared within the network and progressively within international research projects on desertification process, like the European Integrated Project called DeSurvey: “A Surveillance System for assessing and Monitoring of Desertification”

- African dynamics are strong around the ICS of ROSELT/OSS. The current process of DOSE/OSS program implementation for the installation of the national devices of environmental monitoring is based amongst other things on ROSELT methodology.

But the ICS has also experienced difficulties:

- The operational leading process is progressive and take a long time. For example, the methodologies are established but their application in observatories is still at the beginning.
- Institutional aspects are still very restrictive. The scientific institution in charge of data process are rarely interrelated with technical services of State able to make durable the monitoring, and to integrate the environmental monitoring in national policies.
- The charter of management and diffusion of information is still not shared. Indeed, the absence of a finalised process of acceptance of a charter of management and diffusion of information within institutional and political skateholders fragilises the process. The commitment is unequal from one country to another and this makes today the information provided by ROSELT still too timidly shared and diffused to play the role which it aims in the process of decision-making aid, according to the needs of UNCCD or in general AME agreements.
- The contributing role of the local and regional observations in the national devices and the relations between scientists and decision makers at various decision scales have still to be precised. The current process of DOSE/OSS program implementation will contribute to this point.

In conclusion, we would like to insist on the fact that we (scientists, policies and stakeholders) should be patient and constant, we should avoid any conventional or financial breaks, and we should shared and interrelated our different experiences, if we want :

- to give one chance to any long term monitoring process,
- to guarantee a continuous feeding information into any ICS, to establish a second, then a third etc… diagnoses in ROSELT local observatories,
- to give one chance to keep the dynamic of any network at the national and regional scale until the government and national institutions are fully involved and engaged.

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SESSION III

Experiences and lessons learnt implementing ICS in UNCCD Annexes I and II

EXPERIENCES AND LESSONS LEARNT FROM INFORMATION CIRCULATION SYSTEMS (ICS): UNCCD ANNEX I COUNTRIES

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1 Introduction

In the framework of environment and sustainable development, everyone is a user or a provider of information defined in the broadest sense. Information should be understood as data, intelligence, appropriately presented reports of experiences and knowledge. Information needs can be felt at all levels, ranging from the level of major decision makers in national and international institutions to the local and individual levels. In order to ensure that decisions are based on accurate data, it is important to improve access to information in terms of quantity and quality (standards norms, data compatibility).

African countries are facing diverse and sometimes irreversible environmental problems: land degradation, deforestation, water scarcity, pollution, etc. African countries should therefore have dynamic and up-to-date environmental information systems in order to better assess environmental changes and be able to reverse the degradation trends. However, being concerned with environmental information at the country level only is necessary but not enough. Indeed, global challenges and issues require information at the sub-regional, regional and global levels.

The United Nations Convention to Combat Desertification (UNCCD) has defined desertification as "Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climactic variations and human activities".

Information on desertification in thus closely linked to information on land, forest, water resources and climate.

Information circulation systems are very important tools to disseminate, and exchange relevant information about critical issues in Africa such as land degradation, deforestation leading to desertification. Furthermore such information is crucial for decision-making processes. Besides the manner in which indicators/information are reported may have significant consequences for decision-making (SCOPE 1997).

In many African countries however there are constraints in the sense that the institutional setting does not fully permits adequate circulation of the information and the structures tend to have redundant attributions. There is a need for networking among the different structures and for synergies among the existing initiatives otherwise it may create duplication.

This paper is divided into five parts: the first part makes an assessment and analysis of the existing monitoring systems and information circulation system in the area of desertification as mentioned in the UNCCD annex 1; the second part describes and analyses institutional and legal challenges and attempts to provide solutions to some problems that the national institutions encounter; the third part states examples of application of Information Circulation Systems (ICS) for decision-making; the fourth part draw lessons from the utilisation of ICS; and the last part gives recommendations on how to capitalize on the systems.

2. Assessment of ICS in scientific and practical approaches to combat desertification

There are several ongoing initiatives in Africa on information circulation systems in the area of desertification as shown in the annex 1 of UNCCD. However each country has its own institutional set up, approach and solutions to face the problem of lack of or poor information exchange and dissemination. The systems from the annex will be described and analysed in this part. An ICS (not taken from the annex) will also be given as another example of ICS that occurs in Africa.

2.1 Desertification Information System (DIS)

The project on Desertification Information System / Monitoring the Environmental Information System on the Internet (DIS/MEIS) was launched by the *Observatoire du Sahara et du Sahel* (OSS) in collaboration with the United Nations Institute for Training and Research (UNITAR) to accompany the states in the implementation of the UNCCD in countries most affected by drought, and/or desertification, especially in Africa. Primarily the objective was to develop an information network at the national, sub-regional and regional levels to set up a tool for implementing and monitoring sub regional action programmes (SRAP) and national action plans (NAP) in order to meet the UNCCD objectives. This information system provides potential actors involved in combating desertification with scientific and technical papers and other documents on the state of implementation of plans, programmes and projects to combat desertification, and selected, filtered and validated databases, maps, and images. Thus, the information is presented in an understandable way for the different users and use the classical support (paper) and digital support (modern): disquettes, CD-ROM, Internet services...). It is therefore a technical process involving the development of information and communication technologies (ICTs).

The DIS/MEIS was first designed for activities aimed at combating desertification. It has now extended to all the other thematic areas of the environment such as climate change, biodiversity, etc. In Senegal and South Africa for example, the focus was on institutional approach. Indeed, all actors involved in environment issues were involved in the project management. This enhances partnership, networking, consultation and consensus.

In Senegal, the system has not succeeded as it was expected despite the institutional concept, which enables the participation of all stakeholders. Dysfunctions and failures relating to weakening of responsibilities, the non-responsiveness of focal points responsible for representing partners institutions in the system's management, the lack of appropriate technological equipment within partner institutions, are among the reasons why the system has not fully succeeded in Senegal (CSE, 2004)

2.2 Environmental Information Network and Monitoring System (EINMS)

The main objective of this system, which is tested in Zambia, is to provide information services to improve the availability and accessibility of environment information to support planning, monitoring, evaluation and decision-making at all levels. The program is designed to develop five (5) specific EIS sub-systems to address five priority environmental issues, including deforestation, and soil degradation, which are closely linked to desertification. The EIS would provide information and data to support the elaboration of the State of Environment (SOE) report in Zambia.

The SOE reporting process provides decision-makers with an information tool on the state of desertification through state of land, water, or forest resources.
This system is focused on availability and accessibility of data being aware that this is a great issue in African countries. Indeed data centres (data producers) are sometimes if not always reluctant to provide their data. This system would enhance partnership, networking and data and information exchange among national actors to achieve sustainable development.

2.3 Information on early warning systems FEWS NET

This initiative provides early warning information for Africa. It is developed and funded by the U.S. Agency for International Development (USAID) and seeks to establish more effective and sustainable food security information networks in Africa in order to reduce the vulnerability of groups at risk (Gonzalez, 2002 in AID CCD). It is a tracking system – of short-term environmental conditions – that would enable scientists to monitor, analyse and forecast long-term environmental phenomena.
This system can therefore help them elaborate and develop scenarios for the future. "A scenario is a story, told in words and numbers, concerning the manner in which future events could unfold, and offering lessons on how to direct the flow of events towards sustainable pathways and away from unsustainable ones" (UNEP, 2002). Scenarios provide a coherent framework for analysis of how various issues or sectors impinge on one another and interact; they serve as a tool to foster creativity, stimulate discussion, and focus attention on specific points of interest for policy on environment and development and for opening up a constructive analysis of future problems. A scenario approach can be very valuable both for stimulating analysis and sorting out urgent policy issues, and as a means of communication between scientists and policymakers (UNEP, unpublished).

2.4 Environmental Information System for the NAP process

The system already exists in Zimbabwe as the need to establish it has been acknowledged. The objective of this EIS is the development of a common information base and an operational framework that will allow the NAP process to effectively achieve its responsibilities on combating desertification and mitigating the effects of drought in Zimbabwe (Government of Zimbabwe, 1999 in AIDCCD).
Monitoring and Evaluation of the NAP process would be done at national, provincial, district and community levels. Communities themselves will make their own monitoring and evaluation of the programme. Community based indicators will be developed for purposes of monitoring and evaluating progress towards, among others, sustainable utilization of land resources (Government of Zimbabwe, 1999 in AIDCCD).
The originality of this system is that the participatory approach is used enabling the community to be fully involved in the activities of conservation. This is very important in such initiatives as it take into account the needs and priorities of the community itself.
The system can be advantageous so long as it is efficiently monitored. Dissemination of information through this system would be made in a way that it is easily accessible to members of the community. For example, Internet may not be the appropriate tool for circulating the information in this case. Rather, newsletters or radio spots/shows should be used as information circulation. This system should be applied to all African countries.

2.5 Information Sharing System on Desertification (SCID)

This system will be set up as a tool for strengthening the national mechanisms of information sharing on desertification, and as a component of the Sub-Regional Action Programme (SRAP) for Combating Desertification. The project at the origin of this system would be the « Setting up Monitoring-Evaluation Systems of the Action Programmes of Maghrebi Countries ». It was designed by OSS and the National Coordination Institutions (ONC) of the Action Programmes for Combating Desertification of Morocco and Tunisia, together with the UMA (Union of the Arab Maghreb) Secretariat as a focal point of the SRAP for North Africa (AIDCCD).

The overall objective of the project is to assist the North African countries in setting up an operational system for the monitoring-evaluation of the impact of the action programmes for combating desertification, which are instruments of implementation of the UNCCD at the national and regional levels (AIDCCD).

Two of the specific objectives, which are to set up a permanent network for the exchange of experiences and information between countries and partners, and to establish a regional database on desertification and the environment, are key in the efforts towards exchange of experience and information among partners.

Indeed, in such initiatives, networking is a key element, which is not to be neglected. The institutional setting, as well as strong political support, must be accompanied with appropriate and adequate networking framework and organization so as to optimise the system and capitalize the results. So long as the networking is not effective and sustainable, the implementation of the system would not be either.

2.6 Desertification Information System for the Mediterranean Basin (DISMED)

This project aims more particularly at strengthening co-operation between the member states of Annexes 1 and 4 of the UNCCD using harmonized information systems. The partners are: Morocco, Algeria, Tunisia, Italy, Spain, Portugal, Greece, Turkey, Libya, Egypt, the European Environment Agency, the OSS, and the UNCCD Secretariat (AIDCCD).

The main results expected from the project, in terms of products, consist of making a desertification sensitivity map for the Mediterranean Basin. Indeed, this information is very useful for environmental scientists (e.g. meteorologists, climatologists) because they can get the information in a type of output that is readily analysable. It also facilitates understanding, especially for people who are not aware of environment issues. Indeed as a geo-information, which can be combined with information from various disciplines, the system provides accurate information on sites, particular area or specific location to specialists, project managers, and particularly to decision makers.

Indeed, when decision makers do have information, they do not usually know exactly what the information is likely to be about neither its relevance nor its use. (EIS-AFRICA 2001). The geo-referenced information is more meaningful. This is an interesting project but it should be extended to sub-Saharan countries like Mali, Niger, Burkina Faso, Senegal. It would have the double advantage of seeking partnership from sub-regional institutions of the sub-region such as the *Comité permanent Inter-Etats de lutte contre la sécheresse dans le Sahel* (CILSS) and also learn from their expertise in the area of mapping and GIS.

2.7 MEDIATERRE

The *"Système d'information mondial francophone pour le développement durable"* Mediaterre, is a type II partnership as defined in the framework of the World Summit on Sustainable Development (WSSD). The project is implemented by the Francophonie (IEPF) and International Orientation Committee and the first meeting was held in May 2003 in Ouagadougou during the francophone seminar on "Information at the service of sustainable development".

Mediaterre contributes to sustainable development implementation in francophone countries including African francophone countries using information dissemination and exchange. The system draws on two principles: the first taking into account that information and knowledge are a public good; the second aims at creating information exchange among all stakeholders involved in environment and sustainable development. Thus the objectives of the project are to contribute to strengthen capacities by enabling exchange s between actors of sustainable development.

The system is set up on synergies between networks and specialised web sites. It constitutes the most exhaustive reference tool in French in the area of sustainable development, including desertification issues and challenges.

The Network for Environment and Sustainable Development in Africa (NESDA) is working in collaboration with Mediaterre for the management of the Africa portal. NESDA is responsible for posting information for the Human settlements theme. It has however been noted that the technical management of the portal is posing problem because no technical support was provided, for the functioning of the web site and the management of the postings. Suggestion was therefore made to publish a technical document that would also be part of the capacity building effort and the sustainability of the project. The portal is accessible at www.mediaterre.org

3. Institutional and legal challenges

The institutional aspect provides insight in the legal status and the ministry or political/administrative department under which the institutions dealing with EIS operate (act/decree establishing it, its budget, main programme being implemented).

In most of the case in Africa there are a lot of structures working in the sector of environmental information but without efficient communication and exchange. Each of the structure depends on government institution. We can notice, from the analysis of a questionnaire distributed to the structures at the beginning of an environmental information circulation project initiated by UNEP[1], the redundancy in the attributions in the different decree and law. Furthermore, the data collected seldom reach the decision makers and other structures. Besides, communication between the data centres (data providers on climate, environment, energy, land, etc.), and the institutions that need the data for decision-making is not well developed.

Data are necessary for planning at the country and district levels for the execution of the projects, the analysis of a natural resource, and for monitoring and evaluating the impacts of a development programme on the environment. Technical aspects are developed within a framework that does not often take into account the national planning process. This situation leads to a « fragmentation » of the results and data. Decision makers thus

[1] The Africa Environment Information Network (AEIN) initiative

find themselves financing similar projects because there is a lack of actual coordination, resulting in duplication and overlapping in data production (EIS AFRICA 2001).
Furthermore, project managers sometimes seek to "count on" information generated from studies and, require financial compensation. But if the information generated is not sufficient and decisions are taken based on the latter, or on incorrect information, this can have serious consequences and create negative impacts.
In Ghana for example, in the EIS process a coordinating body was selected so as to optimise the networking partnerships for strengthening institutional capacities. The Environmental protection Agency of Ghana (EPA) is working together for the Ministries, Departments and Agencies (MDAs) and the private sector not only on issues of the environment but in development of EIS in Ghana. As a consequence, the EPA has a well-endowed network of partners and stakeholders. The Agency was the secretariat for the National Framework for Geographic Information Management (NAFGIM) programme and currently the focal point for the Africa Environmental Information Network (AEIN), which is a partner of. It is part of the network of institutions that implemented the Environmental Management Component (EMC) of the National Resource Management Programme (NRMP).
The figure below shows how the networking can be achieved at all levels of the ICS system and EIS programmes. In this framework, the information exchange among the sub-regions is also an important element.

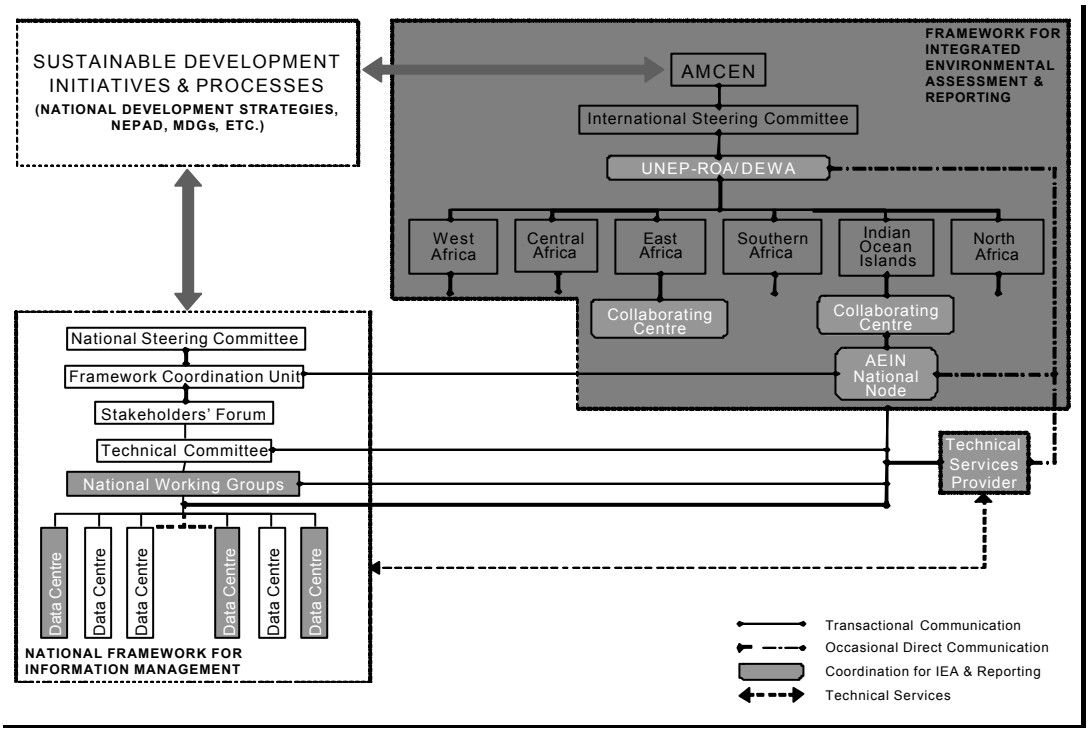


Figure 1: An example of a network structure: AEIN network structure and linkages to on-going initiatives

4. Application of ICS for decision making

Policies elaboration and decision making process for natural resources management and sustainable development require reliable environmental data and information as presented in the State of Environment reporting (SOE). National and sub-regional institutions and experts have over the years produced reports documenting different aspects of the environment, including desertification, at the national and sub-regional levels.

4.1 Case study: National outlook report - Ghana

Ghana has drafted its report on the environment outlook in 2004. The report, which is still a draft, and has not been validated yet, covers topical issues as follows:

- Atmosphere
- Land
- Fresh water resources
- Forest resources
- Coastal and Marine Areas
- Biodiversity
- Energy
- Human settlement

The issue of desertification is addressed through the atmosphere, land, fresh water resources, and forest resources thematic areas. The report is intended for decision makers. It is an information tool to help them take the adequate decision for sustainable management of land and forest resources to mitigate the impacts of their degradation leading to desertification.

The report is a result of a process that involved all stakeholders in the country. Data and information were collected from the different data centres in the country, namely:

- EPA
- Ghana Statistical Services
- Ministry of Health
- Survey Department
- Meteorological Service Department
- Forestry Service Department
- Water Resources Commission

Thematic working groups were constituted to take care of the various themes during the national stakeholders workshop and issues and indicators were identified under each theme. Below is a table of the environmental problems identified for Ghana, including land degradation, under the theme land.

Nature of concern	Causes	Effects	Indicators
Land degradation	Traditional farming methods Bush fires Clearing of watersheds Sand and stone winning Harvesting of firewood	Loss of top soil Loss of biodiversity Loss of medicinal plants Siltation of rivers Salinization of soil	Area affected by erosion
Coastal erosion	Rising sea level Sand wining on beaches Harbour construction	Erosion of coast Loss of spawning ground	% land loss to erosion No of sand wining sites on beach

Pollution of water bodies	Mining activities Indiscriminate waste disposal Farming along river banks Indiscriminate defecation	Damage to aquatic life Poor water quality Toxic water sources	Increase BOD in rivers % loss in aquatic life Increased faecal coliform
Deforestation	Timber exploitation Fuel wood extraction Shifting cultivation Bushfires	Loss of biodiversity Drying of streams Soil erosion	% loss of fauna, flora % loss of forest land/year Number of bushfire/year Carbon sequestration
Poor Waste management	Human activities Mining activities Industrial activities Agricultural activities	Increased soil toxicity Poor water quality Visual intrusion Increase in diseases Emerging diseases	Volume of types of waste No of waste treatment plants
Risk from chemical use	Use of chemicals in fishing Use of chemicals in hunting Agrochemical/pesticides use Industrial use of chemicals	Polluted water bodies Polluted air Increase crop toxicity	Increase pesticides use Level of pesticide in crops Increase in pesticide related disease. Death related to pesticides
Indoor air pollution	Use of charcoal and fuel wood Excessive dust	Poor air quality Increase chest problems	CO_2 emission Dust emission
Desertification	Climatic change Deforestation Poor farming practices Drying of local streams	Loss of livelihood Erosion Loss of vegetation cover	Increase in vegetation loss Decrease in food production loss of soil moisture % loss of surface water
Large scale development	Mining activities Factories near rivers Building on waterways	Loss of arable land Waste generation Flooding in Cities	Pollution levels of air, water Loss of aquatic life Houses flooded annually

Table 1: Environmental problems in Ghana

Source: EPA National Outlook report of Ghana - Adapted from Draft Report of the SEA of the GPRS, 2003

FAO/UNEP (1983) defined land degradation as a process leading to desertification, or the reduction in the capacity of land to satisfy a particular use. The major forms of land degradation in Ghana include soil erosion, desertification, salinization, acidification and plinthite formation.

The United Nations Convention to Combat Desertification (UNCCD) has defined desertification as "Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climactic variations and human activities".

The estimated percentage of total land area of Ghana prone to desertification is 64.97%, which is about 165,000 km^2. The Upper East and eastern part of the Northern Region of Ghana face the greatest hazard with a land area of about 78,718 km^2 prone to desertification. The percentage land area in Ghana vulnerable to low, moderate, high and

very high desertification is given as 7.47, 48.78, 15.15 and 1.04 respectively (EPA, unpublished). Today, deforestation has resulted in land degradation, desertification and food insecurity while most of the unique economic functions of forests are also facing colossal down turn. This situation poses a big threat to forest ecosystem and sustainable management. Furthermore, global warming tends to pose a greater danger. Ghana had a net carbon sink of about -4,082Gg in 1996, which gives the current deforestation rate of about 2.8 percent per annum (EPA, unpublished).

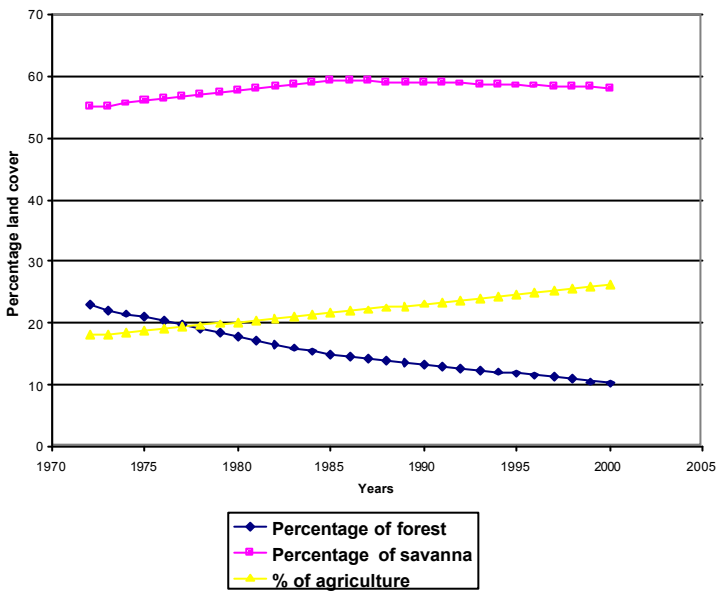


Figure 2: Forest resources compared with savannah and agriculture from1972-2000

Measures initiated in Ghana to arrest the land related problems include the following:

1. National Biodiversity Strategy and Action Plan to arrest the deterioration of biodiversity problems prepared;
2. National Forest Plantation Development Programme to plant 20,000 hectares of trees every year launched;
3. Development of a National Action Programme to combat desertification in the light of the United Nation Convention on Desertification;
4. Biodiversity component, Savannah Woodland management and preparation of land use, land cover maps and environmental information systems of the Environmental Management Coordination of the Natural Resource Management Programme (NRMP) for effective land and biodiversity management;
5. Enactment of Forest Plantation Development Act, 2000 (Act 582);
6. Government response to deforestation by promoting use of liquefied petroleum gas.
7. Strengthening local capacity of bush fire volunteers;

8. National Soil Fertility Action Plan to arrest decline in soil fertility had been prepared
9. Adoption of technologies for enhancing soil fertility; and
10. National Action Programme to Combat Drought and Desertification Document (April 2002). The document has outlined practical action programmes with action plans and activities under the following broad areas:
    - Land use and Soil Management,
    - Management of Vegetative Cover,
    - Water Resources Management,
    - Rural Infrastructure Development,
    - Energy Resources Management, and
    - Improvement of socio-economic environment for Poverty Reduction.

4.2 Africa Environment Outlook reporting Processes - GEO Africa Data Portal

The Africa Environment Outlook project (AEO) is an initiative of the African ministerial conference on the environment (AMCEN) with support from UNEP and the AMCEN Secretariat. AEO intends to elaborate the Africa state of environment report. The first AEO report was published in 2002 and the second one will be in the course of the year 2006.

At the regional and global levels, the GEO Africa Data Portal is a standard information system developed for African nations to acquire process and disseminate information relevant for sustainable development, including issues linked to desertification such as land, forests, water resources. The portal offers an interactive interface for users interested in desertification issues in Africa, and is also a support for reporting processes. Indeed, at the global and regional levels, some of the data contained in the Global Environment and Africa Environment series reports are collected from the portal.

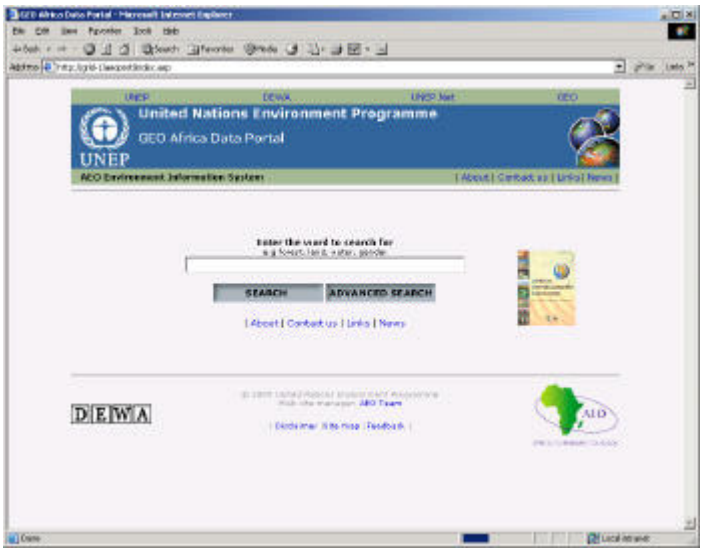
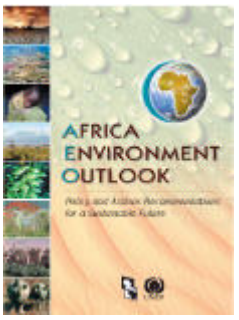


Figure 3: The GEO Africa data portal

The portal acts as a tool for African countries, decision makers and researchers to be able to assess environment and development status compared to their national priorities,

neighbour countries, regional and global standards. The portal provides tabular, spatial and graphical reports and the interface is in English language.
NESDA is the collaborating centre of UNEP for the Western Africa sub-region for the elaboration of SOE reports. NESDA has just published, in collaboration with UNEP the first integrated and comprehensive report on the environment in West Africa. The West Africa SOE report is the result of a close collaboration between NESDA, UNEP and sub-regional institutions like the World Conservation Union (IUCN), the *Comité permanent Inter-Etats de lutte contre la sécheresse dans le Sahel* (CILSS), the Economic Community of West African States (ECOWAS), the African Development Bank (AfDB), and national environment agencies and experts from the sub-region. The report provides an integrated analysis of the environment of the sub-region. Indeed, it establishes a detailed assessment of the current state of the environment in the Western Africa sub-region, highlighting the pressures on the different components of the environment, their impacts on the environment and human beings, and provides recommendations for action. The report is therefore an invaluable resource for African governments in their efforts to tackle the root causes of poverty on the continent, and its environmental and socio economic depletion.
NESDA, as the collaborating centre for West Africa, is providing input into the AEO-2 for the West Africa sub-region.



The approach used to elaborate the AEO report is as follows:

- Assessment: what is the state of environment? (Using the Driving force-Impact-Pressure-State-Response DIPSR framework)
- Analysis: how does this affect implementation of the New Partnership for Africa's Development (NEPAD)? (Interpretation, policy analysis, consideration of linkages and integration)
- Report writing: presenting the information above in a relevant and understandable way to AMCEN policy processes and other decision makersOther institutions are responsible for elaborating SOE for the other sub-regions, as UNEP collaborating centres. They are as follows: the National Environment Management Authority (NEMA) for Eastern Africa, the Southern African Research and Documentation Centre (SARDC-IMERCSA) for southern Africa, the Centre for Environment and Development for the Arab Region & Europe (CEDARE) for Northern Africa, *Association pour le Développement de l'Information Environnementale* (ADIE) for central Africa and the Indian Ocean Commission (IOC) for the Indian Ocean States. This exercise has enhanced

networking and information exchange through meetings, the Internet (the reports are posted on the UNEP web site), and discussion forums.

Theme	Environmental Issue	Indicator/Data Variable	Indicator Type
Land	Land tenure/ownership	Population in Drylands - Total	Pressure
Land	Land tenure/ownership	Population in Drylands - Percent of Total Population	Pressure
Land	Land degradation	Dominant Type of Problem Lands	Pressure
Land	Land degradation	Drylands - Total Area	Pressure
Land	Land degradation	Drylands - Percent of Total Area	Pressure
Land	Land Use	Land Area	State
Land	Land Use	Land in Permanent Crops	State
Land	Land Use	Irrigated Land	State
Land	Land Use	Total Area	State
Land	Appropriate and sustainable farming systems.	Pesticides Consumption - Fungicides, Bactericides and Seed Treatments	Pressure
Land	Appropriate and sustainable farming systems.	Pesticides Consumption - Herbicides	Pressure
Land	Appropriate and sustainable farming systems.	Pesticides Consumption - Insecticides	Pressure
Land	Appropriate and sustainable farming systems.	Forests and Woodland - Percent of Land Area	State
Land	Appropriate and sustainable farming systems.	Permanent Pasture - Percent of Land Area	State
Land	Appropriate and sustainable farming systems.	Fertilizer Consumption	Pressure
Land	Appropriate and sustainable farming systems.	Fertilizer Production	Pressure
Land	Appropriate and sustainable farming systems.	Pesticides Consumption - Mineral Oils	Pressure
Land	Appropriate and sustainable farming systems.	Pesticides Consumption - Plant Growth Regulators	Pressure
Land	Appropriate and sustainable farming systems.	Potential Grain Production per Person - Low Inputs	Pressure
Land	Appropriate and sustainable farming systems.	Potential Grain Production per Person - High Inputs	Pressure
Land	Appropriate and sustainable farming systems.	Potential Rainfed Food Production - Low Inputs	Pressure
Land	Appropriate and sustainable farming systems.	Length of Available Growing Period	State
Land	Appropriate and sustainable farming systems.	Most Suitable Cereal	Driving Force
Land	Appropriate and sustainable farming systems.	Soil Production Index	State
Land	Appropriate and sustainable farming systems.	Meat Production - Total	State

Figure 4: Example of information provided for land by the GEO Africa data portal: state, pressure, impact and response indicators are identified. List of Environmental issues and Indicators linked to Land

The portal provides information for each region, sub-region. The type of outputs range from data values, graphs and maps.

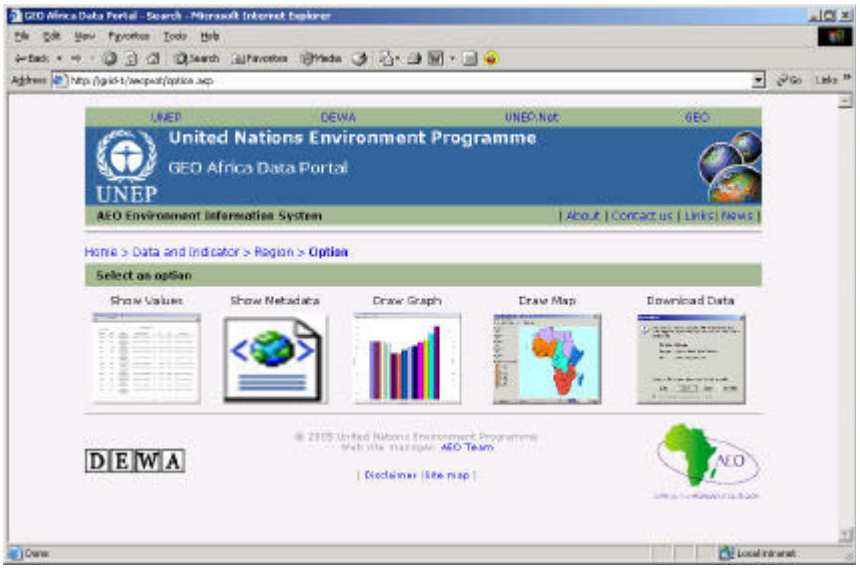


Figure 5: Type of output

Within the AEIN, national-level partners have been assisted to develop and implement National Environmental Information Portals, the purpose of which was "*to provide structured, comprehensive, coherent, accurate, current and validated/authorised information, and to facilitate access to key data and information resources on the environment and sustainable development*" for a wide range of users (UNEP, AEIN strategy).

4.3 The users of ICS

Potential users of the ICS include the following:

- National bodies (government) responsible for coordinating the UNCCD and the United Nations conventions in general;
- Provincial/district administration
- National, sub-regional and international institutions, including NGOs;
- Technical directors and other technical officials;
- Programme and project managers;
- The scientific and technological community;
- The media;
- The general public
- The private sector

Depending on the level of the decision-making, information can be useful or not. Below is a table developed in the framework of the AEIN[2] process. It indicates the level of usefulness of the information by decision makers.

[2] The AEIN initiative is designed as a capacity building programme that aims to harness and enhance access to information and knowledge to support the management of Africa's environmental resources as assets for sustainable development. A key objective of

Decision-Making Level	**Useful Information Types**	**AEIN Products/Services**
Policy-makers: Strategic (Vision and the long-term policy objectives for sustainable development)	♦ Forward-looking projections ♦ Scenarios and policy options ♦ "What-if" analyses ♦ Status of implementation of policy objectives ♦ Strategic environmental overviews/assessments	♦ Policy Briefs ♦ Vital (summary) graphics ♦ Specific decision-support applications ♦ Thematic extracts ♦ Executive seminars
Planning and implementing agencies: Tactical/Managerial (Implementation of policy objectives, ensuring that available resources are used efficiently and effectively to achieve the set objectives.)	♦ Scenarios and policy options ♦ What-if analyses ♦ Policy analysis/implications ♦ Indicator-based trends ♦ Comparative assessments ♦ Medium-term forecasts ♦ Special reports ♦ Situation analyses ♦ Status reports or updates	♦ Indicator-based environment and development reports at all levels ♦ Issue-specific, indicator-based thematic reports ♦ Thematic extracts ♦ Vital (summary) graphics ♦ Case studies ♦ *InfoKiosks*
First-line "actors": Operational Control (Use available facilities and resources to ensure that specific activities are carried out towards the attainment of policy objectives.)	♦ Primary data ♦ Thematic aggregations ♦ Situation reports ♦ Operational information and procedures ♦ Basic facts ♦ Other "transactional-level" information	♦ Indicator-based assessment reports (SoE, AEO, etc.) ♦ Environmental Data Compendia ♦ Metadata bulletin and information catalogues ♦ Datasets and databases ♦ *InfoKiosks*

Table 2: The users of the ICS
Source: UNEP unpublished (AEIN Strategy)

the initiative is to *"build capacity for establishing the essential data foundation needed to support country-level sustainable development initiatives, focusing on the environmental aspects".*

To provide greater insights into the generation, use and impacts of environmental information in local participatory decision-making, the Information Working Group for Africa (IWG), sponsored by the U.S. Agency for International Development (USAID) and the World Resources Institute (WRI), commissioned a case study of a local participatory decision-making exercise in Uganda. The purpose of this study was to test and evaluate whether two information-gathering techniques: one a relatively advanced technique Geographic Information System, or GIS) and the other a technique already commonly used at the village level Participatory Rural Appraisal, or PRA) can be combined to help local organisations prepare better rural development plans and make better decisions about managing their resource.
…
The results of this study indicate, among others that:

- Locally generated environmental information can be used to strengthen local-level decision-making. The community databases generated in this case study are proving useful for participatory rural development planning.
- PRA data can be collected, organised, and integrated in a GIS environment for better analysis of PRA data, enhanced communication and use in a community planning process.

The case study suggests various actions, including the three ones below:

- Policy makers in Uganda should support additional experimentation with community planning exercises that seek to combine modern digital information technology with participatory social surveys
- Researchers and GIS professionals in Uganda should provide additional results concerning the requirements for successfully integrating GIS and other information technologies with participatory methods of local development planning…
- Other African governments, with assistance from the international community should promote experimentation with modern information and communications technologies in participatory development planning.

Table 3: A case study from Uganda: combining use of PRA and GIS in Uganda
Source: WRI (2004)

5. Lessons learnt

Country ownership and political support

The political support is very important when implementing such initiatives. Politicians should be informed well in advance so that they can be involved at the early stages of the implementation phase and better arbitrate the different national partner structures.

The implementation of EIS is a consensual process of putting together the national information heritage encompassing all the public national actors, associations, and private sector involved in environment and natural resources management. Indeed, in addition to promoting information exchange between partners, the system allows the improvement of information flow by setting up data bases and information systems accessible through the Internet and other new technologies of information and communication (NTIC). The EIS is also a useful tool at the service of the implementation and monitoring of agreements and international conventions having an impact on the environment, including the convention to combat desertification.

Furthermore information sharing and circulation at the beginning of the process between and among partners from a region to another is useful and important as it enables to avoid duplications.

The questionnaire

Partners do not always fill in the questionnaire. Referring to UNCCD annex 1, for Southern Africa, in a total 58 questionnaires sent to different persons/institutions, only 8 have filled it in and returned it. For Northern Africa there was no replies.

The project managers in charge of implementing the project have to make sure that the questionnaire is in the appropriate language for each country and that it is not too long.

Besides, there is a need to bear in mind that several issues are to be taken into account when the environmental assessment process at the national level is at stake: it is notably important to assess the national needs and priorities so that we ensure the realignment of country level's needs and priorities to those of the initiative. Therefore the questionnaire is to be elaborated taking into account the needs and priorities of the countries, trying to harmonize it as much as possible as the same questionnaire is distributed to all the countries and partners.

EIS Network sustainability

Once it is set the EIS network should have a coordinator who will devote most of his/her activities to the promotion of the network, and make sure that the partners honour their commitments (periodic provision of data, and updating). The EIS network must continue functioning at the end of any project so as to maintain and sustain it. Otherwise all capacities that may have been built will not be maintained either. Then it is advisable to start looking for additional funds at the beginning of the project to ensure sustainability of the network.

EIS initiatives often reveal that gaps always exist – even if the institutional and technical resources of the countries are quite good. These gaps cannot be filled in the course of a one, two or three-year initiative. It is a very long process that needs to be followed up by the countries to ensure that data and information management processes are sustainable.

The sharing of information is very useful for all stakeholders, as they need regional overview of ICS in Africa in the framework of comparative studies, for example. The networking should be improved and a strong network and/or discussion list among countries should be created. The impact of any ICS project could be greater if experiences in each sub-region are shared in another way than only during meetings.

Synergies
The ICS creates an opportunity to create and strengthen synergies among institutions, and between existing networks.

Funding
In such processes it is not the question of remunerating the participants in the EIS network. However, because of lack of funds, it is difficult to organise meetings and workshops, data collection missions, digitization sessions… More funding would allow countries to organise specific activities such as meetings, workshops, consultations and assessment/ inventories.
Besides, Internet access is still a serious limitation for many of African institutions in the public sector, as they do not have reliable access to the Internet. Budgetary constraints and poor telecommunication infrastructure are the main factors of this situation. It should be improved not only for the data producers but also for the potential users.

6. Conclusion and recommendations
There are several existing Information circulation systems / EIS on desertification in Africa, and they differ from a country or region to another. These systems are useful for monitoring the activities on desertification and related issues such as land, water or forest management. It is also useful for decision makers who need accurate and updated information on desertification to take the appropriate decision and initiate the programme aimed at reversing the trends of land degradation for instance.
Nevertheless, the institutional set up have to be clearly defined and legal conditions to be understood and followed so that the initiative is fully supported by the political environment and has all the chances to succeed. Besides, the ICSs have to meet countries' needs and priorities.
The utilisation of NTIC seems to be the option for change in ICS on desertification initiatives. However, more funding should be given to countries to help them set up an adequate system on this matter. Indeed, Internet connexions in many African institutions are weak if not non-existent. A good Internet connexion would not only enable the dissemination of information on desertification but also to look for information from other sources/countries. On line discussion forums are also a good mean for exchanging information. Below are some specific recommendations relating to ICS in Africa:

- Countries should be encouraged to circulate information on desertification using the Internet and the NTIC, and if necessary they should be given more funding to achieve this. Besides, to a large extent, environmental information should be geo-referenced and require a GIS as a preferential tool, and African countries should adopt policies promoting access to geo-information. It is also recommended that emphasis be put on training on GIS for the personnel within the related African institutions.

- Regarding the questionnaire, in addition to sending it (via e-mail or courier), a combination of country visits and interviews would help accelerate the process of filling of the questionnaire.
- Besides, national stakeholders workshops should be envisaged to gather all the stakeholders to the meetings. They would feel themselves fully involved in the strategies for implementing programmes aimed at combating desertification and in setting up an institutional framework for information sharing and exchange at the national level. These workshops when organised at the beginning of the process would be the opportunity to retrieve the filled questionnaires.
- The setting up of a dynamic international ICS network on desertification would serve as a platform of exchange and of capacity building for the region. It would have an administrative and technical coordination with sufficient legitimacy to have power enabling it to play its coordinating role with success.
- Countries should be assisted for better coordination of EIS activities at national level and good communication should be maintained between network partners / national stakeholders;
- Once created the ICS network, must not be seen as an isolated and additional activity. Rather it should be seen as a complementary activity. For example, in Senegal, sectoral networks on water, forests, climate change etc already exist. The network would come as a unifying element. And the information we would like to generate and disseminate would be optimised and capitalised.
- The implementation of an African project on information circulation systems on desertification would aim at setting up a regional structure that would technically assist government institutions, NGOs, the private sector, etc in analysing and disseminating information on desertification in Africa. The structure would have the objective of meeting the users demand and needs (easy access to data and information, updating of a data base) and be established through a network framework between data and information producers, technicians, and end users.

List of acronyms

ADIE	Association pour le Développement de l'Information Environnementale
AEO	Africa Environment Outlook
AEIN	Africa Environmental Information Network
AfDB	African Development Bank
AIDCCD	Active exchange of experience on indicators and development of Perspectives in the context of UNCCD
AMCEN	African Ministerial Conference on the Environment
CEDARE	Centre for Environment and Development for the Arab Region & Europe
CILSS	Comité permanent Inter-Etats de lutte contre la sécheresse dans le Sahel
DIS	Desertification Information System
DISMED	Desertification Information System for the Mediterranean Basin
ECOWAS	Economic Community of West African States
EINMS	Environmental Information Network and Monitoring System
EIS	Environmental Information Systems
EPA	Environmental Protection Agency (Ghana)
GEO	Global Environment Outlook
GIS	Geographic Information Systems
IOC	Indian Ocean Commission
IUCN	World Conservation Union
NAP	National Action Plans
NEMA	National Environment Management Authority
NESDA	Network for Environment and Sustainable Development in Africa
NRMP	Natural Resources Management Project (Ghana)
NTIC	New technologies of information and communication
OSS	Observatoire du Sahara et du Sahel
SARDC	Southern African Research and Documentation Centre

SOE	State of Environment
SRAP	Sub-Regional Action Programme
UMA	Union of the Arab Maghreb
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environmental Programme
UNITAR	United Nations Institute for Training and Research

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ROLE OF INFORMATION CIRCULATION SYSTEM IN SCIENTIFIC AND PRACTICAL APPROACH TO COMBAT DESERTIFICATION CASE STUDIES AT REGIONAL, SUB-REGIONAL AND NATIONAL LEVELS FOR IMPLEMENTING ANNEX II OF THE UNCCD

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Recalling Article 6 (a) (b) (c) (d) of Implementation Annex II of the UNCCD Text:
(a): promoting and strengthening technical cooperation networks;
(b): preparing inventories of technologies, knowledge, know-how and practices, as well as traditional and local technologies and know-how, and promoting their dissemination and use;
(c): evaluating the requirements for technology transfer and promoting the adaptation and use of such technologies, and
(d): encouraging public awareness programmes and promoting capacity building at all levels, strengthening training, research and development and building systems for human resources development.

1. Introduction

On Nov. 16-18th, 2005, the World Summit on the Information Societies was held in Tunis. Mr. Kofi Annan, Secretary General (SG) of UN made a statement where he stressed that "this Summit must lead to information and communications technologies being used in new ways, which will bring new benefits to all social classes. Most of all, it must generate new momentum towards developing the economies and societies of poor countries, and transforming the lives of poor people". Mr. Kofi Annan further emphasized that "the information society also depends on networks. The Internet is the result of, and indeed functions as, a unique and grand collaboration. If its benefits are to spread around the world, we must promote the same cooperative spirit among governments, the private sector, civil society and international organizations" (www.itu.int/wsis/tunis/). Similarly, the information circulation system is an increasingly important tool for social and economic development, poverty reduction, monitoring environment degradation, policy/strategy/programme development, risk management and natural and human-induced disaster forecasting, and it is one of the driving forces behind the transition towards economies and societies based on information and knowledge. As the world moves forward to the Modern Information Era, the role of information circulation system will be more critical than ever in information-sharing, in the implementation of NAPs, SRAPs, RAPs and the whole UNCCD. There is also considerable scope for international information societies, governmental agencies and regional institutions to promote cooperation and coordination among and between inter-national, inter-regional and inline ministries to facilitate the flow of information among the communities, countries, sub-regions and regions. There is a general lack of information and knowledge, technical assistance, capacity building and training that could facilitate peer dialogue, exchange of experience, effective information-sharing, and accelerating and strengthening good practices. Therefore the implementation of national and regional information circulation system strategies is required at various levels from communities to geographic continents.

2. Facts of Information Circulation System related to Combating Desertification in AP

In AP region, there are many information circulation systems to serve UN agencies, international, multilateral, bilateral and inter-governmental agencies in the region. For instance, UNESCAP, FAO, UNESCO, UNDP, UNEP, World Bank, and others, all these agencies have their information services, information exchange and sharing channels. For example, the United Nations Information System in Bangkok (UNIS/B) is a professional unit to circulate and disseminate information to countries and peoples of AP region and it informs the people of AP about the work, activities and further development of UNESCAP and the United Nations. Among its many duties and responsibilities (www.unescap.org) are to:

- Publish and distribute, throughout the region, press releases, feature articles, newsletters and other information materials on United Nations and UNESCAP programmes, projects and meetings;
- Liaise with the local and international media to strive for maximum coverage of such programmes; to organize exhibitions to commemorate special United Nations observances and days such as the United Nations Day (24 October), World Environment Day (5 June);
- Assist educators, government and non-governmental organizations and special projects, by providing such information products and services as speakers, publications and audio-visual materials on United Nations and UNESCAP activities and programmes;
- Liaise with the other UN Information Centers (UNICs) throughout AP to disseminate information about/produced by UNESCAP;
- Distribute materials from the Department of Public Information, New York, in its seven constituent countries;
- Provide library and information technology services through UNESCAP Library.

At Sub-regional level, information services have been established and installed at some Sub-regional and inter-governmental agencies, like the

UNEP Regional Resource Centre for Asia and the Pacific (RRC.AP) (www.rrcap.unep.org/)**:**

RRC.AP envisions being the key agency to service the needs on environment data and information in the region. It was established in 1989 as a Global Resource Information Database (GRID) facility, which is situated within the Asian Institute for Technology (AIT) Bangkok, Thailand and was later expanded, to encompass DEWA activities. There are three components in the programme: (i) Capacity Building and Servicing, (ii) Data Management, and (iii) Assessment and Reporting. Assessment reports and Early Warning Systems are being developed through these three components.

Towards this goal, RRC.AP's three necessary elements for implementation include:

- Establishment of a Collaborative Assessment Network;
- Technical backstopping on Information Technology for the network and data archiving dissemination; and
- Assistance with SoE's at national, sub-regional, regional and global levels, and establishment of knowledge base as emerging issues of concern.

Mountain Environment and Natural Resources' Information System (MENRIS) (www.rrcap.unep.org/): International Centre for Integrated Mountain Development P.O. Box 3226; Katmandu, Nepal, Tel: (977-1) 525313; Fax: (977-1) 524509, 536747, http://www.icimod.org; Email: pramod@icimod.org.np

South Asia Environment and Natural Resources Information Centre (SENRIC)
South Asia Cooperative Environment Programme #10 Anderson Road; Colombo 5, Sri Lanka, Tel: (941)-596-443, (941)-589-787; Fax: (941)-598-369,
Email: pk_sacep@eureka.lk

Pacific Environment and Natural Resources Information Centre (PENRIC)
South Pacific Regional Environment Programme
P.O. Box 240, Vaitele, Apia, Samoa
Tel: (685) 21929; Fax: (685) 20231
Website: http://www.sprep.org.ws/; Email: GeraldM@sprep.org.ws

Centre for Alleviation of Poverty through Secondary Crops' Development in Asia and the Pacific (CAPSA) (www.uncapsa.org): It is a well developed information service and provides and distributes socio-economic information and data related to poverty alleviation and secondary crop development to member countries and relevant institutes, through its various activities below:

- Publications and dissemination: the Centre publishes monographs, working papers, a monthly bulletin and a quarterly newsletter. These are distributed to research institutions, libraries, universities and individuals worldwide.
- Production of occasional products: a publication catalogue is published every 2 years and available upon request and from its website. The Information Service (IS) department also publishes brochures (regarding CAPSA and its projects), posters, a CD-ROM of research project products and other give-away materials.
- E-commerce: on-line media to browse and purchase the Centre's publications and products. This programme is made possible by the support from IDRC-PanAsia and ASEAN Foundation.

3. Main Constraints and Needs in AP

AP is a diversified region with complex geographic, climate, social, economic and technical information. Data collection, information flow, file documentation and information sharing are well developed in some countries, but others are still at the initial stages. A few countries are equipped with advanced technology and devices but many are in urgent needs of capacity building in communication skill and need better equipment. Information circulation techniques differ from one country to another, not only in the terms of frequencies, but also in the quality and quantity. Particularly, in the least developed countries, poorly developed information sharing and circulation are barriers to alleviate poverty, combat disasters, improve living standards, heighten effectiveness of governance, accelerate cultural progress and develop human civilization. The prevailing main constraints are manifested as followings:

1- Insufficiency of institutional capacity for information circulation and data dissemination;
2- Weakness of political profile and knowledge to desertification and land degradation issues;
3- Lack of information, data, files and publications on implementation of NAPs, SRAPs, RAP and UNCCD;
4- Poor utilization of existing channels, facilities and means for data collection, information flow, exchange and analysis;
5- Necessity of creation of Websites and e-communication means at national and local levels;
6- Less development of contact database and information-sharing platform;

7- Shortage of academic exchange and technical cooperation, particularly in modern technological aspect, like satellite image and remote sensing techniques transfer;
8- Ignorance of Media tools for public awareness, training, education and capacity building;

By analyzing current facts and existing situation of information circulation system and summarizing prevailing experiences in information-sharing, dissemination and data exchange in AP, some primary needs are basically outlined for consideration and discussion among NFPs and concerned parties under the framework of UNCCD. In general, these outlines are just drafted as general/common principles for further action on information circulation and they can be elaborated through wide communication from scientific, academic and research levels to practical and end-users levels, or from bottom-to-up levels. From macroscopic viewpoint, the main needs for information circulation in AP are:

1. Continue to strengthen the institutional capacity and dissemination ability for information circulation at regional, sub-regional, national and local levels;
2. Further public awareness raising is needed to accelerate the political profile of the issues at top level and to enrich people's knowledge and understanding of the severity and urgency of the issues they face and to promote global, regional, sub-regional, national and local efforts dealing with desertification combating, land degradation rehabilitation and environment protection;
3. Publications on implementation of NAPs, SRAPs, RAP and UNCCD: these publications play a central role in disseminating concerned information to partners at various levels. There will be an issue series on the priority/thematic areas and case studies and lessons learnt as appropriate. It can be via printed copies, electronic versions and made available on internet, and through CD-ROM compilations;
4. Preparation of data, files and documentations: these information are aimed to describes NAP process in simple brochure or booklet format to be distributed to stakeholders/partners to brief implementation of NAPs, SRAPs, RAP and UNCCD at global, regional, Sub-regional and national levels;
5. Creation of NAP Website: it is useful to provide up to date information on NAP implementation matters, on development of new policies/programme/projects, lessons learnt, knowledge/know-how/best practices/traditional skill and case studies. The above I) and II) mentioned publications, data, files and documentation can be accessible through NAP Website;
6. NAP, SRAP, RAP and UNCCD contact Databases: e-mail account, contact list and mailing database must be set up and maintained/updated to ensure that all concerned publications/data, files and documentations reach all stakeholders/ partners, and development donors, including decision-making authorities, line ministries, departments, academies, media, civil societies, CBOs, NGOs and even private sectors who are strongly interested in the implementation of NAP, SRAP, RAP, UNCCD and operation of best practices in combating desertification and rehabilitating land degradation;
7. Academic exchange programmes and communication schemes: workshops, seminars, meetings and study tours/ground observation, field investigations provide opportunities to exchange ideas, ensure accurate understanding and fostering new ideas. These could also be training and awareness raising activities planned and financed in NAPs, SRAPs and RAP. These programmes and schemes should be an effective supplementary means for information circulation on the basis of multilateral or bilateral cooperation through SRAP and RAP mechanism;
8. Feedback system: effective forms of communication are set up to ensure that NAP

remains innovative and responsive to meet different needs. The feedback is on an informal basis through e-mail or questionnaire surveys regarding the usefulness of information;

9. Miscellaneous awareness tools: these could be cartoons, TV cassette, posters and other information kits.

4. Case Studies at Various Levels in AP

4.1. At Regional Level

Thematic Programme Networks (TPNs) in AP

The resolutions adopted during the First Regional Conference on the Implementation of the UNCCD, held in New Dehli, August, 1996, laid the basis for the preparation and development of the Regional Action Programme for Asia and the Pacific. Within the principles and provisions of the Convention, especially those in its Annex II, the Regional Implementation Annex for Asia, Asian and the Pacific country Parties, with continued assistance from the UNCCD Secretariat, have taken initiatives aimed at achieving the objectives of the Convention. As a follow-up to First Regional Conference in New Delhi, two other important regional meetings were organized: the Ministerial Conference on Regional Cooperation to Implement UNCCD in AP, held in Beijing on May 13-15th, 1997, and the International Expert Group Meeting on the Preparation of the Regional Action Programme for Combating Desertification and Mitigating the Effects of Drought in AP, held at UNCC/UNESCAP, Bangkok in Nov. 1998. Those meetings carried the AP through a process of mobilizing political commitment to regional and Sub-regional collaboration. They also paved the way for the formulation of a framework for the RAP and the development of NAPs. Furthermore, the meetings established TPNs that provide structural support and institutional arrangement for implementing RAP, which, essentially, are at the core of action for combating desertification in AP (www.unccd.int).

4.1.1 Desertification Monitoring and Assessment (TPN1)

Dealing with desertification monitoring and assessment and understanding the dynamics of drought involves a high degree of uncertainty with complex scientific, technical, socio-economic and administrative variables. Many countries in AP have taken advantage of space technologies, such as satellite-borne remote sensing and geographic information systems (GIS) for natural resources accounting and environmental monitoring. The current knowledge and understanding of the spreading processes of desertification and drought effects in AP is a product of space technology applications in meteorology and climatology, satellite communication, the use of global positioning systems (GPS) for environmental and disaster monitoring. There is a need in AP for promotional efforts to bring about public awareness, political profile, knowledge and understanding of space applications in policy/programme making for desertification monitoring and assessment. This gap can be addressed in the AP RAP by focusing its action programmes in the areas of: (i) developing the framework for the conduct of assessment and monitoring on the status of desertification at regional and national levels using in combination the various systems of space-based technologies; (ii) support to NFPs that will enhance and improve the linkage of national databases with regional and international databases applying digital and communication technology (e.g., internet, e-mail etc.); (iii) developing a regional framework for the conduct of joint or collaborative information gathering and database consolidation of scientific information on desertification rehabilitation, land degradation control, sustainable land/soil and water management; (iv) formulation of programmes that will promote the use of information

generated by space-based technologies for policy and programme development; and (v) transfer of information and data to field-level end users.

Objective

The overall objective of TPN1 is to enhance the desertification monitoring and assessment capacities of countries in AP through the establishment of a network and the harmonization of approaches for its conduct in the region.

Relevant Initiatives

1. Launching Meeting for TPN1 on July 26-27, 1999, Beijing, China. Outputs include: Decisions of the Launching Meeting and Background Paper for TPN1;
2. Workshop of TPN1 on June 28-30, 2000, Tokyo, Japan. Output of the Workshop are: Co-Chairmen's summary, Report of CST Ad Hoc Panel on Benchmark and Indicators, GM's Note on Resource Mobilization for TPN1;
3. Task Group Meeting on benchmarks and indicators (B&I) for desertification monitoring and assessment under TPN1 on Nov. 26-29, 2001, Beijing China; the outputs of the meeting include: Chairman's Summary and Appendix II;
4. TPN1 Meeting on Benchmark and Indicators Development and Mapping for Desertification Monitoring and Assessment on December 22-24, 2003, Beijing, China; Outputs of the Meeting: Chairman's summary and Framework of Mapping.

Participating Member Countries

China, India, Islamic Republic of Iran, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Mongolia, Oman, Pakistan, Philippines, Syria, Tajikistan, Thailand, Turkmenistan, Uzbekistan, Vietnam, and Yemen.

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4.1.2 Agroforestry and Soil Conservation in Arid, Semi-arid and Dry Sub-Humid Areas (TPN2)

The focus of these interventions is on arid or semi-arid lands, many of which were once forested or naturally vegetated. Over centuries, trees have been cut and the hills converted to grazing lands of grass and scrub. Tree removal, cropping and overgrazing have resulted in severe soil erosion and watershed depletion. Where dams have been built, silting of reservoirs from poorly protected watersheds is occurring.

Woody species of trees and shrubs can be used to establish greenbelts and windbreaks. The planting of fruit and nut trees also aids watershed management and other environmental stabilization. There is a need to establish which species and seed sources are of greatest value in forest management systems which are compatible with animal grazing. The determination of the economic value for various species of trees, and sharing of agroforestry developments with other countries are a regional priority. This is particularly the case in hill areas where forest management as a means of watershed and erosion control is a major concern.

It is acknowledged that many countries in AP have adopted approaches and strategies for intensifying reforestation in arid lands. As a result of practical methods of inoculating indigenous species with their symbiotic nitrogen-fixing bacteria to hasten growth of trees in arid and semi-arid lands, many hill lands have been planted with trees, as have areas around new towns and in water catchment sites in drier areas. Another approach is the establishment of seed banks of native species of trees and shrubs which will be used to reforest wild lands in areas prone to erosion. In several

countries, governments are active with aforestation programmes for hill lands, and establishing windbreaks and greenbelts. In many countries there is a mix or interface of aforestation with orchard tree planting involving olives, almonds and figs in the drier areas and other fruits where there is more rainfall. Much practical work has been undertaken to combine tree planting with hillside stabilization to reduce rainwater runoff, and forest areas are increasingly used for recreational purposes.

Objective

The overall objective of TPN2 is to curtail the process of wide-scale deforestation and watershed degradation through the development and promotion of economically viable and environmentally sound technologies for expanding tree cover and their incorporation into farming systems.

Relevant Initiatives

1. The International Experts Group Meeting on the Preparation of the Regional Action Program (RAP) for Combating Desertification and Mitigating Drought Effects in AP on 10 - 13 November 1998 at UNCC/UNESCAP, Bangkok, Thailand. Outputs are: Conclusion, TPN1 Framework Paper, TPN2 Framework Paper, and TPN3 Framework Paper;
2. Launching Meeting of TPN2 on March 14-18, New Delhi, India. The outputs are: Decisions of TPN2, and Proceedings Note;
3. First TPN2 Workshop on 18 - 21 December 2001, Hyderabad, India. Outputs include: Chairman's summary, and proceedings.

Participating Member Countries

India, Islamic Republic of Iran, Jordan, Kyrgyzstan, Laos, Mongolia, Myanmar, Nepal, Niue, Sri Lanka, Syria

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4.1.3 Rangeland Management in Arid Areas Including the Fixation of Sand Dunes (TPN3)

The principal economic value of arid and semi-arid rangeland is provision of grazing for livestock, primarily sheep, goats and camels. Livestock production is one of the major economic and subsistence activities of the arid and semi-arid lands of AP. Rangelands also constitute the largest area of degraded lands in certain zones of AP. The three principal types of rangeland degradation result from: (a) overgrazing, which reduces plant cover and the proportion of plant species that can be consumed by livestock; (b) removal of range vegetation for agricultural production; and (c) collection of fuel woods. A number of factors influence these forms of rangeland degradation. These include: reduction in the area of rangeland resources available for pastoral activities (due to privatization and conversion of range to other forms of land use); shifts away from traditional livestock management practices (including provision of water and feed supplements in areas where stocking rates should be limited); land tenure issues, and population growth. Overgrazing and unsustainable rangeland use is reducing rangeland productivity and biodiversity and, in some instances, is causing desertification.

The generally low priority assigned to tackling range degradation through improved range management has been associated with lack of awareness of the main issues on the part of both policy makers and resource users, and the low level of political influence of pastoral groups. There is an urgent need to identify and establish rangeland management systems that are productive, environmentally sustainable, and socially equitable. TPN3

is a participatory and voluntary network involving a wide range of members, including countries, national institutions such as the Forest and Range Organization and local community groups such as village councils. The national, provincial and local offices of TPN3 collaborate with many governmental and non-governmental agencies and groups.

Objective

The overall objective of TPN3 is to re-establish sustainable systems for managing rangelands and livestock production in the rangelands in an economic and socially equitable manner. This will entail the definition, development and application of participatory approaches to rangeland management in order to enhance recovery of vegetative cover to increase rangeland productivity, and improve options for social and economic development for those communities using these fragile areas.

Relevant Initiatives (Planned Pilot Projects

1. The launching meeting of TPN3 was held on 7 to 9 May 2001, at Yazd (I.R. Iran);
2. Draft proposal pilot project: Sand dune fixation in TPN3 member countries;
3. Proposal of pilot project: Rangeland management in TPN3 member countries; and
4. Combination of Traditional Methods and Modern Technologies for Rangeland Management.

Participating Member Countries of TPN3

China, Islamic Republic of Iran, Jordan, Kazakhstan, Kyrgyzstan, Oman, Pakistan, Qatar, Saudi Arabia, Syria, and Uzbekistan.

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Email: fro_fcic@hotmail.com

4.1.4 Water Resources Management for Agriculture in Arid, Semi-arid and Sub- Humid Lands (TPN4)

Sustainable use of the limited supplies of water and the avoidance of degradation of irrigated soils are complex issues affecting all countries in AP region. Over-irrigation combined with inadequate irrigation systems and, in water-scarce areas, the reuse of drainage water for irrigation, has led to water logging and salinization. Improved efficiency in the use of marginal water is being explored in several countries through use of brackish aquifers and treated wastewater. Processing and use of urban wastewater, the effective exploitation of brackish aquifers, and the use of limited poor quality water resources for sustainable agricultural productivity, will require a thorough integration of existing activities and interventions through policy and economic incentives. The sharing of experience in this area amongst countries of AP is especially useful. Management of marginal water and the soils receiving it will require improved technologies and new investments in wastewater recycling, brackish water processing, soil management, and soil and water quality monitoring. Water use efficiency can also be improved through introduction of drought and salinity tolerant crops. Major constraints to the use of marginal water and reclamation of saline soil for agriculture include: insufficient precipitation on irrigation water for leaching salts from agricultural soils; the high investment cost of treatment facilities for wastewater; outdated regulatory standards governing the use of saline and waste and surface waters in agriculture; inadequately defined national policy and institutional responsibility for management of marginal waters and saline soils, and insufficient technical expertise and access to ongoing activities in this field of research and development.

Objective
The overall objective of TPN4 is to promote cost effective approaches to the use of scarce water resources, to minimize further soil degradation caused by salinization, and to test methodologies for the reclamation and use of already degraded soils. Information-sharing and expertise exchange are the main priority tasks of TPN4.
Relevant Initiatives
1. Launching Meeting of TPN5 was taken place on July 4-7th, 2002 at Damascus, Syria;
2. TPN4 Status Paper with Annexes has been drafted on Aug. 31st, 2000;
3. Report on the analysis of the Questionnaire has been developed;
4. TPN4 Focal Institutions have been investigated;
5. Summary Report of the Questionnaire has been drafted;
6. TPN4 Framework Paper has been prepared.

Participating Member Countries
China, India, Jordan, Kazakhstan, Kyrgyzstan, Mongolia, Philippines, Qatar, Saudi Arabia, Sri Lanka, Syria, Tajikistan, Turkmenistan, Uzbekistan, and Yemen.
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4.1.5 Strengthening Capacities for Drought Impact Management and Desertification Control (TPN5)
The vastness of AP gives a different characterization of the arid, semi-arid, dry sub-humid and sub-humid areas of the largest region on the planet, making it equally difficult in formulating a single strategic approach to drought management. It is imperative to make a risk- analysis assessment of AP in relation to the frequency of drought occurrence as well as its severity. Drought is a recurring climatic phenomenon that should be distinguished from climatic change. However, the frequency of drought is certainly affected by climate change. Historical analysis of climatic variations and drought occurrence is very important as a basis for risk assessment. Moreover, existing models of projected climatic change in the above regions as a result of the postulated greenhouse effect should also be used in risk assessment, particularly with regard to possible changes in aridity and drought frequency. In parallel with the risk analysis, an assessment has to be made concerning the impact of climate change, drought and desertification on both agricultural production and food security in the sub-regions of AP. Livestock, production systems, whether extensive, intensive, or as mixed farming, should be included as a separate part of agricultural production and food security. The agricultural production of food is only one element, albeit a very important one, in the analysis of food systems and food availability, which together relate to food security. Other items to be included: climatic and environmental review by region in relation to agricultural and livestock production and food security, food production figures by category with time, food reserves in relation to food security, vulnerability (environmental, economic, social), bottom-up and top-down related causes for changes in agricultural production and food security, as well as recommendations for improvement in food production and food security with increased drought preparedness and desertification control.
Objective
The overall objective of TPN5 is to enhance preparedness and strengthen institutional capacities to plan for drought preparedness and management with the end view of developing early warning systems and medium-range forecasting methodologies for

improving food security.

Relevant Initiatives

The launching meeting of TPN5 was held on July 14-16th, 2003 in Ulaanbaatar (ULB), Mongolia. The following topics have been discussed at different sessions:

1. Assessment on Capacity Building for Combating Desertification and Mitigating Drought in the Context of UNCCD Implementation in AP;
2. Early Warning System for Desertification and Drought;
3. Integrated Ecosystem Management and Drought Risk Management;
4. Priority Programmes of TPN5 and Management of TPN5 Activities;
5. Drafting of PTN5 Operational Guideline and Priority Programmes.

Participating Member Countries

China, Fiji, India, Japan, Laos, Kyrgyzstan, Mongolia, Nepal, Samoa, Sri Lanka, Syria, and Vietnam.

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4.1.6 Assistance for the Implementation of Integrated Local Area Development Programmes (LADPs) Initiatives (TPN6)

This area is closely linked to NAPs. Noting that the poor are both agents and victims of desertification, it is necessary that decentralized institutional arrangements and economic incentives are developed to assist the poor in managing natural resources. The Convention's poverty orientation explicitly reflects the main development challenges facing many of UNCCD country parties. To eradicate poverty, the Convention proposes measures linked to the development of rural markets, expansion of agricultural diversity, establishment of adequate price and tax policies, promotion of drought-resistant crops, and application of integrated dry-farming systems. The attainment of these aims not only demands a reappraisal of the financial aspects of the development process but also an intensive resource mobilization both domestically generated and through official development assistance.

Similarly, efforts to combat desertification should be closely coordinated with the affected communities, promoting their participation at all levels of decision-making. Given the strong social dimensions of sustainable development, the Convention is focused on: a) promoting effective participation at local, national and regional levels of non-governmental organizations (NGOs) and local populations, including women, farmers, pastoralists and their organizations; b) encouraging the use of cooperative mechanisms, including NGOs; c) responding to the specific needs of local populations, promoting traditional and local knowledge, and strengthening extension and dissemination; and d) giving due consideration to local area development programmes.

Objective

The overall objective of TPN6 is to support a comparative analysis of locally developed initiatives undertaken by communities which adopt specific and innovative approaches in combating desertification. The intention is to pilot these experiences and consolidate the results for possible replication on AP region-wide scale.

Relevant Initiative

The launching meeting of TPN6 was conducted on May 2004 in Islamabad, Pakistan.

Participating Member Countries
Open to all countries in AP which can mobilize villages to implement integrated local area development projects in combating desertification.
China, Fiji, India, Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Laos, Lebanon, Mongolia, Pakistan, Philippines, Oman, Qatar, Samoa, Saudi Arabia, Sri Lanka, Syria, Tajikistan, Uzbekistan, and Vietnam.
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4.2 Asia Regional Coordination Unit and its contribution to Information Circulation
The Asia RCU is recognized as a cost effective, demand-driven support structure for the TPNs. The facilitation of the function of the TPNs largely hinges on the creation of the RCU which is contemplated to be set up in response to needs identified during the initial phase of implementation of the RAP. The Asia RCU is stationed in Bangkok and co-hosted by UNESCAP. Asia RCU started its operation in Sept. 1999 on the basis of MoU for co-hosting of Asia RCU between UNCCD Secretariat and UNESCAP. It supports and reports to the Steering Committee. Responsibilities of the Asia RCU include:
a) Secretariat of steering committee and overall support and coordination of the RAP;
b) Assistance to the TPNs in the design of the RSPs, including:
   i) Preparation of project portfolios for possible financing institutions;
   ii) Coordination and facilitation of links among programme components;
c) Manage capacity-building programmes identified and prioritized by the TPNs; and
d) Assistance in the development of a framework of programme indicators and milestones for monitoring and assessing impacts;
e) Help NFPs formulate and approve their NAPs;
f) Provide technical assistance services to NFPs to implement the NAPs, SRAPs, RAP and UNCCD at national level;
g) Offer logistic service to interregional and regional agencies for conducting pilots and demonstrations in AP;
h) Coordinate planned activities on combating desertification and rehabilitating land degradation in UNESCAP regions; and
i) Conduct synergy among international conventions, on the basis of MoU between UNCCD and UNCBD and UNFCCC.
Asia RCU's inputs to help NFPs organize national awareness raising campaigns, NAP formulation workshop, conventions synergy seminars and round-table meeting in the following countries in AP: Bangladesh, Cambodia, China, DPRK, Indonesia, Laos, Mongolia, Myanmar, Nepal, Palau, PNG, Samoa, Singapore, Thailand, Vietnam.
Asia RCU, in collaboration with other UN agencies and international institutions, has published the following publications and has disseminated to public:
a) *Publication of "Global Alarm: Dust and Sandstorm from World Drylands".* UN Publication, Feb. 2002, 345 p. English and Chinese versions, www.unccd.int/publication.
b) *Revelation to Combat Desertification and Rehabilitate Land Degradation in China,* China Science Press, Beijing, Aug. 2004, 329 p. Chinese version, www.sciencp.com;
c) *Publication of "Regional Review of UNCCD Implementation and Best Practices in Asia and the Pacific—Case Studies from Australia, China, Mongolia, Thailand and*

Vietnam". China Environmental Science Press, Oct. 2005, 279 p. English Version, published especially for the COP7 on UNCCD held on Oct. 17-28, 2005, at UNON, Nairobi, Kenya, www.cesp.com.

d) *Newsletters of DSS.* 2003-2004. (www.asiansandstorm.org.)

Asia RCU has created DSS Website: www.asiansandstorm.org at the end of 2002.

4.3 At sub-regional Level

Dust and Sandstorms (DSS) in Northeast Asia (NEA)

DSS is a serious environmental phenomenon in Northeast Asia (NEA). The major sources of DSS in the region are the arid and drylands of China and Mongolia (DSS originating source areas) and it is a long-range transboundary environmental problem.

4.3.1. The Issues of DSS

DSS as a natural phenomenon has occurred for thousands of years in the region. During the past 50 years, however, the frequency has increased, geographic coverage has expanded, and damage intensity has accelerated. China's statistics indicate that average occurrence of DSS was 5 times a year in 1950s, 8 times in 1960s, 14 times in 1970s, and 23 times in 1990s. The region experienced 32 DSS in 2001, and the most severe DSS for decades in early 2002.

Large-scale DSS has significant environment effects that cause enormous economic losses, present serious public health concerns over a wide geographic area. Taking the DSS event on 5 May 1993 as an example, this DSS disaster directly affected 1.1 million square kilometers in China, which resulted in death of human beings and animals. It was estimated that 4,412 houses were destroyed, 120,000 livestock dead or lost, and 373,000 hectares of crop land damaged. The direct economic cost of this DSS in China was as high as US$66 million. Two disastrous DSS in decades took place in March and April 2002 in the sub-region. They swept across Mongolia and hit 18 provinces in China, the Korean Peninsular, and some districts of Japan. Total suspended particulate levels in these affected areas were recorded from tens to hundreds of times higher than the national standards in these countries. The DSS in early April was so severe that Mongolia had to close its international airport in ULB for 3 days, and the Republic of Korea had to close primary schools and cancel more than 40 flights departing from Kimpo Airport in Seoul. Satellite images of DSSs and analysis of the dust samples collected on the ground have revealed that impacts of strong DSSs are not limited to the region, but reach as far as North America across the Pacific Ocean.

Natural elements, huge arid/semi-arid zones and drylands landscape surface, prevailing strong and dry winds from the Siberia drifting DSS originating source areas, prolonged drought, natural disasters, and other factors contribute to DSS occurrence and spread. However, intensity and severity of DSS have been significantly strengthened and reactivated by human interventions during past decades, such as overgrazing, over reclamation, deforestation, and mis-management of water resources in the arid/semi-arid and dryland regions, which lead to rapid land degradation and soil deterioration. Although all the countries in the region are affected by DSS, urgent and positive actions are needed in the DSS originating source areas in China and Mongolia to rehabilitate degraded land, before the situation becomes irreversible.

4.3.2. Concerned stakeholders

China and Mongolia have developed and formulated their NAPs to Combat Desertification and incorporated their NAPs into their Five-Year National Economic and Social Development Plan. In early 2002, China announced a 10-year program with

a total investment of Chinese Yuan (CNY) 54 billion (about $6.5 billion) to address the DSS concern in the northern China. However, the linkage of these national initiatives to the regional concern of transboundary DSS is yet to be set by establishing a cooperative mechanism beyond national borders. Without an effective policy and coordination at a regional level, the effectiveness of the national initiatives will be limited.

The intensified transboundary DSS has mobilized very strong political will for sub-regional cooperation on prevention and control of DSS, particularly in the DSS-prone areas, where peoples have been exposed to the impacts of DSS disaster on living environment, life standards, economic growth and even public health issues. In addition to various initiatives of the governments, civil societies and volunteers from the DSS-prone countries have been actively undertaking cross-border activities to mitigate the disasters caused by DSS, but in a sporadic and uncoordinated manner. Regional cooperation will maximize the effects of the initiatives from the private sector and civil societies in the affected countries.

4.3.3 Multilateral donations

To address this disastrous environmental issue in NEA, a sub-regional cooperation mechanism is needed among the countries in the sub-region so that the problem can be addressed in a coordinated manner with wider concerns from sectors. At the request of the governments of the China and Mongolia, in early May 2002 the ADB started to prepare a regional technical assistance (RETA) for prevention and control of dust and sandstorm in NEA. In parallel, three agencies of the United Nations—UNEP, UNESCAP, and UNCCD—initiated a similar project proposal to seek support from the GEF to address the same environmental problem in the region.

To integrate the support from the international community and maximize its effects, at a meeting among the environment ministries of China, Japan, ROK, and Mongolia in June 2002, the governments of the four countries proposed that ADB, UNESCAP, UNCCD, and UNEP jointly develop an expanded and integrated TA to promote regional cooperation on DSS to be co-financed by GEF. A joint fact-finding and consultation mission comprising representatives from ADB, UNESCAP, UNCCD, and UNEP and led by ADB visited China and Mongolia from 26 August to 2 September 2002. The mission reached an understanding with the governments of China and Mongolia on aspects of the TA including the goals, purpose, scope, implementation arrangement, cost estimates, financing plan, and terms of reference.

4.3.3.1 Programmed Activities for regional monitoring and early warning system.

Phase 1 (short term) Data sharing with existing monitoring capacity.

In this phase the network monitoring stations in the source areas are identified (25 in China and 5 in Mongolia, plus designated stations in ROK and Japan and arrangements are finalized to allow data sharing in real time. A decentralized network is preferred with data sharing for the purpose of short-term forecasting. Priority is given to gathering PM10 data and instrumented visibility readings.

Phase 2 (medium-term): Strengthening of monitoring capacity.

This involves expansion of the number of network monitoring sites, especially in Mongolia and upgrading the equipment at selected sites. The principal focus will be on adding PM10/TSP at many sites and Light Detection & Ranging (a scientific device) (LIDAR) measurements at a few sites in China and Mongolia.

Phase 3 (Long-term): Strengthening of forecasting and early warning capacity. This phase will focus on improvement in forecasting methods (including software development, training and capacity building) to provide both short-term (early warning)

and long-term (seasonal) predictions. Long term forecasting will depend heavily on data derived from ground surface monitoring and on verification of prediction model output. The Phased approach should involve simultaneously planning the best way to quantify important parameters and how to identify and equip the selected sites. An expected benefit will be aimed at the collection of data that enables the link between anthropogenic influences and DSS outbreaks to be identified and to use feedback from the network monitoring system in the prevention and control of DSS.

4.3.3.2 Programmed Activities for Investment Strategy for Establishing a Joint Demonstration for DSS Prevention and Control at Sino-Mongolia Border.

Objective of the Programmed Activities is to develop and demonstrate the good practices in combating land degradation and desertification, and to promote sustainable land management and integrated water resources management at Sino-Mongolia border area, so as to better prevent and control the development of DSSs originated in this border region. Specifically, these programmed activities are aimed to increase human and institutional capacity building or strengthening. To this end, training facility will be established, while joint or separate training programme for Mongolian and Chinese "trainers" and technicians will be developed, as appropriate. The training programme would facilitate technology transfer from China to Mongolia. The technical capacity of the local community may also be enhanced through a properly designed public awareness programme, which may include exchange field visits between Erlianhot of China and Zamin Uud and Mongolia. This would, in return, result in the improvement of the quality of life and reduction of property damage as experienced by the people in Erlianhot and Zamin Uud, as well as those in the DSS downwind areas. It is expected to yield the following outputs:

(a) Demonstration sites that show case the good practices of re-vegetation programmes for stabilizing the soil surface, and hence preventing and controlling the development of DSS in these source areas; of sustainable grassland management, including community-based grassland management; of integrated water resources management, including various cost-effective water harvesting techniques, and the use of wastewater for irrigation in re-vegetated sites and for greening the cities programmes;

(b) Human and institutional capacity strengthening through joint comprehensive training programmes, especially the training of "trainers", on combating land degradation and desertification, sustainable land management, integrated water resources management, including public awareness programme at community level. To this end, appropriate training facility will be established while training programme, which would facilitate technology transfer from China to Mongolia, will be developed;

(c) Cooperative mechanism between the two sides for data collection, information sharing and exchange regard to the above mentioned sustainable land/grassland, water management and DSS prevention and control.

As final results, the studies of this DSS project have been concluded as a three-volume report. The first component is focused on the establishment of regional network monitoring, early warning and forecasting DSS. It presents a phased programme to establish a regional DSS monitoring and early warning network by strengthening the monitoring capacity in China and Mongolia, establishing an institutional framework among the partner countries, and improving the information flow for effective early warning services. The second component is focused on 1) selection of demonstration sites in both China and Mongolia; 2) the identification of best practices for the demonstration projects for DSS prevention and control; 3) development of an

investment strategy including recommendations on sustainable financing mechanism for the promotion and dissemination of best practices in addressing the causes of DSS.

- Regional Master Plan to Prevent and Control DSS
- Establishment of Regional Monitoring and Early Warning Network for DSS Prevention and Control in NEA
- An Investment Strategy for the Prevention and Control of DSS through Demonstration Projects.

4.4 At National Level

4.4.1 Case of Nepal

Land degradation and desertification are the prominent environmental issues in Nepal. The State of the Environment Report 2001 urged implementation of land improvement activities to arrest further land degradation as curative and/or rehabilitative measures while desertification is a dynamic and prevailing problem at present and requires preventive actions. Nepal has progressed since 2000 in generating information and drafting the NAP. The NAP recognises the need for continuation of various programmes and actions as preventive and rehabilitative measures for increasing the productivity of land and water system with a bearing on poverty reduction. The NAP opens avenues to integrate and expand income-generating activities in its national and local programmes. The NAP requires adequate funding, trained human resources, enabling mechanisms and expanded monitoring and evaluation system for its successful implementation. In this context, Nepal expects additional technical and financial assistance from bilateral and multilateral donors. Nepal also expects that NAP implementation will help in addressing the major problems of the mountains, reducing poverty, further bringing the people in the mainstream of natural resource management, and resolving highland-lowland issues at the sub-regional level.

Nepal is making efforts to implement various provisions of the Convention in a phased manner and has expanded policies, awareness raising, capacity building in legislation reinforcement and programmes development to ensure people's participation in natural resource management and desertification rehabilitation.

Measures Taken within NAP Framework

Land degradation and desertification have been clearly stated as the most important issue requiring urgent action in the State of the Environment Report, 2001 (UNEP, 2001; Annex 1). Besides other studies conducted by different organisation, Nepal has completed the following six studies directly related with the Convention (MOPE, 2001) after the submission of the First National Report in 2000 to CRIC. They are:

- *National Programme and Country Status Paper on Combating Desertification, July 2000* - synthesis UNCCD obligations, present status and recommended actions along with capacity building needs.
- *Traditional knowledge, know-how, practices and technologies, July 2001* – documents major practices and technologies currently in use.
- *Identification of financial, technical and technological needs, July 2001* – documents financial needs on capacity building of grass-root institutions, and development and transfer of appropriate technologies; technical needs on research and extension, integration of poverty alleviation, classification and mapping of degraded land, community empowerment, partnership building, and involvement of private sector; proposes needs for water harvesting and management, appropriate farm technologies for non-cereal crops, early warning system, non-forest-based alternative energy, and reduction of CFC emitting substances.
- *Identification of capacity building and public awareness activities, July 2001* –

outlines activities on improving knowledge base, access to information, capacity building for information dissemination, maximize the use of print and electronic media, provide research internship etc.

- *Identification of data needs, desertification monitoring and evaluation parameters (indicators), July 2001* – documents data requirements on land classification, stock and yield rate of different land uses such as agriculture, forests, and pasture, monitoring of weather, soil, ground water, population and migration etc.
- *Linkages amongst UNCCD, UNCBD and UNFCCC and identification of issues for the development of necessary regulatory measures for UNCCD, July 2001* – describes common approaches to these three conventions particularly on objectives, poverty alleviation, national policies and strategies, information sharing, research and training, traditional knowledge and know-how, community participation, public awareness and emergency responses. This study recommends to codify and amend environmental laws, and to change the current land holding and land use policy.

Effectiveness of Measures in Local Capacity Building

Nepal has institutionalised users' participation in its resources management programmes, and has continued to build local capacity in developing and implementing operational plans in community and leasehold forests. Local people are being promoted in an effort to resources management and their sustainable use through policies and legislation. The government institutions and NGOs have continued to build the capacity of the users. However, its coverage is low. Nepal realises an additional need for developing capacities of the local bodies and grass-root institutions so that policies and legislative provisions are adequately translated into actions.

Local NGOs and CBOs will be the main facilitators and implementers in promoting public awareness. They will develop farmers' capabilities in implementing NAP activities. The academic, scientific and research institutions will be encouraged to conduct site-specific research and refine locally suited techniques and technologies blended with scientific innovation. The academic and research institutions such as the Royal Nepal Academy of Science and Technology, Institute of Science and Technology, Institute of Agriculture and Animal Sciences, Institute of Forestry, Department of Forest Research and Survey, Department of Plant Resources, and Nepal Agriculture Research Council, Department of Water-induced Disaster Prevention, Department of Hydrology and Meteorology will be encouraged to participate in data collection, information analysis, information-sharing, problem-solving action research, develop technologies, provide scientific advices and facilitate the farmers to adopt proven techniques and technologies independently or through collaborative arrangement.

4.4.2 Case of Vietnam

Status of information data

There is a close contact between National Focal Point (NFP) of Vietnam and UNCCD Secretariat and its Regional Coordination Unit co-hosted by UNESCAP in Bangkok. All information is available by two-way (international-national) communication. There is also another information channel between TPNs 1, 2, 3 host countries and NFP and TPNs' national focal institutes through transferring information by e-mail, internet and workshops/meetings.

In Vietnam, there is also close collaboration and communication between NFP and other line ministries through National Coordination Body (NCB) members. The information data are now available at NFP unit as well as at Forest Sector Support Programme Coordinating Office. The main specific documents related to combating desertification include:

1. National report on combating desertification, April 2000
2. National Action Programme on Environment and Sustainable Development
3. National Action Plan on Biodiversity
4. Final draft of National Action Programme on Combating Desertification submitted to the government for approval, March 2002
5. National Forest Sector Development Strategy
6. Memorandum of Agreement (MoA) of Vietnam Forest Sector Support Programme and Partnership
7. Agriculture and Rural Development Strategies
8. Land Law
9. Forest Protection and Development Law.
10. Compendium of Rural Development Projects/Programme, etc.

Communication and Information Channel

An effective mechanism for disseminating and sharing information, knowledge and experiences within sector, among sectors, among countries and international organizations is very important for implementing NAP. This mechanism is characterized by the following objectives:

1. Provide cutting-edge information, knowledge, and experiences on NAP implementation to sectors with or developing NAP and those supporting NAP, such as international organizations, bilateral donor agencies, and NGOs;
2. Generate and disseminate cutting-edge information, knowledge, and experiences relating to key areas of NAP: 1) combating land degradation; 2) stabilizing shifting sand; 3) preventing deforestation; 4) drought mitigation; 5) livelihood improvement;
3. Provide knowledge on the impact of activities in the related sectors and on synergy among governmental agencies;
4. Establish effective networking partnerships for information sharing with other organizations undertaking complementary work and provide platform to support information-sharing and data exchange and learning on best practices for combating desertification;
5. Fill gaps in the existing communication flows between different levels of decision making that influence the implementation of NAP;
6. Enhance two-way communication between the national and local level, strengthen the provision of information, knowledge, and experiences relating to desertification issues from international organizations;
7. Contribute to establishing a common understanding of NAP at international level through collaboration, information-sharing and exchanging of views;

Communication mechanism

1. The communication is strategic and targeted with an emphasis on quality over quantity. They are focused on NAP priority issues, and on sustainable development. The communication is targeted to meet specific needs of NAP implementation process, needs of its main stakeholders;
2. Vietnam establishes effective networking partnerships among sectors, organizations undertaking complementary work to achieve maximum impact with limited resources. Vietnam sets up a network of such partners so as to be very well connected and aware of the existing information and knowledge relevant to NAP implementation process, and to have immediate access to the best available information and knowledge;
3. NAP network of partners includes international organizations, multilateral and bilateral donor agencies, environment-related conventions, regional processes, NGOs, research institutes, and the private sectors;

4. A feed back system where partners express what communication services are most effective is the central to NAP communications and to ensure that NAP remains innovative and responsive to meet varying and evolving information needs.

5. Recommendations

It has been demonstrated that information circulation/service/sharing are supportive and useful for the successful implementation of the Annexes of UNCCD and operations of NAPs, SRAPs and RAPs. Cooperative mechanisms are necessary for the information circulation and sharing among agencies, institutions, academies, communities and peoples in all Annexes regions of UNCCD and affected country parties. At present, recognition (political profile) of information circulation/service needs to be elevated and necessary support/help are needed from international/national and local donations and technical support in kind. In consideration of further smooth and effective operation of information circulation, particularly in the aspects of scientific and practical approaches to combating desertification at various levels, the following recommendations are made for your consideration at the AIDCCD Seminar.

5.1 At global level

Make a full use of existing information services of UN agencies, international organizations, regional, sub-regional units and inter-governmental bodies, which are free of charge.. For this practical purpose, it is recommended that an inventory and current information circulation, database, capacity building for awareness raising information analysis and service should be encouraged and conducted with assistance from the Information and Library Unit of UNCCD. An information circulation linkage and exchange platform should be established among the UNCCD Annexes regions on the basis of the said mentioned inventory.

5.2 At regional level

In all Annexes regions of UNCCD, TPNs have been stationed in a certain countries and equipped by in-kind supports and financial assistance by the hosting governments. Some TPNs have made visible efforts and developed good results, but some are in fact are unproductive as their capacity is limited by lack of financial and technical supports from the participating member countries and multilateral institutions. Therefore, GEF and development partners are recommended to consider the feasibility of offering financial and technical assistance to the successful operation of the TPNs. One Medium-sized Project (MSP) of GEF could be mega project for each TPN for conducting a Medium-term programme, especially in information collection, analysis, circulation and exchange among affected country parties between Annexes regions and sub-regions. For instance, TPN1 of AP has compiled a draft map of Desertification in Asia and the Pacific using its own finance, labs facilities and technical human resource, but the final academic review, ground interpretation, labs technical treatment and final production of the map is stopped by lack of financial donation.

5.3 At sub-regional level

In AP region, there are a number of sub-regional, inter-governmental and private information centres and data services which installed and funded by international, multilateral and national authorities and institutions. A major failing is that these information centres and data services are weakly linked, and lack coordination in work plan, data collection and information dissemination. Consequently, many duplicated and overlapping works have been programmed and conducted among these information

services and centres. In consideration of resource-saving and dissemination efficiency of information production, it is suggested that an annual meeting on information dissemination, work loads, information development and service should be organized at regional, sub-regional and national level, similarly like this AIDCCD seminar sponsored by EU and Italian Institution.

5.4 At national level

In almost all affected country parties of the Annexes regions of UNCCD, the importance and necessity of information circulation/dissemination is well recognized. But the problem is that the frequency, quality and quantity and outcomes of information dissemination/circulation are limited by the shortage of financial resources and technical backup. The Desertification database is needed at least in each affected country for providing baseline scientific data to be used in decision making, project programming and management and guide international cooperation in combating desertification and rehabilitating land degradation. The proposed National Desertification Foundation is suggested to be the resource mobilization and GM of UNCCD should lay its focus on this issue. Development partners are warmly welcomed to join this initiative and make a contribution to international information circulation and data service. European Space Authority and the *DesertificationNet* of Germany set pioneer example in this field.

5.5 At academic level

Information sharing, data exchange and information service can be realized through broad exchange programme and scholar visiting schemes between affected developed countries and the affected developing countries among the Annexes regions of UNCCD. CST of UNCCD is recommended to play active role in this field through encouragement of positive involvement of academies and institutions in information service, particularly the Expert Roster of UNCCD should not be ignored and they can make huge contribution and great efforts to disseminate and distribute information, knowledge and skill. Also, academic and scientific institutions should be encouraged to pay more attention on the public awareness of citizens, and provide advice to decision making and management circles at central government level. TC Dialogue of Belgium is playing a leading role, particularly in extension of scientific results from Labs to the field.

5.6 At CBO, NGO and grass root levels

According to experiences and practices in information circulation and data services in AP region, the function and roles of community-based organization, NGOs and even the private sectors at grass root level in context of information circulation/dissemination/distribution and public awareness raising, technique transfer, education and training are fundamental and significant. CBOs, NGOs and private sectors are the linkage to serve the people and assist agencies, particularly in information circulation/dissemination to bottom and to feedback authority the necessity and like/dislike of grass root level. Without active involvement of people, any initiatives to combat desertification, rehabilitate land degradation, mitigate drought effects, reduce disaster impacts and alleviate poverty, in both affected developing and affected developed countries, will be commitment in words and on paper. People have the right to use, to share and to be beneficiaries of information. Therefore, information circulation/dissemination at CBO, NGO and grass root level should be actively promoted. The Northeast Asia Forest Forum of Republic of Korea and the SCOPE of Pakistan are moving in the right direction in this aspect and their functions and

contributions are appreciated by NGO forum of COPs.

List of acronyms

ADB	Asian Development Bank
ASEAN	Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam
Asia RCU	Asia Regional Coordination Unit (UNCCD
AIT	Asian Institute for Technology
AP	Asia and the Pacific
B&I	Benchmark and Indicators
CAPSA	Centre for Alleviation of Poverty through Secondary Crops' Development in Asia and the Pacific
CBOs	Community-based Organizations
CFC	Chlorofluoro Carbons
CRIC	Committee for Review of the Implementation of UNCCD
CST	Committee on Science and Technology (UNCCD)
CNY	Chinese Yuan
DEWA	Division of Early Warning and Assessment (UNEP)
DSS	Dust and Sandstorms
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
GEF	Global environment Facility
GIS	Geographic Information System
GRID	Global Resource Information Database (UNEP)
GPS	Global Positioning Systems
SG	Secretary General (of UN)
ICARDA	International Centre for Agricultural Research in the Dry Areas
IS	Information Service
LADPs	Integrated Local Area Development Programmes
LDCs	Least Developed Countries
LIDAR	Light Detection & Ranging (a scientific device)
MENRIS	Mountain Environment and Natural Resources' Information System
MPHPT	Ministry of Public Management, Home Affairs, Posts and Telecommunications (Japan)
MOPE	Ministry of Population and Environment (Nepal)
MoU	Memorandum of Agreement
NAPs	National Action Programmes
NCB	National Coordination Body
NEA	Northeast Asia
NFPs	National Focal Points
NGOs	Non-Governmental Organizations
PENRIC	Pacific Environment and Natural Resources

	Information Centre
PM10	Particulate Matter of <10K
RAP	Regional Action Plan
RETA	Regional Technical Assistance
ROAP	Regional Office for Asia and the Pacific (UNEP)
ROK	Republic of Korea
RRC.AP	Regional Resources Centre for Asia and the Pacific (UNEP)
SENRIC	South Asia Environment and Natural Resources Information Centre
SRAPs	Sub-regional Action Programmes
TA	Technical Assistance
TPNs	Thematic Programme Networks
TSP	Total Suspended Particles
ULB	Ulaanbaatar
UNCBD	United Nations Convention for Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention for Climate Change
UNICs	UN Information Centers
UNDP	United Nations Development Programme
UNIS/B	United Nations Information Service/Bangkok
US$	U.S. Dollar
WB	World Bank
WMO	World Meteorological Organization

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DESERTIFICATION INFORMATION SYSTEMS – INFORMATION SYSTEMS AND ENVIRONMENTAL MONITORING ON INTERNET: COMMENTARY AND OUTLOOKS

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Abstract
Collecting and disseminating pertinent, accurate and up-to-date information is of paramount importance for gaining awareness of our environment. Being able to quickly access such data is a prerequisite for the drafting of effective policies for combating desertification and protecting the environment in general.
In Africa, apart from initiatives undertaken by international organisations (FAO, USAID), very few of Environmental Information Systems have progressed beyond the demonstration stage. This is mainly because of institutional and financial constraints. Thus, efforts to develop indicators and benchmarks for monitoring desertification and evaluating combating desertification activities often founder on the lack or scattering of relevant information. Most studies carried out on the subject stress how crucial this shortcoming is Desertification Information Systems – Information Systems and Environmental Monitoring on Internet represent an important experience to circulate information specifically for actors involved in the combat against desertification. Launched by OSS as part of its 2000 strategy, and reflecting the principles and recommendations of the CCD, the concept strive to facilitate the dissemination of pertinent, validated information concerning desertification and related environmental problems. The idea is implemented using New Information and Communication Technologies (NICT).
The concept entails setting up information systems featuring tools that support (i) the implementation of anti-desertification action programmes at various levels and (ii) the planning of natural resource management activities and the monitoring and evaluation of their impact. Another goal is to foster greater dialogue between the actors involved, encouraging them to share their experiences and information resources in the interests of a genuine partnership.
Specifically, these circulation information systems ensure information is distributed to and discussed by the partners involved in implementing environmental actions programmes at various levels.

Key words: Desertification, information circulation system,

1. Introduction

There is no longer any doubt that possessing salient information and data is critical to sound policy-making, especially when it comes to managing natural resources in arid areas threatened by degradation. Without information on the condition, evolution and use of natural resources, no sustainable strategies for managing them can be devised and implemented in these regions, meaning valuable ground will be lost in the combat against degradation.

Collecting and disseminating pertinent, accurate and up-to-date information is of paramount importance for gaining awareness of our environment. Being able to quickly access such data is a prerequisite for the drafting of effective policies for combating desertification and protecting the environment in general.

Agenda 21, which emerged from the United Nations Conference on the Environment and Development in Rio in 1992, stresses that though a substantial body of data already exists, it is necessary to gather much more voluminous and varied information at local, regional and global level with regard to ecosystems, natural resources, pollution and people's socio-economic circumstances. The stark gulf between the developed and developing nations in terms of access to good, coherent, standardised information sources has grown steadily wider in recent years and significantly inhibits many countries' capacities to make decisions on the environment and development with full awareness of the effects.

NEPAD's Environment Initiative action plan addresses sustainable development issues and concerns shared by all of Africa; it emphasises the need to use the best available and most up-to-date information and enhance access to salient data, particularly for evaluating vulnerability and issuing early warnings to mitigate the effects of crisis situations and environmental threats.

The UNCCD accentuates in several places how crucial it is to control the various stages of the production and use of information. In particular, it advocates adopting measures to set up local, national and subregional integrated information systems (IIS) to help anticipate the effects of drought (early warning systems, prevention devices and drought management, etc.).

All these conventions and initiatives highlight the importance of crafting environmental policies on the basis of salient information, and indicate priority activities for achieving this objective; but identifying and drawing up such information remains the responsibility of the actors tasked with implementing environmental policies at various levels. Moreover, information needs can only be identified by taking account of the specificities of the entities concerned (zones/geographic areas/countries) and the levels of operation (local, national and regional).

When it comes to producing and disseminating environmental information, most systems have been designed and implemented as responses to information needs in most cases identified before the ratification of the MAEs and the adoption of ensuing environmental policies. Most systems were devised by actors responsible for sector-specific natural resource management strategies. Consequently, the processes of identifying the information to be used to inform decisions relating to the environment were frequently motivated by a desire to ensure that pre-existing data was used, even though this did not always cater to the real needs of the bodies responsible for implementing environmental policies. It should also be pointed out that in many cases the staff of these bodies came from sector-specific bodies (such as forestry boards, soil and water conservation departments, etc.), meaning they are usually influenced by narrow sectoral approaches.

2. Information Systems in Africa

In Africa, apart from initiatives undertaken by international organisations (FAO, USAID…), very few of Environmental Information Systems have progressed beyond the demonstration stage. This is mainly because of institutional and financial constraints. Thus, efforts to develop indicators and benchmarks for monitoring desertification and evaluating combating desertification activities often founder on the lack or scattering of relevant information. Most studies[1] carried out on the subject stress how crucial this shortcoming is.

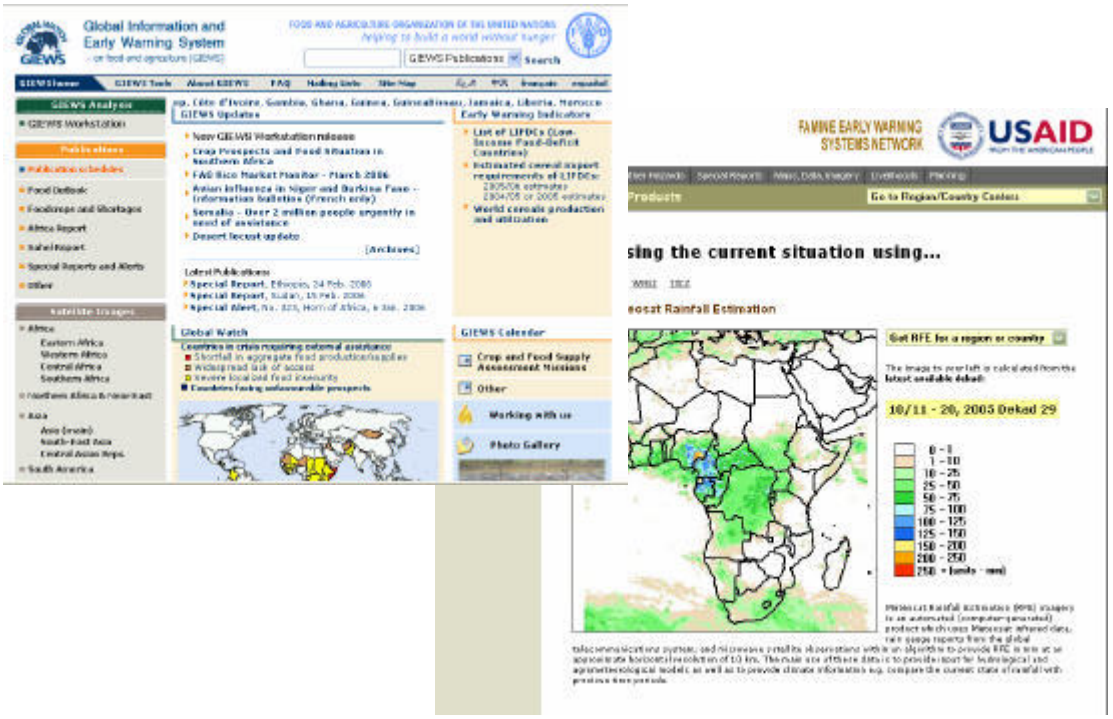

Figure 1: Example of global information systems (GIEWS of FAO and FEWS USAID)

The lack of coordination of data management activities is often cited as the main barrier to the smooth operation of desertification monitoring systems. Despite the fact that countries have equipped themselves with structures for implementing the MAEs, the status and means of these structures usually means they can have little operational impact and are incapable of being genuine co-ordinating bodies.

One essential task when setting up devices for monitoring desertification and informing policy-making is identifying the data needed and the methodologies for gathering, processing and disseminating/sharing it. Many of the difficulties encountered in identifying and formulating monitoring indicators derive from the gathering procedures and the nature of the existing data (scales, accuracy, validity, etc.). This is compounded by the fact that the data derives from an array of different sources, often in incompatible formats. The lack of coherence and *comparability* of non-harmonised data prevents them from being used by many environmental monitoring systems.

[1] Summary and preliminary analysis of the information in the reports submitted by affected African countries - Bonn, 2 – 11 May 2005
Report on the state of the art on existing indicators and CCD implementation in the UNCCD – AIDCCD 2005.

To maximise the benefit gained from investments in setting up data gathering and circulating systems, it is necessary to harmonise definitions and naming conventions, adopt standardised data gathering and production protocols and develop solid data and metadata bases.

Particular attention should be given to updating data existing in information circulation systems. The main factors determining the frequency with which particular data is produced are its type, nature and cost.

In Africa, leaving aside a handful of still tentative experiences, the main operational systems for producing reliable information in accordance with standard protocols and at regular intervals deal with regional level and tend to focus on the issue of food security.

The CCD has, of course, two objectives: to combat the degradation of resources and to eradicate poverty; therefore, any information system relating to managing natural resources and/or socio-economic conditions can be considered as a system that supports the implementation of the Convention. Indeed, the various types of knowledge (general, historical, regular and current, etc.) constitute the basic elements of understanding phenomena, appraising states, expressing observations and regularly monitoring resources. It is imperative for the formulation of strategies, action plans and monitoring-evaluation exercises that such salient and up-to-date knowledge be available.

The complexity of the desertification phenomenon and the profusion of actors involved in the fight against it mean that information is produced by a variety of actors and passed through a clutch of different channels.

Information systems that provide relevant data to support the implementation of the convention (UNCCD) at different levels (regional, subregional, national and local) can be grouped into two major categories:

- Those that produce/disseminate information linked to the CCD's goals
- Information systems dedicated specifically to desertification

Since policies and strategies attach increasing importance to producing and distributing information, national, subregional and regional institutions have drawn up and applied strategies that reflect their eagerness to equip themselves with protocols for producing, processing and transmitting environmental data.

3. Desertification Information Systems

Desertification Information Systems – Information Systems and Environmental Monitoring on Internet (Systèmes d'Information sur la Désertification – Système d'Information et de Suivi Environnemental sur Internet: SID - SISEI) represent an important experience to circulate information specifically for actors involved in the combat against desertification.

Launched by OSS and UNITAR as part of their strategies, and reflecting the principles and recommendations of the CCD, SID-SISEI strives to facilitate the dissemination of pertinent, validated information concerning desertification and related environmental problems. The idea is implemented using New Technologies of Information and Communication (NTIC).

3.1. Objectives

The concept entails setting up information systems featuring tools that support (i) the implementation of anti-desertification action programmes at various levels and (ii) the planning of natural resource management activities and the monitoring and evaluation of their impact. Another goal is to foster greater dialogue between the actors involved, encouraging them to share their experiences and information resources in the interests of a genuine partnership.

A more general objective of the SID-SISEI is to provide an efficient communication tool for Environmental Action Programmes (EAPs), as championed by the World Bank in its structural adjustment programmes in Sub-Saharan Africa. Concretely, this means creating a tool to support good environmental governance through the exchange and use of salient environmental data and information.

Specifically, the SID-SISEI ensure information is distributed to and discussed by the partners involved in implementing environmental actions programmes at various levels. This means they:

- Help de-compartmentalise the different bodies working on natural resource management;
- Valorise and better capitalise information resources to which it is, at present, difficult to gain access
- Offer decentralised access to dispersed information;
- Foster partnerships and synergies between actors at local and international levels;

3.2. Structure

The basic concept of the SID-SISEI recommends structuring them into three sections – institutional, topical and products. This structure may be adapted to suit the specifics of a certain country or region.

The institutional section covers not only the SID-SISEI framework and objectives but also the way in which the different actors involved in fighting desertification should be organised. In particular, this is where actors are described and information pertaining to them (missions, roles, structures, products, etc.) is reviewed.

In the topical section, information is classed by sector of activity (forestry, pastoral farming, combat against desertification, bio-diversity, early warning, etc.).

The product/information section provides access to tools for monitoring phenomena/issues related to the topic at hand. It presents information in the form of lists of data or indicators, dash boards and studies, all of which are designed to assist management policy-makers and operational actors.

3.3. Examples

In the framework of a project coordinate by OSS and financed by the European commission (SMAP program) and aiming to set up monitoring – evaluation devices to assess the impact of combating desertification action programs in the Mediterranean southern countries, three Desertification Information Systems were developed and are now accessible on Internet. The development of these systems was based on the concept SID-SISEI.

3.3.1. The Circulation Information System on Environment and Desertification of the Arab Maghreb Union

This web site is dedicated to circulate data and information relevant for the sub regional level. Information is structured in four sessions:

Institutional

This session include the following:

- General presentation of the AMU
- Treaty of the AMU
- The general secretary of the AMU
- Presentation of the SCIDE
- The AMU environment charter
- The Sub regional Action program
- The institutional profile
- Stakeholders
- AMU instance recommendation

Monitoring-Evaluation

- Maps
- State of the desertification
- Forum

Tools

- Map Server
- Virtual library
- News
- Downloades
- National DIS

Programs and projects

Programs of the SRAP
New initiatives

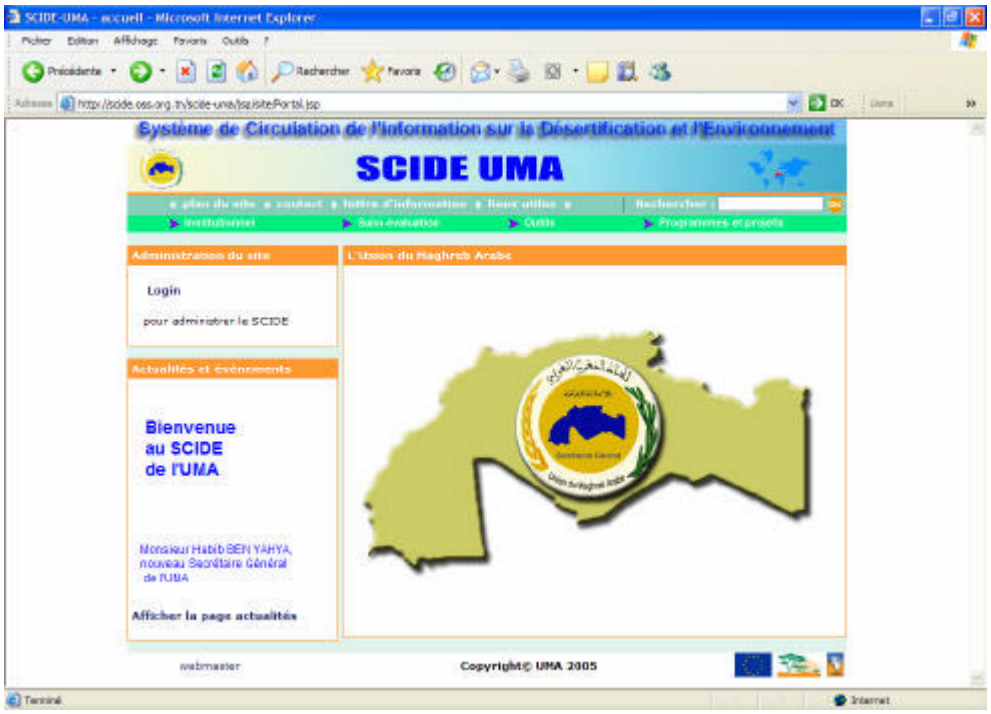

Figure 2: Home page of the MAU Circulation Information System on Desertification

3.3.2. The Circulation Information System of Morocco (SCID-SISEI)

The main sessions of the portal are the following:

National level Information

This section describes the institutional profile and the main objectives of the UNCCD.

General Information

Here are presented different information related to desertification monitoring and to activities and events concerning this issue.

Monitoring-Evaluation

The indicators presented are structured in eight classes:

- Combating against desertificatio n
- Water resources
- Forestry
- Grazing
- Pluvial agriculture
- Irrigated agriculture
- Oasis
- Global indicators

Programs and projects

This section gives a view on different program and project involved in combating desertification and/or implementing tools and devices for their monitoring and evaluation.

Figure 3: Home page of Morocco Circulation Information System on Desertification

3.3.3. Tunisian Desertification Information System (DIS)

In order to ensure its sustainability and the updating of the data and information it contains, the DIS is accessible throw the official environmental portal. The information it contains is structured in three sessions:

Institutional

In this section are presented the objectives of the DIS and the framework of the NAP/CD implementation. Are also described the institutional profile and the National Committee for combating desertification.

The charter organizing the circulation of information and defining the rule for sharing and using data is accessible threw this section.

Finally, we find in this section the contacts for the work group involved in the implementation of the NAP/CD Monitoring-Evaluation device and allow links to relevant web sites.

Tools

Until now, only the virtual library is available. It gives access to different kind of documentation related to the desertification phenomena.

Figure 4: Home page of the Tunisia Desertification Information System

Products

This section gives access to the different indicators related to the monitoring and evaluation of the NAP/CD implementation and its impact on the natural resources and local population.

Indicators are grouped in two classes:

- Basic indicators that cover all the thematic related to desertification
- Synthetic indicators considered as the mostly relevant for the monitoring-evaluation

Every indicator is presented with its metadata:

Libellee

Definition

Classification

Documentation (producer, existence, reference date, updating frequency, publication, elaboration method,

The values of each indicator are given in different forms: tabular, graphic and maps.

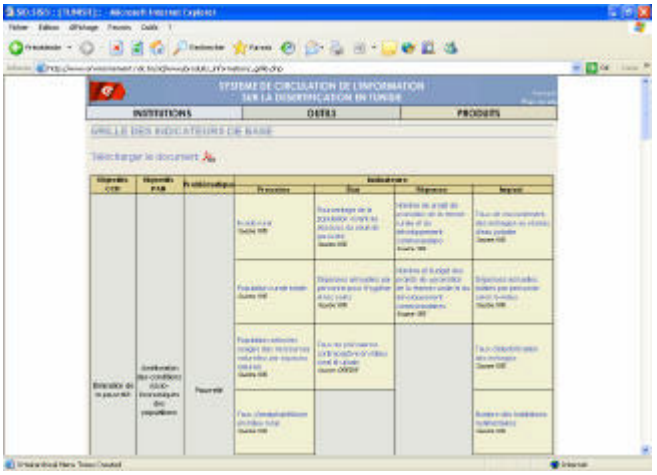

Figure 5: Organization of the basic indicators

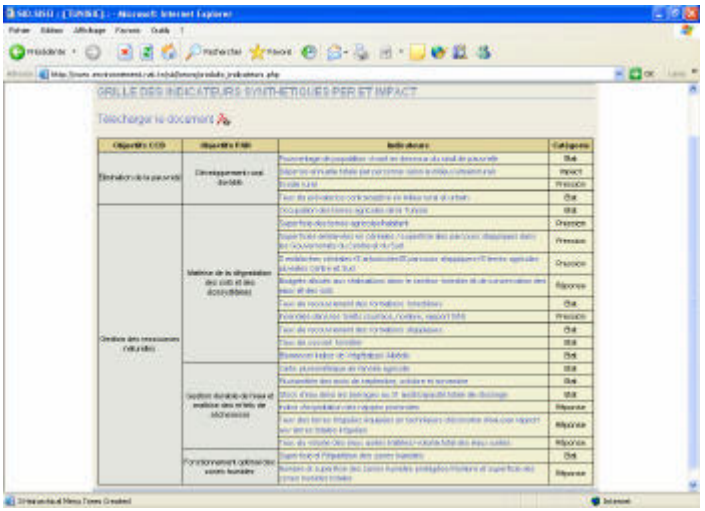

Figure 6: Example of synthetic indicators

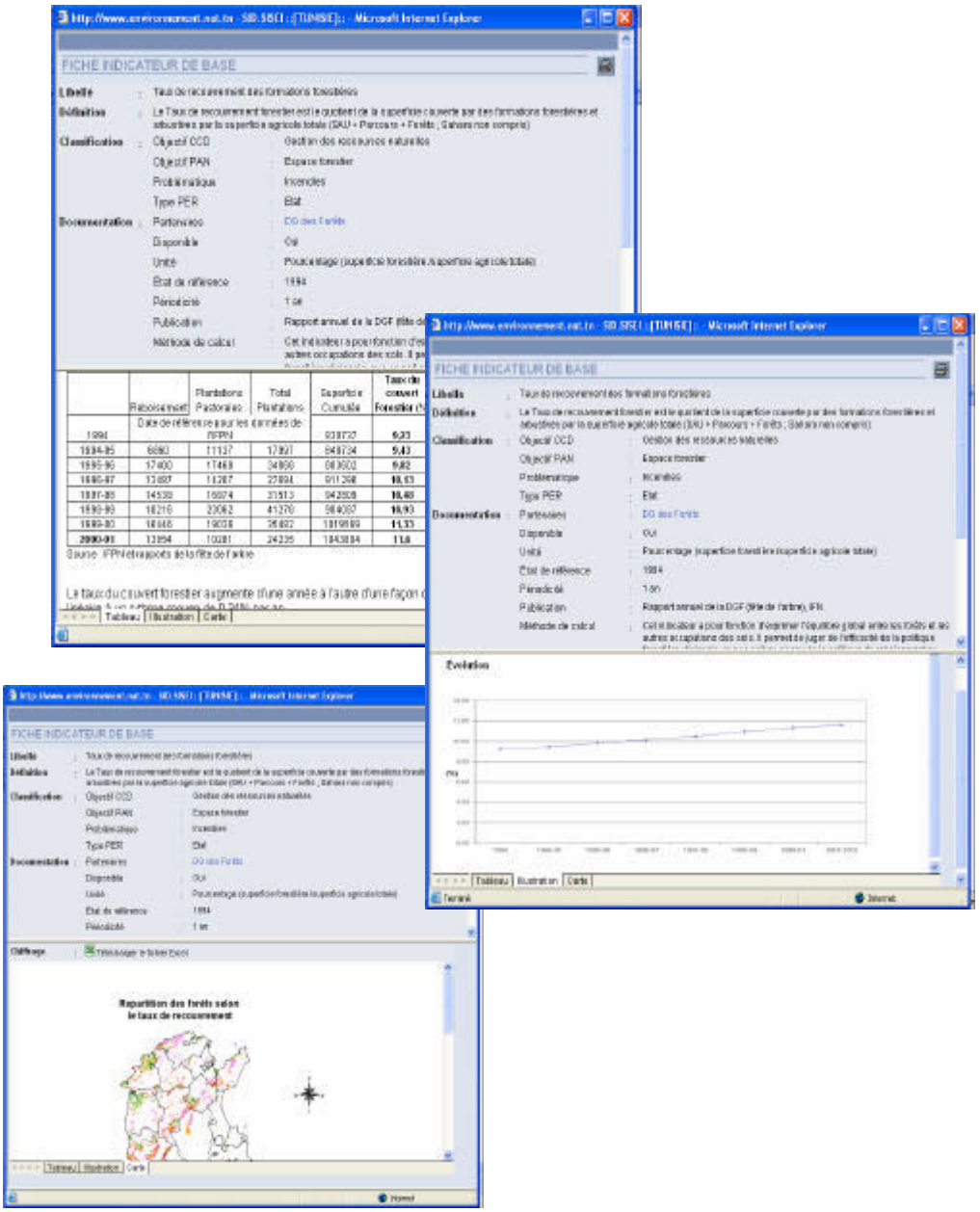

Figure 7: Examples of an indicator (rate of forestry cover), presented in different ways: tabular, graphic and map)

4. Evaluation and outlooks

Despite the clutch of positive experiences, most desertification information systems are yet to be fully developed, remaining in the demonstration stage. Actors have signalled their commitment to mastering technical tools but they have not yet translated this into the institutional measures and actions needed to incorporate them and make them operational. The handful of success stories, from which the results are starting to be disseminated in several countries, confirm that embedding effective systems is a long-term endeavour that must take account of scientific, technical, institutional and organisational factors.

List of acronyms

AIDCCD	Active exchange of experience on indicators and development of perspectives in the context of UNCCD
AMU	Arab Maghreb Union
DIS	Desertification Information System
EAPs	Environmental Action Programmes
FAO	Food and Agriculture Organisation
FEWS	Famine Early Warning Systems Network
GIEWS	Global Information and Early Warning System on Food and Agriculture
IIS	Integrated Information System
MAE	Multilateral Agreement on Environment
NAP/CD	National Action Program for Combating Desertification
NTIC	New Technologies of Information and Communication
NEPAD	New Partnership for Africa's Development
OSS	Observatoire du Sahara et du Sahel
SCIDE	Système de Circulation de l'Information sur la Désertification et l'Environnement
SID - SISEI	Systèmes d'Information sur la Désertification – Système d'Information et de Suivi Environnemental sur Internet
SMAP	Small and Medium Action Program
UNCCD	United Nations Convention to Combat Desertification
UNITAR	United Nations Institute for Training and Research
USAID	US Agency for International Development

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INFORMATION CIRCULATION SYSTEM FOR COMBATING DESERTIFICATION AND SOCIETAL DEVELOPMENT IN INDIA USING SATELLITE BASED PROGRAMMES: A HOLISTIC APPROACH

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Abstract
The information required for combating desertification is multi disciplinary in nature as it involves multi-thematic details and socio-economic issues. In India there are various policies / programmes of Government of India, as regards imparting important information, through various modes, including tele-communication, which is among most effective. There exists a net-work of governmental and non-governmental agencies working hand in hand towards mitigating land-degradation, rejuvenating exhausted natural resources, addressing the socio-economic issues for sustainable development. Remote Sensing is the fastest and trusted means of generating faithful information on land degradation conditions, desertification- indicators / processes etc and has been effectively used for land and water resources development leading to combating desertification. As of now, there exists certain gaps. It is realized that early warning of desertification is the key to combating desertification and India is making efforts to address this important issue. The paper describes in detail the models applied in information circulation among various levels, case studies, results achieved, challenges and lessons learn. The paper is supported by some case studies.

1. Introduction

The fore-most and instantaneous information need in any desertification programme is the *inventory* of the land-degradation and its present status. This carves out the present condition of existing land and its resources vis à vis the past status. The present and the past conditions of desertification, helps in assessing the trend of desertification in time and space domain and thus orienting the future course of action to mitigate desertification.

India occupies only 2.4 % of world's geographical area, yet supports about 16.2 % of the world's human population. India has 0.5 % of the world's grazing area but supports 18 % of the world's cattle population. About 69% of its geographical area fall within dryland (arid, semi-arid, dry sub-humid). In addition 4.26 % is Cold Desert (in Himalayas).

About 72 % population lives in rural areas and depend mainly on rain fed crops. Eastern India receives highest rainfall in the world yet large part of India suffers from water-scarcity, especially the western, central and southern India.

Government has formulated programmes/plans for societal development and long term (=>5 years) and short terms various developmental plans like:

- DMA - Desertification Monitoring & Assessment
- DDP - Desert Develoment Programmes
- DPAP - Drought Prone Area Programme
- IWDR - Integrated Wasteland Development Project
- EAS - Employment Assurance Scheme

- I JRY - Intensified Jawahar Rojgar Yojna
- NWDORA - National Watershed Development programme in rainfed areas.

For this, there is a structured and institutional set-up ranging from financial aids, technological support, information circulation etc. involving both governmental and non-governmental agencies.

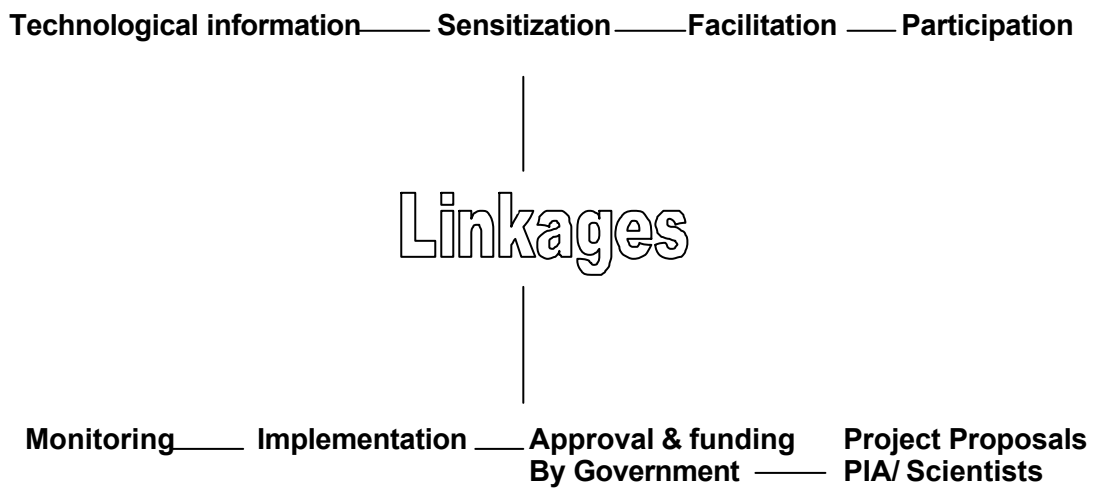
Under the auspices of UNCCD TPN-1, desertification monitoring and assessment has been addressed & pursued at national level and in accordance with the global perspective. A pilot project has been undertaken and successfully completed on 1:50,000 scale for Desertification Status Mapping (DSM) using Indian Remote Sensing Satellite (IRS) data, for both hot and cold desert regions Desertification indicators have been standardized, a comprehensive classification system and methodology for DSM has been evolved and validated in different dry-land conditions. Ultimately the methodology of DSM has been operationalised.

In India, Desertification Status Map (DSM) of entire India has been operationally carried out on 1:1 million scale using Indian satellite wide field sensor (IRS-AWiFS) data. This is the first ever DSM map of the country. This project is taken up for dove-tailing the results with the UNCCD-TPN1 mandate of having a desertification Status Map of entire Asia..

The DSM maps provide information on the dominant desertification processes active in different land use/ cover units. Such important information provides basis for combating of desertification. The technical action plans are generated depending upon local conditions and needs. The sustainable development involves the participation of technocrats, decision makers, implementing agencies (GO/ NGO's) and the end-beneficiary i.e. farmer. An institutional model has been developed

2. The Institutional Mechanism for circulation of information

We have a well woven institutional set-up in India for development of the society through a balanced blend of state-of-the-art technology and national development programmes. It involves information generation, sensitization, facilitation, participation, linkages , implementation of combating plans and monitoring of the implementation. The following schematic shows the flow chart:



In past tree decades India has used satellite based tele-communication for tele-education, thus imparting important information to farmers and students. Past 24 years, India as successfully used its own satellite called INSAT for various purpose like mainly for weather forecasting, disaster warnings and tele-communication.

Recently India has launched a satellite completely dedicated to imparting education to students and other beneficiaries. The name of the satellite is EDUSAT. There has been various satellite based tele-communication experiments for educating rural and tribal people in some of the remotest areas of the country.

Satellite Remote sensing has been effectively used for assessment and management of various natural resources in the country. Currently, a programme called VRC (*village resources development*) has been taken up by ISRO and this programme is aimed at taking the benefits of information technology of satellite to the grass root levels of the society e.g villagers, for eradication of illiteracy, better health care, training on better jobs, skill development, enhancing agricultural productivity, ensuring drinking water availability/management etc, facilitated by digital connectivity through Space based services, emanating from Satellite Communication (SatCom) and Earth Observation (EO) satellites. This well-proven institutional and technological capabilities are to be percolated through Village Resource Centre (VRC) in association with other Central and State agencies as well as with NGOs community centric services down the line at the grassroots. VRC, conceptualised as community resource, aims to deliver space enabled as well as other IT based and E_GOVERNANCE related services in the *backward region of India* where terrestrial infrastructure is not adequate to provide information and space technology provides 'the last mile'. In fact we have had very successfully carried out implementation of technical combating plans in practicable way by interlinking the Non-governmental organisations (NGO's), the beneficiaries (farmers) and the funding agencies government agencies) in India. This involved *sensitizing* the *implementers* about the role of technology, training them through various methods and creating an awareness among the *end-beneficiaries* (villagers) about the implementation-benefits of the technical plans of combating desertification for a sustainable development. This is the approach to *capacity building.* The benefits of implementing sustainable development programmes like construction of check –dams, rain water-harvesting structures, agro-forestry etc are *systematically monitored* through ground based surveys and multi-temporal satellite coverage. This *monitoring system* works in most cases.

Tele-education is an important governmental policy in India. This is done through satellite communication based *24 hours T.V-education at the door steps of rural sector* in India through EDUSAT. The programme is called Gyandarshan.

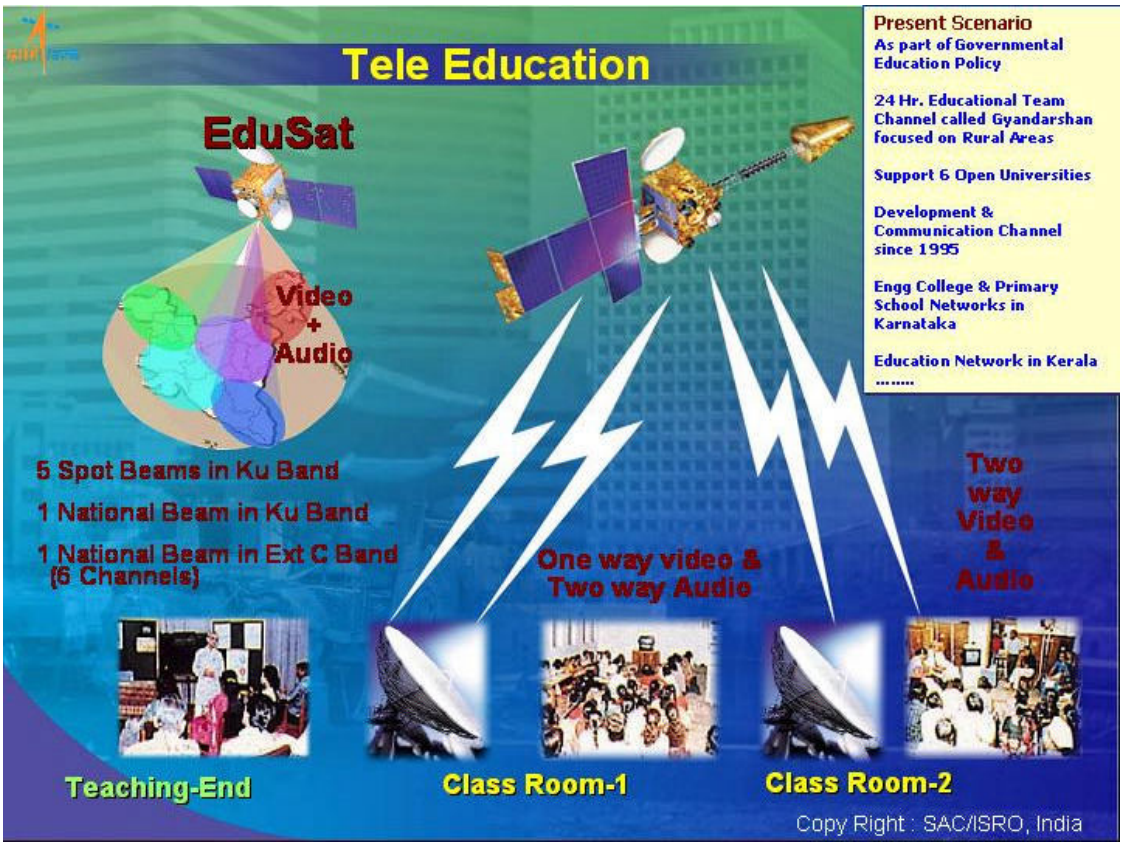


Figure 1: Tele education

3. Combating Desertification: some case studies in India

Satellite Remote sensing has been effectively used for combating desertification.

Some of the desertification combating measures like construction of check dams for water harvesting in scarcity prone areas of Panchmahal district, in India, has been implemented for sustainable development as shown in fig 2 and 3. A lot of wastelands have been reclaimed in tribal regions in India , as sown in fig 4. A large part of the dryland areas is marginal land, having mostly rainfed crop due to paucity of groundwater, which is always limited. Thus such areas have been lately using sprinkler irrigation , thus conserving the limited resource of ground water as shown in fig 5.

Figure 2: Check dams, construction Phase (Panchmahal District, India)

Figure 3: Check dams after construction (Panchmahal District, India)

Figure 4: Reclamation of wasteland areas by proper land leveling and water management

Figure 5: Sprinkler irrigation in arid dryland regions to conserve the groundwater

The remote sensing data has been very useful to monitor the changes in the ground conditions after implementation of the desertification combating measures. As sown in the following figure n° 4., which shows the increment of vegetation due to commissioning of water harvesting structures in Hatni watershed , Jhabua district, M.P , India.

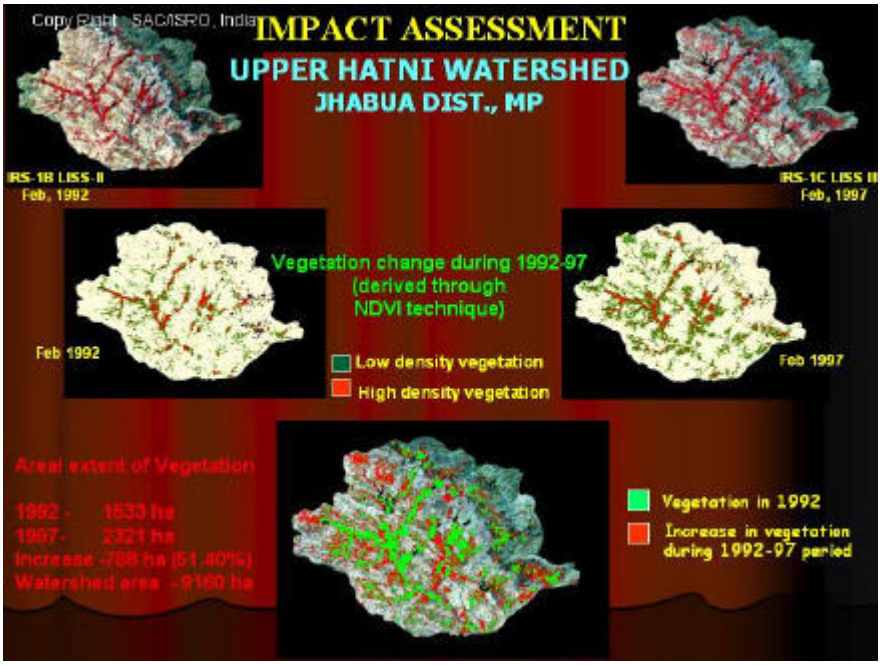


Figure 6: Impact assessment using remote sensing.

However, the challenges are not about the institutionalization or inventory of information or dissemination of information. It is about the way the information is perceived by the end-beneficiary (the farmer). It is about how much are we able to convince people about the need to conserve, preserve, manage the existing natural resources and rejuvenate the lost ones, as best possible, through innovative, but mostly simple desertification mitigation measure. Second challenge is about the expectations of the people from institutions. It is a general norm that the end-beneficiaries always expect that they will be indefinitely helped financially and materialistically. The challenge is about sensitizing people for being self-dependent. This has been understood by many enterprising farmers and they have started to continue the developmental activities in their villages through people's participation and common funds resources. It is very important to educate people about the existing governmental schemes about loans to buy cattle, tractors, water pumps etc. so that there is continuation of development and the people do feel a sense of involvement in all the developmental activities. A major challenge is about having a dependable and faithful desertification early warning system. India has initiated efforts in this direction by virtue of addressing desertification vulnerability which addresses technical and socio-economic issues and gives estimated projections of areas vulnerable to desertification in future.

Gaps: there is a need for *Early Warning System for Desertification*

- To have near real-time information system about the land-degradation, weather, climate, natural hazards, infectious diseases
- There is a `time gap' in linkages between the technical inputs and the socio-economic set-up.
- The vulnerability of land needs to be identified not only on the basis of natural and physical conditions of land but also the socio-economic causes and implications
- To have a comprehensive global adaptive and standar information generation and circulation system, linked to all the countries in the world.

Challenges **:** there are three main challenges

- To circulate the information among the grass-root level
- To meet the needs and aspirations of the people by participatory approach and making farmers self reliant
- To have sustainable programmes percolating down to the end-users
- To lessen the load on government as regards the dependency of end-beneficiary on governmental infrastructure and support always.

Lessons Learnt: the Desertification is mainly a result of human activities and thus it is imperative to educate people through proper information circulation at three different levels i.e:

1. *National level*. for general and common interest of people
2. *State / District level*, for harmonizing the regional issues with people's interests as per state policy and lastly
3. *Local level*, focusing more on taluka / village level issues

The information needs to be translated into simple language and simple ways of circulation, perceivable by lay man.

EFFORTS FOR COMBATING LAND DEGRADATION WITH IEM AND INFORMATION SHARING IN WESTERN CHINA DRYLAND ECOSYSTEMS

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Abstract

This paper will introduce an ongoing 10-years long program that is the China-GEF Partnership on Land Degradation (LD) in Dryland Ecosystems. It has approved as the Operational Program 12 (OP12) of GEF and managed by a Country Program Framework (CPF). The CPF will support a series of phased priority activities such as: (i) strengthen the enabling environment and build institutional capacity for integrated approaches to combat LD including building up an information network mechanism among the inter-agencies and an joint IEM-Information Center of LD in each province (Autonomous regions);(ii) demonstrate viable Integrated Ecosystem Management (IEM) models for widespread replication etc. The partnership of the program include 11 key national agencies to adopt IEM at the central level and in six Provinces (Autonomous regions) that are the most degraded dryland areas of the western region. The partnership also include GEF, World Bank (WB), Asian Development Bank (ADB) and LADA (FAO), WOCAT etc. both in financial and technical support and/or cooperation.

Key words: Land Degradation (LD), Integrated Ecosystem Management (IEM), Dryland, Data Sharing, Partnership

1. Introduction

There has been a great environmental and economic Challenges in China in the past decades. Sustained economic growth and reduced poverty has been achieved. But China is a country with large rural area and rural poor is highly reliant on productive natural resource systems. At the same time unfortunately, there has been a corresponding rise in degradation of natural resources: soil, water and bio-diversity. At western region of China poverty incidence very high and lags behind other regions of the country. Highly degraded: dry fragile soils, source of dust storms, salinity, desertification. The provinces (Autonomous Regions): Gansu, Inner Mongolia, Ningxia Hui, Qinghai, Shaanxi, Xinjiang Uygur, with 120 million people, has been worst affected by land degradation (LD). They have extremely rich biodiversity: many rare species with high commercial value & huge tourism opportunities. Chinese government has launched many eco-programs & plans and had a large amount spending to solve environmental problems, but concerned at recent years that combating LD has been still a prior task. The country needs common understanding of the root causes: public and private sectors need to pay much greater attention to environmental management. But

gap between Ministries and Sectors from national to provincial level and not communicate to each other; Information from deferent sources were not compatible and may be contradictory to each other. Best practices and an integrated ecosystem management approach could help future rapid economic growth and sound environmental management.

In China as well as in its Provinces (Autonomous regions) many relevant government sectors as well other scientific and social organizations deal with LD problem. In most situation each one handle its own responsible problem of LD types. For example agricultural sector is for the improvement of vegetation degradation in grassland and soil degradation in farmland; water resource sector is for the improvement of water and soil erosion; forestry sector is for the improvement of forestry LD types and desertification combating etc.. They are normally not exchange and share information of each other. So the China central government and local government can't have the whole picture of the LD problem in the country as well as in particular Province (Autonomous region). The country's efforts to combating LD in the past couldn't be joined together. So even though a huge amount of investments have been put for solving the problem of LD but still not be very effective. By taking the lessons from international experience an IEM-style approach; institutions working together with communities approach; comprehensive, scientific, and participatory approach and bottom-up, not top-down approach will be put in better management practices. The Program now promotes adoption of integrated ecosystem management (IEM) approach to address land degradation problems, and provides technical and financial support to solving problems of inter-agency and cross-regional natural resource management. This is of significant importance to ensure sustainable development of the Western China.

2. Program of China-GEF Partnership on Land Degradation (LD) in Dryland Ecosystems

An ongoing 10-years long program is the China-GEF Partnership on Land Degradation (LD) in Dryland Ecosystems. It has approved as the Operational Program 12 (OP12) of GEF and managed by a Country Program Framework (CPF). The CPF will support a series of phased priority activities. The first phase of CPF is The Capacity Building to Combat Land Degradation Project. It will improve the capacity in national, provincial and local level on the Policy, Laws, and Regulations for LD Control, Strengthening National and Provincial Coordination, Improving Operational Arrangements at Provincial and County Levels, Capacity Development for LD Investment Project, Monitoring and Evaluation System for LD.

In particular the component of the Monitoring and Evaluation System for LD will have major output on (i) a national coordination mechanism for collecting, sharing, and analyzing LD related data as well as the compatible software and standards to facilitate sharing of data sets. (ii) Activities will be guided by an advisory group on monitoring and evaluation of LD including establishment of a unified geographic LD IEM information centre at each Province (Autonomous regions), training in LD assessment, development of indicators for monitoring LD, workshops, study tours and exchange visits. In addition at the community level the direct stakeholders would be involved in

pilot monitoring and assessment studies, and would actively participate in assessing the nature, severity and impact of LD in their local area. For this purpose a community based LD control demonstrations will be undertaken in at least 3-4 selected pilot areas per Province (Autonomous regions). A public awareness campaign on the IEM approach will be undertaken, and workshops on community based LD control, study tours/exchanges and publications will also be supported. Efforts will also be made to enhance the capacity of provincial and county agencies to work with rural communities in bottom-up participatory planning and implementation of field level LD control through an IEM approach.

Capacity will also be developed to support the implementation of the 10-year CPF, including future IEM projects and donor coordination. Logistical and technical support will be provided for the already established project coordination office (PCO) in Ministry of Finance (MOF), and the project management office (PMO) that has been set up in State Forestry Administration (SFA) for day-to-day management. Information exchange between projects, agencies, and other stakeholders will be a major activity to promote understanding of lessons learned, the role of IEM, and to improve cooperation and transparency. The experiences and lessons will be also shared with international community.

3. Integrated Ecosystem Management (IEM) Approach

IEM is a holistic approach to addressing the links between ecosystem functions and services (such as carbon uptake and storage, climatic stabilization and watershed protection, and medicinal products) and human social, economic, and production systems (such as crop production, nomadic and sedentary livestock raising, and infrastructure provision). This approach recognizes that people and the natural resources they depend upon, directly or indirectly, such as land, water, and forests, are inextricably linked. Rather than treat each resource in isolation, integrated ecosystem management offers the option of treating all elements of ecosystems together to produce multiple benefits. This way of managing the environment has been incorporated into a number of international conventions concerning environment and development, and international experience is beginning to demonstrate the benefits of this innovative approach. The IEM approach offers the China a new way to plan and manage its dryland natural resources. It also provides an integrated planning approach within which to develop the legal, policy, institutional, and socio-economic systems required to support the sustainable utilisation of its ecosystem resources. The overall rationale for the adoption of the approach is that IEM serves as the basis for greater efficiency and sustainability. There are some complementary and inter-linked IEM principles. Among these some important principles is IEM should involve all relevant sectors of society and scientific disciplines. Because most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate. This should require our project to build up a relevant information circulation system in scientific and practical approaches and data sharing mechanism among the partnership.

For practicing the IEM concept we have to Coordinate across different sectors by recognising common concerns, establishing common goals, and exploiting the synergistic benefits of working together on the identification, design and implementation of common ecosystem management programs. We will also develop a comprehensive understanding of the ecological and socio-economic situation within each of western China's ecosystems through improving the sharing of information between different sectoral agencies. In this way LD control will more efficient and investment saving. The widespread adoption of IEM practices requires that the public has access to adequate knowledge on the concepts and principles involved as well as information on specific improved ecosystem management technologies. This requires the development of appropriate public information, education and communication programs as well as effective government and private sector advisory support services.

4. Information Circulation and Data Sharing

The partnership of the project is the first of its kind to combat land degradation. No precedent to base experience on. Partnership requires LD related information and data sharing between project partners. In the first phase of the project the partnership of 11 national ministries/agencies and 6 provinces/regions Coordination among sectors as well as Provinces / Autonomous Regions Gansu, Inner Mongolia, Ningxia Hui, Qinghai, Shaanxi, Xinjiang Uygur is the core feature. The partnership also involves GEF, ADB, World Bank, IFAD, GM/UNCCD, FAO (LADA), IUCN, IFPRI, UNEP, UNDP, CDM, CIDA, AusAID, ACIAR, DFID, GTZ, KFW, EU, JICA, USEPA, WOCAT, WWF, Ford Foundation, Consulting firms, private sector, and research agencies as well as Chinese and international experts.

To build up the information circulation systems and data sharing will through mainly three works: one is the establishment of a nationally coordinated data-sharing mechanism on land degradation, another is the establishment of IEM information centers at the 6 provinces/regions and the third is participatory and "train the trainers" approach in the county and village level.

4.1 Develop an National LD Information network mechanism

There is a need for a comprehensive overview of LD status in national level. In China several institutions are involved in the collection and compilation of national level data on different forms of land degradation. (i) The State Forestry Administration (SFA) monitors desertification and forest; (ii) The Ministry of Water Resources (MWR) monitors soil erosion and water resource; (iii) The Ministry of Agriculture (MOA) monitors soil fertility and grassland; (iv) The State Environmental Protection Administration (SEPA) monitors ecological changes and biodiversity; (v) The Ministry of Land Resources (MLR) monitors changes in land use and land conversion; (vi) The China Meteorological Administration (CMA) monitors climate change and dust storms; and (vii) The State Bureau for Surveying and Mapping (SBSM) monitors spatial data on infrastructure development. No one agency collects all the data required for a comprehensive understanding of the land degradation processes in China that are reducing. The results of individual monitoring surveys have been released at different

times, with potentially confusing, and sometimes conflicting, assessments as to the nature, extent and severity of land degradation within the country as a whole, and the western region in particular. Data is rarely shared between agencies, and comparisons between data sets are difficult, due to the different approaches used to acquire and process the data. Furthermore each monitoring survey only presents a part of the picture with regard to the true nature and extent of land degradation. There is also no universally accepted definition of what constitutes land degradation in the China, different agencies defining the problem according to their specific institutional mandates and responsibilities.

There is a need to improve the current sector-based land degradation monitoring and evaluation programs. This requires coordinating activities; agreement on common assessment standards, sharing data collection and analysis. Only then will it be possible to provide senior policy makers the accurately report with comprehensive, consistent and reliable data on the overall current degradation status, identify changes over time and likely future degradation scenarios.

The project adopts an IEM and participatory approach, not a sector based approach, promotes increased coordination among partnership agencies with information circulation and data sharing. So to achieve an inter-agency consensus on a network mechanism for co-ordinating and sharing the collection and analysis of national level land degradation related data sets. The project has organised an expert group to do a special study to find the barriers of data sharing and the best solution to solve the problem reach this goal. The main action is to develop an operational national land degradation monitoring and assessment network mechanism for coordinating and sharing the collection and analysis of national level data sets. It will include the following action:

1. Document current institutional efforts to monitor and assess land degradation.
2. Identify the requirements of current and potential end users of land degradation related data.
3. Review the current definitions and indicators used by different agencies for monitoring and assessing different land degradation types.
4. Formulate recommendations for a set of common national level definitions, standards and indicators for monitoring and assessing different land degradation types (including a common comprehensive definition of land degradation).
5. Review past and current proposals for inter-agency data sharing in related fields.
6. Identify alternative options for inter-agency network mechanisms for coordinating the collection and sharing of land degradation related data, and provide details on the advantages/ disadvantages of each option.
7. Formulate a draft project proposal for the development of an effective inter-agency network mechanism for coordinating the collection and sharing of land degradation related data.

4.2 Provincial IEM Strategy and Action Plan for LD Control

For compiling the Provincial IEM Strategy and Action Plan each Province (Autonomous Region) must create a multi-agency and inter-disciplinary provincial

strategy formulation task force including securing agreement for the release/secondment of the task force members from their respective agencies. The task force will fulfill the task. The members of the task force come from each participatory agency which handling or related to LD.

The task force members will do preliminary investigation to/ secondary data collection from each related agency and institution. The data of provincial ecosystem characterisation would involve bio-physical characterisation and socio-economic characterisation. The members of the task force should do assessment of the policy, legislative and institutional environment as well as land degradation assessment together. They should then identify the type and nature of the constraints (problems) for: (i) increased farm production (crops and livestock); (ii) improved grassland management; (iii) improved forest resource management; (iv) improved water resource management; (v) bio-diversity preservation; and (vi) improved infrastructure development. They also will identify the causal linkages between problems and determination of potential intervention points as well as the opportunities. Finally they will review and finish the strategy and action plan for each Province (Autonomous Region). In this way they have to circulate information and share data of each other.

4.3 Establishment of Provincial IEM-Information Center

The project will assist each of the participating provinces (autonomous regions) to establish their own IEM information centre, complete with an operational GIS unit and documentation unit. Each information centre will be set up with the aim of meeting the information, and data, needs of all those agencies engaged in controlling land degradation and promoting improved integrated ecosystem management within the province/autonomous region.

Making the component GIS unit operational will involve the development of comprehensive computer databases with province specific geo-referenced information on: (i) the bio-physical and socio-economic characteristics of the major ecosystems; and (ii) the nature, extent and severity of all forms of land degradation. An operational documentation unit will involve developing both computer databases and a library (for hard copies of maps, and other documents) to provide province specific information and data on: (i) past and on-going land degradation control projects and programs; (ii) national, regional and provincial institutions and experts/ resource persons involved in IEM/land degradation control; (iii) successful land degradation control technologies and approaches; (iv) literature (reports, books, scientific papers, technical guideline manuals, extension materials, etc) related to monitoring, assessing and controlling land degradation; and (v) other media materials (photos, videos, DVDs etc).

The provincial IEM information centre will also act as the location for the provincial components of the Environmental Legal and Policy Information System. It will therefore serve as a repository for information on the policy and legislative environment for land degradation control within the province(autonomous region).

The provincial IEM information centre would be used to collate and analyse much of the data collected by the provincial strategy and action plan task forces. For instance the GIS unit would be used to overlay maps showing area data on poverty and land

degradation/ecological sensitivity to show the extent to which these are linked. The GIS unit would also produce all of the maps required for the strategy and action plan document.

4.4 Document and Evaluate Best Practices

In order to minimize the time, effort and budget required to implement this component activity the project will seek to benefit from, and build on, the links established by 2 previous ADB TA projects with the global *World Overview of Conservation Approaches and Technologies (WOCAT) program*. The project will therefore make use of the existing WOCAT questionnaires and database software for documenting and evaluating Chinese technologies and approaches for land degradation control and IEM.

Provincial level - focusing on the collection and handling of data related to IEM/land degradation control, including the documentation and evaluation of best practices (technologies and approaches), within the province;

County level - focusing on pilot studies using participatory tools and indicator sets to monitor and assess land degradation, and the documentation and evaluation of alternative technologies for its control, at the local (community) level.

4.5 Piloting local level participatory land degradation monitoring and assessment

The project will work in partnership with the global LADA program, and the LADA China Task Force, to identify, develop and field test a common set of participatory tools, and bio-physical and socio-economic indicators, that can be used to undertake local level comprehensive land degradation monitoring and impact assessment studies. The project will also act as a link between the LADA program and those donor funded projects and programs that have a common interest in monitoring and assessing the impact of land degradation within western PRC.

The provincial, national land international experts of the project will review, with the LADA China task force, the tools and indicator sets: (i) from the global LADA program; (ii) developed, and used, by other donor projects for monitoring grassland degradation, soil fertility decline, desertification etc; and (iii) used by central and provincial government technical agencies to monitor their sectoral land degradation concerns. Following this review a set of 'best bet' tools and indicators will be selected for testing and validation in a number of pilot study areas. County and village people will join the participatory activities and bottom up making choice.

5. Challenges

The project involves many sectors both in national and local level as well as legal, strategy plan, monitoring & assessment etc. As well as to implement the project with many challenges:

1. The Partnership is the first of its kind to combat land degradation. No precedent to base experience on lessons applicable to other countries & regions;
2. CBCLD involves 11 ministries/agencies and 6 provinces/regions Coordination among sectors is the core feature;
3. Establishment of a nationally coordinated data-sharing mechanism on land

degradation and operational run the provincial IEM information center;

4. Demonstration IEM LD control pilot sites: 21 sites under this project and 5 LADA sites 5, total 26 sites;
5. NAP to Combat Desertification: Ongoing work to establish IEM approach;
6. Coordination with demonstration projects of WB, ADB, IFAD;
7. Provincial LD strategies plan and the real role in 11th FYP, and 12th FYP etc.

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SESSION IV

Experiences and lessons learnt implementing ICS in UNCCD Annexes III and IV

ROLE OF INFORMATION CIRCULATION SYSTEMS (ICS) IN THE PROCESSES TO COMBAT DESERTIFICATION. THE CASE OF LATIN AMERICA AND THE CARIBBEAN

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The present work is part of a series of wider and more ambitious studies, the common element of which is being integrated within a same research project: the project "Active Exchange of Experience on Indicators and Development of Perspectives in the Context of the UNCCD – AID-CCD".

The main goal of this study is "to favour the exchange of information and experiences among the main institutions involved in the implementation of the UN Convention to Combat Desertification (UNCCD) in all the regional annexes". Within this goal, the project intends to make progress in the analysis, discussion and exchange of two thematic lines, collecting in turn information referring to all annexes integrated into the Convention to Combat Desertification and Drought. The thematic lines referred to are:

1- Local and Regional Desertification Indicators in a Global Perspective

2- Role of Information Circulation Systems in the scientific and practical approach to combat desertification

In May 2005, the first thematic axis motivated the holding of an international thematic seminar in Beijing, China. The second axis of analysis will be the reason for holding, in April 2006, a second international thematic seminar in Namibia. This seminar attempts to address institutional, not technological, challenges affecting information circulation within and among all levels.

Now, if on the one hand the project acknowledges the vital importance that the stages of experience exchange acquire, on the other hand it also warns of the need to broaden and deepen the knowledge of the realities that each of the annexes presents, a stage without which the subsequent exchange stages would not be secured.

In this context, and in order to serve as one of the base documents for the discussion to be held at this second international thematic seminar, the present study seeks to broaden knowledge about the "role of information circulation systems (ICS) in scientific and practical approaches to combat desertification in Latin American and the Caribbean". The study assumes the need to analyse this thematic axis, at least on three of the action levels recognized by the UNCCD: the regional, sub-regional and, finally, the national level.

As for the mode of development of the present study, it must be mentioned that analysing the role of ICS in LAC has posed some methodological difficulties worthy of consideration. In the first place, it is to be highlighted that the amount of available information is high, particularly for regional levels, although profoundly disordered and disperse. At this level, major efforts have been made to have access to the great amount of available data, and to afterwards lay them out in a clear scheme. In relation to sub-regional levels, it must be pointed out that the flow of information is significantly lower. The existence of networks, information systems and systems for circulation of the information has not been previously documented for the region, so a systematic tracking of available information had to be done, mostly through the Internet and by consulting key informants. However, the information voids observed and the lack of response of several key informants makes the risk of having omitted existing databases or systems important. The methodology followed on this point does not discard however the

possibility that existing databases or systems may have been omitted. Finally, with respect to national levels, the problems mentioned for sub-regional levels get worse to an extreme point. In this respect the present study reports on those systems likely to be accessed, but risks of omission, for this particular case, are high.

In addition to a systematic search for information available on the Internet, intensive use has been made of two data sources. Firstly, an enquiry carried out during the information survey, which gave origin to the study "Use of Indicators in the NAPs Relevant Activities In Annex III" (Abraham; Torres; Gutiérrez Espeleta and Febles: 2005) included within the same AID CCD project. Although this enquiry was primarily directed to survey aspects related to the use of B&I in the annex, it indirectly tackled the second thematic axis, namely the "role of information circulation systems (ICS) in annex IV. In this sense, a second review of the enquiry material available was conducted, and those data were reinterpreted to meet the objectives of the present study.

Secondly, and according to the difficulties found regarding information availability at some levels of analysis (mainly sub-regional, national and local), a request for information was made to key informants working in the annex. Nevertheless, the percentage of responses obtained was low (30%) and unbalanced from the territorial standpoint. While some informants provided valuable information, for instance about the Chaco and Hispaniola Sub-regional Programmes, or about the ICS in Argentina and Chile, the representatives of other SAPs or countries failed to make any contributions. Yet, it must be recognized that even though achievement of the study goals was hindered by this situation, this is in itself an indicator of the status of some NAPs and SAPs, and therefore constitutes a datum of inestimable value that ought to be interpreted.

Beyond the abovementioned difficulties, and once the data survey process is concluded in January 2006, an interesting flow of information has been achieved which, aside from the gaps likely to be closed over time, allows to grasp a current image of the situation in the annex.

Concerning the way in which work is organized, the first section includes an analysis of the regional or supranational level as related to ICS in LAC. Although emphasis is put on analysing those systems directly linked to the desertification issue, some others having –indirectly- an analogous direction have also been incorporated. Thus, the cases of some agencies that have displayed a potentiating action, both in the process to combat desertification and in the creation and nurturing of ICS, are included. These, among others, are the cases of FAO, UNEP and UNDP. This section includes the analysis of the: "International Network of Non-governmental Organizations" that works actively in the annex (RIOD-LAC).

In the second section the sub-regional level is analysed, as well as each of the SAPs existing in the region: SAPs for Great American Chaco, American Puna, Caribbean, Hispaniola and Mesoamerica.

The third section includes an analysis of the national level with the information available, and a brief report on some successful experiences at local level. Towards the end, and already in the conclusions, some considerations are given on the situation of LAC in relation to this issue.

1. Supranational level

Along the information survey process –both collected from Internet sites and from consultations with specialists in the subject- it emerges that, for the case of annex III, participation of different development agencies has been, and continues to be, of central importance.

These agencies –among them the paradigmatic cases of FAO, UNEP and PNUD – have had synergizing and potentiating effects in the region as regards the combat against desertification. Coherently, they have also had important effects on one of the mechanisms foreseen in these combat processes, as is the case of ICS.
As it has been possible to observe, if the UNCCD gives vital importance to the creation and enrichment of ICS, to the building of networks, and to the likelihood of the sharing of data and experiences among the different regions, in turn the agencies cooperating with the annex take a similar direction. Habitually agencies have ICS and, specifically, they have data on each of the countries composing the annex, as well as information about the outstanding issues and processes underway in each of these countries. This degree of synchrony between recommendations made within the scope of the UNCCD and within the agencies' scope must of course be encompassed in the framework of previous relationships between both these types of organizations, and has in turn been recurrently ratified by the successive COPs and regional and sub-regional meetings held as of 1994. Along this same line, it is worthwhile to highlight that the UNCCD and the Global Mechanism have ICS that prove valid for all annexes, including annex III. However, a distinctive note between the systems available in either space is that whereas in the UNCCD ICS are directly focused on desertification issues and on combat processes, the agencies associated with the United Nations system address more general or specific issues, so their contributions may be regarded as more indirect than those of the previous cases. It is, for instance, habitual for the ICS available in these agencies to have data on certain resources (land, water) or on certain problems (poverty, erosion) not always directly associated with "desertification or drought issues". Notwithstanding, and given that they also cooperate as systems supporting decisions on resource management, they have been taken into consideration.

The UNCCD, the Global Mechanism, DESELAC and Themanet

With respect to the UNCCD, a detailed analysis of the role of ICS cannot neglect mentioning the system of information support and the richness of links that the Convention Web page provides. Although the portal of access cannot in itself be regarded as an ICS, the site works as an unavoidable access key to desertification-related topics, and offers abundant information about each and every one of the countries and annexes integrated in the UNCCD.
For the particular case of LAC, the entirety of the National Action Programmes of the countries in the annex are available, as well as the national documents and reports generated over time. The richness of these databases enables even to historize the participation of the different countries and to have an accurate notion of the most severe problems confronted by the region and the countries involved. The information access system generated in this area is relatively user-friendly, has a simple design and -a not-the-least datum for LAC- is readily available in several languages, Spanish included.
The only difficulty posed by the site, and one likely to hamper its accessibility, is that the vocabulary used therein is barely comprehensible to those not in close relationship with the UNDC, in addition to a real excess of abbreviations difficult to decode (CRIC, COP; NAP, SAP; etc.).
Otherwise the site functions as an interesting multiplier of information, as it provides links with major international organizations: CBD (Convention on Biological Diversity), GEF (Global Environment Facility), GM (The Global Mechanism/ UNCCD), IFAD (International Fund for Agricultural Development), FAO (Food and Agricultural Organization), UN/DESA (United Nations Department of Economic and Social Affairs), UNDP/UNSO (UN Development Programme, Office to Combat

Desertification and Drought), UNEP (UN Environment Programme), UNEP/IUC (UN Environment Programme/Information Unit for Convention), UNESCO/WWAP (World Water Assessment Programme), UNESCO/MAB (Man and the Biosphere Programme), UNFCCC (UN Framework Convention on Climate Change), UNITAR (United Nations Institute for Training and Research), WHO (Regional Office for Europe, European Centre for Environment and Health), ESA/TESEO (European Space Agency, Treaty Enforcement Services using Earth Observation), IISD/Linkages (International Institute for Sustainable Development/Linkages), PCA (Permanent Court of Arbitration), Ramsar Convention on Wetlands, RETA (Prevention and Control of Dust and Sandstorms in Northeast Asia) and The World Bank.

On a similar line, the availability of information provided by the Global Mechanism cannot be omitted, especially regarding sources of financing. In fact, this institution was created to exercise, at world level, functions of mediation and harmonization between the demands of programmes to combat desertification and the financing offer. Within the framework of these functions, it is essential to collect and spread information about needs and financing resources.

In practice, this function is made effective through the FIELD (Financial Information Engine on Land Degradation) system, that gathers information about the different aspects of the CLD financial aid: financing institutions and amounts of funds available, selection criteria, financing conditions, priorities, modes of application, contacts and (co)financing needs, programme and project components, duration, results obtained, lessons acquired, appropriate practices, among other data. In spirit, the system puts forth the possibility of using the Internet to provide the power of information, and a worldwide offer of accessibility, cost efficiency, and time saving. Finally, the system offers a user manual that makes access conditions easier, is open to users' suggestions, and is also available in Spanish, all elements that make it relatively friendly to users.

With respect to Annex III, it is interesting to point out that the IX LAC Regional Meeting (Bogotá- June 2003) has played a relevant role in triggering an ICS of regional character. This meeting, where the LAC Regional Action Programme (RAP) was elaborated for the five-year period 2003/2007, created a Network of Thematic Programmes integrating six programmes:

a- Identification and use of B&I in desertification and drought.
b- Desertification Information Network for the LAC Region (DESELAC).
c- Programmes for integrated management and efficiency of water resources.
d- Promotion of agroforestry and combat against poverty.
e- Better practices, knowledge and traditional methodologies.
f- Promotion of sustainable renewable energies.

Although the need to create a network that could render useful for information exchange among the member countries of the annex had been expressed years earlier (CCD: 1997, CCD/ Coordination Mechanism in Latin America and the Caribbean: 1998), it is at this meeting that DESELAC (Desertification Information Network on Soil Degradation, Drought and Desertification in LAC) is formally created.

The purpose of the portal of DESELAC is to "provide the entire LAC region with ample information about soil degradation, drought and desertification". Its main goal is to support, promote and improve the application of the Convention through:

a) Daily exchange of information and experiences among the different countries.
b) Storage and supply of data on soil degradation, drought and desertification in all countries.
c) Providing links to major information sources worldwide.

d) Services of open forums, on-line conferences and electronic support bulletins.
e) Improvement of the technological potential of the different countries and the necessary stimulus to build national links.
f) Connection among all participants, including governmental contacts, Non-governmental Organizations (NOGs), scientific institutions, and experts both in the issues tackled by the communication network and in the related fields.
g) Supply of data, to the public in general, on soil degradation, drought and desertification in Latin America and the Caribbean.
Although the site is in the building process, it has information relative to each of the countries in the region (with links to a national site, a country profile, the National Action Programme and different National Reports) and it is foreseen to have data on the Regional Action Programme, the different Sub-regional Action Programmes and the different TPNs in LAC. It is relatively user-friendly and, even though at the moment it cannot be viewed in all its extent because information gaps are habitual, it is a great regional effort.
Lastly, since not long ago the efforts made by the Group of Experts of the UNCCD (GOEs) are being recorded in the Themanet website. Although this site will be put to use in February 2006, its prototype can currently be consulted[1].
As informed by the website entrance page, the following –among other issues- fall within the terms of reference of the GOEs: the development of a mechanism which would facilitate coordination activities and exchange of data, experience and results, to ensure sufficient information flow between National Coordinating Bodies (NCBs) in the period between Conferences of Parties.
In this context the proposal arises to create the THEMANET website, as a mechanism for an interactive and thematic data/metadata network. In this website, scientists of all disciplines nominated by the Parties in the Roster of Independent Experts have the opportunity to submit their views, and results, on key topics intended to represent the uniqueness of the UNCCD process.
The goals of Themanet are:

1. to implement the Information and Communication mechanism;
2. improve NCBs information and communication activities at national and international level;
3. facilitate exchange of data, experiences and results among NCBs;
4. facilitate efficient information flow among NCBs and the Roster of Independent Experts.

Inside the website it is possible to have access to documents arranged in a simple scheme (1- bibliography and abstracts of papers already published on referred journals; 2- full text of papers and documents free of copyright or authorized by publishers and 3- geographic information - data and metadata), and links to important ICS (some national and others supranational) are provided.
Even though the prototype of this website is structured in a clear, simple manner and is friendly to the user, it is interesting to point out that it lacks –at least for the moment- a version in Spanish, which makes accessibility difficult for users in the region.

The agencies of the United Nations system in LAC: FAO, UNDP and UNEP
As already mentioned, the role assumed by some international agencies has been of central importance to LAC, because they have synergized the efforts for the

[1] http://themanet.casaccia.enea.it/index.php

consolidation of ICS. Outstanding among the agencies that deserve specific treatment in relation to the case of LAC are FAO, UNEP and UNDP.

1.1 A paradigmatic case FAO

The role played by FAO is vital to LAC and most particularly to the Caribbean. Within this agency, efforts made over the last decades by the WAICENT system and the Land and Water Development Division (AGL/FAO) are to be highlighted.

WAICENT, the world agricultural information centre created at FAO, is a portal integrated by numerous specialized information systems. The system provides links to approximately 250 thematically arranged pages, and therefore functions as a prism that refracts information relative to different situations, problems and countries. By entering the WAICENT website, it is possible to have access to information about issues such as: rural and social development; economics and politics; education and specialization; information management; legislation; geographic and regional information; engineering; technology and research; human nutrition; fishing and aquaculture; plant production and protection; animal production and health; natural resources and environment; food security; silviculture; and crop systems and practices. From these links it is possible to enter –for example- the FAO Web site on desertification, which in turn promotes new links.

As for the Land and Water Development Division (AGL/FAO), it has oriented towards the development and application of computer-based data analysis and information systems to support decisions on various land and water issues. Soil, land and water systems have been developed in this way. According to the document "Land resources information systems in the Caribbean" (FAO: 2001), soil and land systems focus on methodologies and tools for the assessment of global, regional, national and sub-national land resource potentials, and water systems concern irrigation water use and management at field level, and regional and national water resources assessment.

AGL systems comprise a set of tools to store and analyse information and generate and disseminate information products for land and water decisions. The systems integrate tools of five kinds: 1- Database tools, 2- Model tools, 3- Decision support tools, 4- Documents and publications, and 5- Multi-media tools.

Three types of systems correspond with the three application areas described: 1- land resource assessment systems, 2- water resource assessment systems, and 3- irrigation water management systems.

A detailed overview of the "land and water resources information systems (LWRIS)" in FAO shows that –among others- the following information systems stand out: SDBm PLUS: Multi-Lingual Soil Database, WOCAT (World Overview of Conservation Techniques and Approaches[2], AQUASTAT (Information System on Water in Agriculture and Rural Development), GATEWAY to land and water information, AEZWIN (Agro-Ecological Zoning Systems) and GAEZ (Global-Ecological Zones 2000).

Just as an example it can be pointed out that one the most interesting impacts these systems have had on the annex became materialized in the Caribbean, particularly in relation to agricultural concerns. In this sense, and considering the central role that agriculture plays in the countries of the region, the member states of the Caribbean

[2] According to FAO, "WOCAT has compiled a database and updated land degradation and rehabilitation maps of more than 200 reported successful soil and water conservation techniques and institutional implementation approaches from almost 30 countries in Africa, Latin America and the Caribbean and Asia and the Pacific (recognizing that conservation advice is more easily adopted if it is has already been tested and shown to be effective)" (FAO: 2001:7)

Community (CARICOM) launched a Regional Transformation Programme for the agricultural sector. At sub-regional level, the Organization of Eastern Caribbean States (OECS) has formulated a Strategic Plan of Action to improve the effectiveness of the OECS Agricultural Diversification Programme. Three problematic areas are integrated through these efforts: land use, water resources and plant nutrients. In 1998, the first Annual Technical Meeting of the Caribbean Land and Water Resources Network (CLAWRENET) met in Sta. Lucía and identified a number of priority projects to be developed and implemented. Among these was the collection and dissemination of information on land and water resources, as well as promotion of public awareness of natural resource management.

Also worth pointing out is the fact that the FAO website, a portal from which to access Land and Water Resources Information Systems (LWRIS) as well as each of the abovementioned systems, has links of interest to the region, such as the "UN System Network on Rural Development and Food Security" and the "Food Insecurity and Vulnerability Information and Mapping Systems" (FIVIMS)

The former aims at: 1- supporting efforts by Governments and their partners to implement the World Food Summit Plan of Action and rural development and food security programmes; 2- reinforcing ties between UN System organizations and other stakeholders, notably NGOs and civil society organizations; 3- fostering synergies between Network members and 4- exchanging and disseminating information, experiences and best practices.

Created in 1997, and comprising 20 UN organizations, this network is an inter-agency mechanism for follow-up to the World Food Summit (1996) and World Food Summit. The Network Secretariat is managed by FAO, in collaboration with IFAD and WFP. The network has information on countries of the LAC region.

With respect to FIVIMS (Food Insecurity and Vulnerability Information and Mapping Systems), these are networks of national information systems that assemble, analyse and disseminate data on food insecurity and vulnerability. Their objectives are: 1- Raise awareness about food security issues; 2- Improve the quality of food security related data and analysis; 3- Facilitate integration of complementary information; 4- Promote better understanding of users' needs and better use of information; and 5- Improve access to information through networking and sharing.

The network provides access to country profiles, among many other things. Information available by country includes some LAC countries (Argentina, Bolivia, Chile, Colombia, Guatemala and Haiti, for example)

Finally, a simple comment stating that all mentioned networks functioning within the framework of FAO are available in Spanish and that, even though they handle a great deal of information and promote great number of links, all of these networks are relatively accessible.

1.2 United Nations Development Programme (UNDP)

As informed by one of the pages of access to the UNDP system, the aim of this organization lies in contributing to human development in the establishment of sustainable production and consumption patterns, and to poverty eradication within a democratic institutional context. The assistance it provides is related to national plans and priorities, and it allocates and administers funds entrusted by the beneficiary countries. The UNDP strives to contribute to the progress of the countries so as to meet the goals set at the Millennium Summit. At the same time, it supports all processes of political dialogue and provides advisory services to developing countries, particularly in the fields of *Democratic Governability, Social Development, Environment and*

Sustainable Development, and *Productive Development*. For LAC, a role known as "Associates for Development" has been established, where both the UNDP and the Governments identify development problems affecting the country, and each contributes its comparative advantages to bring a solution.
In the framework of Agenda 21, it has been made explicit that "in sustainable development, every person is at the same time user and provider of information, the latter considered in a wide sense and including data, information and the appropriate set of experiences and knowledge. The need for information is required at all levels, from the national and international level, to the community and individual level. There are two ranges of programmes that must be applied to take care that decisions are increasingly based on reliable information: reduction of differences in terms of data, and improvement of access to information".
Inspired on this principle, the UNDP launched the Sustainable Development Network Programme -RDS-, and currently several LAC countries have Sustainable Development Networks (Colombia, Nicaragua, Honduras, Costa Rica, Jamaica and Mexico).
Lastly, the UNEP/ORPALC, in joint action with the CCD Secretariat, coordinates the Regional Action Plan through the Regional Coordination Unit for Latin America and the Caribbean (1999). This Unit addresses degradation and drought issues, and carries out activities relative to education, information exchange and dissemination. Although the existence of this Regional Coordination Unit was known via other Web pages, it was not possible –at least over the period of this work- to directly access to it (www.rolac.unep.mx/deselac/esp) because the system showed systematic link failures.

1.3 United Nations Environment Programme (UNEP)

Before describing some of the ICS existing in the UNEP, it ought to be mentioned that this organization was established in 1972 and is comprised of different divisions: early warning systems and assessments; policy development and law; policy implementation; communication and public information; regional cooperation; trade; industry and economics and support for multi-lateral environmental agreements. The organization asserts that it works with national governments, cooperating institutions and other partners in LAC, providing information to support environment management, decision-making and policy setting.
Among the UNEP networks available, cases worth mentioning are –for example- the "Environmental Formation Network for Latin America and the Caribbean" and the "Authority Network for Environment Management in Cities of Latin America and the Caribbean". The former, which functions since 1982, has as its main goal the coordination, promotion, and support of activities in the field of environmental education, capacity building, and formation in the region. It coordinates and offers assistance for the organization of courses and the development of environmental formation programmes, activities of environmental capacity building at community level, and promotion of strategies for sustainable development policies. The primary goal of the latter is to "operate as an instrument of connection and action of local authorities for environmental and urban management of LAC cities", and additionally this network is oriented towards contributing a Latin American and Caribbean Initiative for Sustainable Development (Johannesburg, 30 August 2002), and all agreements of the Forum of Environment Ministers in Latin America and the Caribbean.
Nevertheless, the network that draws the highest interest in the frame of the objectives of the present work is UNEP.Net. This network, created in the year 2000, gathers all environmental information generated by different research agencies, and helps exchange said information using Internet technologies.

UNEP.Net provides: 1) specific links that guide the user to specific searches and 2) two portals of access to information: one thematic and the other one regional. Inside the links, information is arranged in four sections:
1- Environment Times, with environmental information in a newspaper format
2- GLOBIO (Global Methodology for Mapping Human Impacts on the Biosphere)
In general terms, and as informed by its Web page, the mission of GLOBIO is to present a clear visual overview of the cumulative impacts of increasing resource demands on humankind and the environment, based on the best available scientific evidence, in support of the global environmental assessments.
3- Poverty Mapping: seeks to promote the use of poverty maps in policy making and targeting assistance, particularly in the areas of food security and environment management. In turn, this site offers different links (a- Global spatial database of poverty mapping examples and possible indicators, b- comprehensive library of publications with newsletters and articles related to poverty and the environment, c- links to finding additional information and d- Specific information on food security, poverty, and the environment)
4- GLOBALIS, an interactive world map with statistics on environment and development.
Lastly, even though the information found in the UNEP area is interesting and meets the objective of spreading databases and information that may prove useful for the combat against desertification, two circumstances attract attention. In the first place, the access page is not available in Spanish, which seriously hinders use of the information by non-expert members of the public and, in the second place, it is a very little user-friendly system that, at the beginning, could barely be advantageously used by local governments and populations. For such reasons, although it may be correctly said that it collaborates to some extent in the combat against desertification, it appears to do so for the first levels of the system (regional, sub-regional, and –perhaps- national), and always for the case of specialized users.

RIOD-LAC, a dynamic structure across the world and in LAC
The first records of the International NGO Network on Desertification (RIOD) date back to the year 1994. The objectives of the network were stated that year, as well as its basic organization through focal points at national, sub-regional, regional and global levels. To this purpose, six regions were established: Africa, Asia, Latin America and the Caribbean, Europe, North America, and Australia. Since then the Global Focal Point and all six Regional Focal Points compose the RIOD's Inter-Regional Committee, with the addition of sub-regional and national focal points (RIOD: 2001).
In Peru –a year later (1995)- the CODEFF (Committee for the Defence of Flora and Fauna, Chile's NGO) and Proterra (Peru's NGO) organized the Conference of NGOs from Latin America and the Caribbean on Desertification and Drought, where the RIOD-LAC was established.
The goal of the RIOD-LAC is to promote the combat against desertification and give Non-governmental Organizations (NGOs) and Base Community Organizations (BCOs) an effective role in the preparation, setting in motion and review of national action plans in the countries of Latin America and the Caribbean.
This is a structure that helps NOGs and BOCs to exchange information and coordinate actions. Among the specific objectives to be achieved is "to facilitate dissemination of information and exchange of experiences to the civil society of the region, with the view to comply with the compromises undertaken in the framework of the UNCCD".

If, on the one hand, it its highlighted that the very structure of the RIOD-LAC embraces the participation principle as a pillar, on the other hand, the RIOD-LAC Web page is observed to reflect and actively support these principles, promoting a site of encounter and connection for the NGOs and BCOs in the region.
In this context the RIOD-LAC website serves as a channel of access to a wide information spectrum that enables the visitor to know the history of the network, get in touch with institutions related to desertification issues and actions to combat desertification, have access to on-line publications, contact a wide array of NGOs and, finally, participate in the network itself.
Lastly, although it is true that the site is not in itself an information circulation system, it is worthwhile pointing out that this site is the result of a huge regional effort, that gathers NGOs from all over the region, and that it is easy to handle and highly friendly to the user. This last condition is crucial in the case of the RIOD, given that –by definition- the site must be accessible to users not always specialized, the only condition that would safeguard the participation principles supported as pillars of the network.

2. The Subregional Level: SAPs and TPNs in LAC

At present, Annex III has five action sub-programmes (Great Chaco, American Puna, Caribbean, Hispaniola and Mesoamerica) and six TPNs.
With respect to the former, although it is deemed licit to assume that SAPs should agree with the central role given to information exchange by Agenda 21, and later by the UNCCD, consideration of the different paths taken by the SAPs in the region cannot be omitted. These data turn to be relevant because whereas some SAPs have made a long way and have been the object of important regional efforts, others are still on the early stages of formation/organization, and consequently the results, relative to ICS, yielded by the analysis of one or the other are markedly different.
Beyond these considerations, it must be highlighted in the first place that access to information about the SAPs in LAC has been extremely difficult, and more so when attempting to analyse the role that ICS have played in them. Most of the programmes are inaccessible through Internet search tools, they are not linked to the UNCCD website (a search engine that a regional or extra-regional specialist would try), are not accessible from DESELAC, it is to be supposed that many of them do not have Internet sites allowing access to the information and, finally, major information voids have been found in those few cases when websites have actually been accessed.
This set of limitations, added to the fact that many key informers in these SAPs gave no response to the requirements for information made over the research process, determine that this work is limited to provide a brief account of such SAPs, websites, and Internet pages that could be accessed.
The Great American Chaco SAP –comprising Argentina, Bolivia and Paraguay- has a Web page that gives information on the central features of the region, its major issues, and on the SAP itself.
This is the SAP with the longest trajectory in the region. The first records date back to 1996, and it became definitely established that same year, upon the signature of the SAP's Consolidation Proceedings in the II Latin American and Caribbean Regional Conference to Combat Desertification (Mexico, June 1996).
From that date on, a high number of meetings have been held among intervening countries, where progress has been made in defining the SAP. In addition to government representatives, non-governmental organizations and different social actors interested in the Sustainable Development of the Sub-region have participated. Progress has also been made in putting into effect proceedings of agreement between countries,

in defining shared goals and activities; recognizing the need to undertake coordinated actions among the different social actors, to promote the setting up of projects relative to the sustainability of the bioregion, and to support the Regional Desertification Information Network (DESELAC).

This SAP has a website containing general information on the region, and details about the SAP agreed by intervening countries. Among other things, this site provides detailed information about the history of the programme and about projects underway, as well as access to a series of documents reflecting the process of growth and consolidation of the Chaco SAP. Furthermore, a link to a database (currently in the building phase) is announced, and information about other actors relevant to the process is provided, as well as contacts with key institutions and persons within the structure of the SAP.

Even though, as mentioned above, the page is in the building process, it currently offers an interesting array of information that will surely be widened over time. Yet, it should be noted that, particularly in the documents section, users might not able to access –for example- scientific material on the region. Although documents on the growth process of the SAP are abundant, these might not be altogether accessible to a non-specialized public, while information about the region and the multiple realities it encompasses (biophysical, social, cultural, for instance) could be of great interest to a myriad of social actors.

Finally, even though the page is friendly, access to it is a bit complex and, in fact, cannot be achieved directly via Internet search (e.g. google.com). Contrarily, access to this page is guaranteed by the Environment Secretaries of intervening countries, but as these Secretaries and Ministries are complex structures, having plenty of information, searching for a specific topic -Chaco SAP in this case- may turn out difficult.

As for the AMERICAN PUNA, this SAP becomes established a year later than that of Chaco, on occasion of the III Latin American and Caribbean Conference to Combat Desertification (La Habana, 1997). This SAP has delegates from Argentina, Bolivia, Chile, Ecuador and Peru. The objective proposed by the PASPUNA delegates is "*to improve the quality of life of populations in the American Puna through the combat against poverty, the setting in motion of alternative economic activities and conservation of ecosystems*".

With respect to this sub-programme, and in relation to ICS, suffice it to mention that in the Web page of one of the member countries (Argentina) a brief description of the region is available, as well as the process of creation and consolidation of the SAP. However, for the moment, the PASPUNA lacks a website. As reported by a person interviewed, close to this SAP, "PASPUNA is an emerging SAP, so diffusion is a mid-term objective, once the programme has become operationally consolidated through substantive programmes and projects such as the developing GEF projects"

In relation to Hispaniola, it must be considered that the border region between Haiti and the Dominican Republic is that part of Hispaniola which is most affected by land degradation and desertification processes. Both countries have progressed in the establishment of the PAN-FRO (UNCCD National Frontier Action Programme) within the HISPANIOLA SAP. In the framework of this programme, both countries, along with different international agencies, are coordinating efforts to combat desertification and poverty.

Even though some key informers have given an account of the richness of this harmonization process among the policies of the two countries, at the ICS level it has not been possible to have access to systems enabling to reach a more thorough understanding of the region, its problems and/or characteristics.

The Caribbean sub-region exhibits an analogous situation to that of Hispaniola. As reported by the GM, between 2004 and 2005, this institution provided catalytic funding through the UNCCD Secretariat to support NAP process in all Caribbean SIDS (Small Island Developing States).

This approach was agreed in February 2004 by the countries in the region at the Regional Workshop on Sustainable Land Management (GM, FAO, CARICOM, UNEP) held in Trinidad and Tobago. This led to the establishment of the Partnership Initiative on Land Degradation and Sustainable Land Management in Caribbean SIDS (PISLM). Among the elements identified in the PISLM are: a) the elaboration of National Action Programmes (NAPs); b) the elaboration of a sub-regional action plan and the design of a sub-regional platform to support NAP formulation and implementation; c) a communication and database system to facilitate the flow of information among Caribbean SIDS; d) capacity building including training and research; and e) targeted development of GEF-funded initiatives to support and complement various components of the Partnership Initiative.

In turn, at the X Regional Meeting held in Sao Luis (Brazil, 2005), this sub-region, through its representative in Jamaica, reports to be working on the elaboration of a detailed proposal to tackle land degradation in insular states. On the other hand, the Mesoamerican representative informed of the need to device a programme for the sub-region, and submitted a tri-national initiative at the Gulf of Fonseca (El Salvador, Honduras and Nicaragua) that might become the first thematic nucleus in the region. In a coherent way, and with emphasis on this sub-region's backwardness with respect to the others (UNDC: 2005), it is reported that Mesoamerica is impelling the development and validation of NAPs in those countries that lack them, an element that –somehow- has delayed formulation of the SAP. At the same meeting, LAC countries informed that one of the most serious issues confronted by the region, and limiting the likelihood of applying the terms of the Convention, is the lack of information. In this respect, the need is again emphasized to keep on developing a reliable and efficient system for managing knowledge in order to find, select, organize and present information in a way that may improve application of CLD in LAC.

Lastly it is clear that, at NAP level, all recommendations and efforts are directed to improving information circulation systems. However, for the moment these are rather devoted to resolve preliminary work phases, which on later stages will result in the betterment of ICS.

Along a similar line, one of the persons interviewed during the work comments that *"...information networks in LAC reflect the level of consolidation of National Action Plans. Until the year 2004, only 7 countries had NAPs, with 5 of which corresponding to PASPUNA countries. According to the Bonn Declaration, by late 2005 all the countries in the region should have concluded formulating their NAPs. In the short term we could expect an operational explosion related to the combat against desertification and drought in LAC. Once the NAPs are consolidated, the generation of thematic networks at national level will allow laying the foundations for very strong information networks at sub-regional and regional levels".*

Briefly, concerning the TPNs in LAC, it has already been mentioned that the region has six TPNs.

TPN 1: Identification and use of benchmarks and indicators of desertification and drought.

TPN 2: Information network on desertification and drought (DESELAC).

TPN 3: Programmes on integrated and efficient management of water resources.

TPN 4: Promotion of agroforestry and combat against poverty.

TPN 5: Better practices, knowledge and traditional technologies.
TPN 6: Promotion of renewable sustainable energies.
As evidenced by information from interviews, in the context provided by TPNs, LAC maintains three networks in operation: desertification indicators (TPN-1), DESELAC (TPN-2) and agroforestry (TPN-4). A water network is in the structuring process (TPN-3), and the formation of networks dealing with traditional knowledge (TPN-5) and renewable energy (TPN-6) is foreseen for the mid term. Unfortunately, throughout the course of the present work it has not been possible to access these networks, probably because of the failure to dialogue with the persons directly responsible, and because they are not available from DESELAC. For this reason, no further critical analysis of said networks will be made at the present time.

3. The national level: the greatest wealth of LAC

Concerning this level of action, it must be mentioned that 14 countries of Annex III have elaborated their NAPs, and that those countries that have not yet achieved them are seriously devoted to complying with this stage. Notwithstanding, even though this is an encouraging element, it again confronts us with a great diversity of situations, with countries that have made great progress in this process, and others that still are on the initial stages. Such diversity of situations was widely documented in relation to the use of B&I in the work previously submitted to the AID CCD project (Abraham et al: 2005)
Now, even at this general level, three preliminary comments, which are valid for the overall Annex III, are to be made. In the first place, all LAC countries, after having ratified the Convention, have experienced profound change processes at national level, which have been fundamentally reflected on the legal and institutional levels. In general, it can be observed that laws have been sanctioned and institutions created, and these are actions directed to comply with the compromises assumed at international level. In the second place, in LAC all actions to combat desertification are linked to the sphere of national governments that take charge of environmental and natural resource issues. Government directorships, divisions or programmes relative to desertification are primarily connected with the environment area and not with, for example, the areas of social development or economics. Beyond the administrative fact in itself, this initial clarification is necessary because its effects are evidenced in the treatment of the problem and the kind of information that predominates. It is for instance habitual that official pages abound in physicobiological or institutional information on desertification processes and combat actions, but they are much more humble when it comes to economic, social or cultural characterizations. Finally, currently the great majority of LAC countries, and the government spheres working on these issues, have systems of information access, mostly linked to the Internet, which become a primary tool of unique value and extent.
In order to analyze the main accomplishments reached at national level by LAC countries, a brief account will be given of some cases that –in view of the goals of the present work- turn out to be relevant.
In the case of **South America**, and running the risk of omitting as many interesting cases, advances made in this issue, promoted by countries such as Argentina, Bolivia, Brazil, Chile and Venezuela, are worthy of note.
For example, in regard to **Brazil,** the fact cannot be disregarded that this country has been –at regional level- one of the major promoters of information exchange networks. In this context, the paradigmatic case should be mentioned of the "International Desertification Information and Documentation Network" (REDESERT) –created in

1996- fundamentally oriented towards the development of activities related to desertification research, transfer and capacity building.

In **Argentina**, the Directorship for Soil Conservation and Combat against Desertification (Ministry of Health and Environment, Secretary of Environment and Sustainable Development) provides a website that acts as one of the main access routes to national information on the issue. In addition to giving information about Argentina, the Web page provides access to the Chaco SAP Web, and information about PASPUNA. Lastly, it promotes links to major national information and research centres (CONICET and INDEC, among many others), and links to networks dealing with environmental issues (UNIRED, SIDALC-CASTIE-IICA, REPIDISCA, among others) and to the UNCCD. Also in Argentina, but in the case of NGOs, worthwhile mentioning are –for example- the efforts made by "Fundación del Sur", an active NGO connected with the RIOD, that provides information about the desertification issue and actions underway. Moreover, it promotes the links to RIOD and UNCCD. Both –the Directorship of Soil Conservation and Combat against Desertification and "Fundación del Sur"- have on-line libraries that facilitate access to information on desertification.

Another interesting case in South America is that of **Bolivia** where, under the sphere of the Ministry for Sustainable Development, there functions the National Information System for Sustainable Development (SNIDS). According to the access page to the site "it is an articulated set of data and information about the multidisciplinary, multiscale and multitemporal components representing the concept of Sustainable Development in its overall sense, to help circulation and exchange of data and information between the different levels of the Ministry for Sustainable Development and those institutions interested in making decisions". In the field of efforts made by organizations not related to the government, worth highlighting are the actions of REDESMA, "Sustainable Development and Environment Network", a non-profitable initiative impelled since 1999 by centres and organizations in Bolivia (CEBEM, LIDEMA, FOBOMADE and CI), interested in sustainable development and environmental issues. Through their website, and by means of diverse instruments, they are intent on building a virtual space of integration and knowledge able to connect different institutions and people interested in the problematic of Bolivia as much as in those in the rest of the world. In the case of **Chile,** one agency stands out at government level, the National Commission for the Environment (CONAMA), whose mission is "to promote environmental sustainability of the development process, and coordinate actions derived from government-defined policies and strategies regarding the environment". This institution has a Web page, provides relevant information at national and regional level, and promotes links to other institutions addressing environmental and sustainable development issues. According to key informers consulted during this study, this country has an important number of on-line public information systems. SINIA is one of the sites summarizing environmental information on the country. This site counts on the contributions of many national organizations that generate environmental information. Along the same line is SNIT, which operates within the field of CIREN (Information Centre for Natural Resources). As for the particular case of desertification issues, outstanding institutions are MONITOR, REDATAM and the National Land Use Monitoring System operating in CONAF, the UNCCD National Coordination Body in Chile. With the support of GEF it is expected to integrate the MONITOR, REDATAM and SINMUT systems, and generate a National Degradation Monitoring System (SIMDET). In the special case of REDATAM, this is an on-line information system associated with the Web page of the regional seat of CEPAL in Santiago. This website maintains information on line about indicators of the socioeconomic impact of desertification in Chile, Argentina and Brazil.

In **Venezuela,** worthy of note is the creation of the MARN Web page (www.marn.gov.ve), a first step towards the process of facilitating environmental information access. It is also the first stage of a more ambitious project: the System for Environmental Information and Communication (SICAMB) that will strengthen exchange of information among the different MARN offices (INV CLD: 2000). Besides, the country has the Land Information System of Venezuela (SITVEN), the National Hydrology and Meteorology Information System, the National Cartography System, all of which are under constant revision and updating (INV CLD: 2000).

In **Mesoamérica**, the case of **Costa Rica** cannot be overlooked, a country that has the Development Observatory within the framework of the National University of Costa Rica. According to the Observatory Web page, its mission consists in "providing relevant and timely information to the decision-making process regarding Costa Rican and regional development". The work of the OdD is divided into four programmatic areas, each providing access to information: 1) Environment and development, 2) Quality of life and related areas, 3) Methodological Development and computational applications, and 4) Sustainable development network.

In turn, the goal of the Sustainable Development Network is to "support development processes using the new information technologies". Information, exchange and support services focused on diverse sectors of the civil society have been built to accomplish this goal.

Aside from Costa Rica, other countries in Mesoamerica have developed Sustainable Development Networks (UNDP) that cooperate in generating awareness in the different agents of the civil society by diffusing and promoting the principles and recommendations of the Earth Summit. Among the members of these networks are governmental and non-governmental organizations, academic and research centres, social and cultural institutions, communication media, and international cooperation agencies that offer and exchange information and opinions on sustainable development, contributing to the diffusion of environmental information and to reduction of the data gap. In addition to Costa Rica, other countries that have SDNs are: **Nicaragua**, **Honduras**, **Jamaica**, **Mexico,** as well as **Colombia**.

In an analogous sense, worth highlighting is the quality of the information access system provided by **Panama**, through the links promoted by the Web page of the National Environment Authority, http://www.anam.gob.pa. From this page quick access can be had to national information on desertification, NAPs in the country, and diverse national documents and reports submitted to international meetings. A similar situation shows **El Salvador** through the Ministry of Environment and Natural Resources (http://www.marn.gob.sv)

In the case of the **Caribbean**, and basically in that of the small insular states comprised by this sub-region, the situation reported by the countries is -in general terms- quite similar. All of them coincide in putting forward relatively homogeneous demands, needs and situation status. It is commonly mentioned that these countries have made efforts to put into work systems for data collection and for ICS, however they pose difficulties basically centred on: not having sufficient technical means or specialized personnel, and not being able to ensure –in the frame of said difficulties- continuing information and data collection processes. There is consensus as well on the fact that inventories of existing resources are limited, that currently available data are poor in quality and detail, and that development of information circulation systems is a priority for these countries. As encouraging elements in this process, the countries also report a series of changes, particularly in institutional spheres. Some of them (**Guyana**, **Cuba**, **British Virgin Islands**, **Haiti**, among others) have experienced progress in legal

matters, and have created and consolidated institutions and action plans for problem areas (biodiversity, land use, water resources, for example).
Along a similar line, **Cuba** has made progress in creating a national network especially oriented towards the desertification issue: DESELAC-Cuba. Even though the page is not working to its full capacity, it shows promise to compile information valuable to the country and the region, and to provide links to the UNCCD.
In the case of the Caribbean, but this time in the field of NGOs, the Caribbean Network for Integrated Rural Development (CNIRD) stands out. CNIRD is an independent regional non-governmental organization that was launched in Jamaica in 1988. Its mission is "to promote sustainable and environmentally sound development through consultation with and the involvement of communities and their relevant entities in order to improve the quality of life in rural areas and the well-being of Caribbean people". It has representatives in Barbados, Belice, Dominica, Dominican Republic, Jamaica, Leeward Islands, St. Lucia, St. Vincent, Grenada, Guyana and Trinidad & Tobago.

4. Conclusions

In conclusion, it is worthwhile giving an account of the most interesting processes and trends recorded for Annex III.
In the first place it is interesting to mention that desertification has become a definite issue in Annex III, and that all countries in the region are working following internationally agreed directions.
In keeping with this trend, important changes are observed at legal and institutional level, a situation that has been reflected in the sanctioning of diverse national laws and in the creation of institutions and mechanisms for natural resource control and management.
At sub-regional level a similar trend is observed and, even though at different paces, instances of shared work have been increased by the countries, either through projects to combat desertification grouping several countries, or within the framework of the SAPs.
An encouraging element observed in asking Annex III about ICS, is that all the countries in the region have declared -particularly in the framework of the NAPs- that facilitating and democratising the access to information is a key element in the process to combat desertification, and that creating mechanisms of this sort is an unavoidable phase to advance in such process. Nevertheless, a detailed view on Annex III also allows noticing that -although committed to support combat processes- the whole region is affected by profound situations of territorial imbalance. Whereas some countries have made significant progress in diagnosing their problems, in defining combat actions, and in creating ICS, other countries are on the initial stages, still defining their NAPs. Consistently, it is observed that whereas some countries have managed to build human and technical capacities and have scarce but enough technology, others lack the basic raw materials that would allow for the development and consolidation of ICS. In this context, territorial imbalances inside the region are serious and, in case of being unattended, they could attempt against the application of agreements reached in the core of the UNCCD, especially in some countries and SAPs.
On quite another level, it is worth mentioning that, at government level, LAC countries channel actions to combat desertification through ministries and government divisions closely connected with the issues of "environment" and "natural resources". As mentioned above, beyond the administrative fact in itself, this characteristic turns out relevant in many senses. On the one hand, because it produces some sort of "conditioning in the outlook" of the desertification phenomenon. Concerns about

natural resources predominate, there is a tendency to list endangered natural resources and, when it comes to populations, poverty conditions occurring are superficially mentioned. In the cases analysed, important voids of information are observed, for instance, as regards the economic or social features of populations, or the structural relationships that such populations or spaces have with other spaces and populations.
On the other hand, the fact that the desertification issue is tackled within the field of action of the ministries of environment, in Third World countries, determines the non-inclusion of combat actions amongst the urgent issues to be solved, even though desertification and poverty are mentioned as being part of the same circle of problems. Other social problems (children facing severe food deficiencies, problems of non-access to health care and education services, high unemployment levels, non-access to basic services among many others) are more visible than desertification, which entails that all national efforts -and especially local efforts- are focused on them. In the framework of these conditions, government divisions working on desertification are on limited budgets and develop low-impact actions. Moreover, some informers consulted have mentioned that "desertification and development" are perceived as separate spheres, and that environment ministries and divisions function as decorative areas to government actions.
Given this set of conditions, worth noticing is the risk run by these ministries at the time of developing ICS, in the sense that they may well become one of the more visible faces of the "decorative function" that some assign to them. In this sense, it would be interesting that, beyond the presence or absence of ICS, data collection systems, Web pages or networks, countries and institutions became aware of the need for these systems to be alive, active, and above all functional for the purpose of the processes to combat desertification. In this direction, they must promote exchange of experiences, access to information and its democratisation, rather than being rigid platforms of institutional propaganda.
If, on the one hand, the desertification/environment and natural resource ministries relationship explains in LAC the strong limitation of resources available for processes to combat desertification, on the other hand, this same phenomenon accounts for the strong presence of international cooperation agencies in the Annex, and very particularly those associated with the UN system.
As observed in the first part of this work in relation to ICS, it is precisely in the context of these agencies where a greater flow of information is available, and where seemingly there is a higher amount of resources for actions to combat desertification and for the development of ICS.
However, in a parallel manner, it is interesting to notice that the presence of these agencies has no innocuous effects to the region, and that, on the contrary, their consequences are reflected -among others- on the ICS.
With respect to the ICS existing at the international level, that collect information relevant to the region, a truly important volume of information is observed, particularly regarding some thematic axes. In this respect, and as mentioned above, the realities of all LAC countries are reflected, disperse information is gathered, and some user-friendly sites are provided. Notwithstanding, and even acknowledging these advantages and achievements, two situations -at least- are to be considered.

1- On the one hand, the volume of information available -in some cases or for some topics- can be more than enough, overwhelming, and;
2- This information -again in some cases- draws attention because of its levels of repetition, generalization, inaccessibility to more operative levels, and homogenisation.

It is, for example, a curious fact that abundant information is displayed at international level about the general characteristics of the countries, and about the most outstanding features of the environmental problems they face, or that sites abound in quantitative data on population. However, at the same time, attention drawing as well is the fact that the very voids mentioned for national cases are repeated at international level, so also these systems are lacking in information about, for instance, the political, cultural, economic or social features of countries and societies. Along the same line, compact lists of B&I are in general provided, but there is no in-depth consideration of the implementation of integral studies relating these indicators with one another.

On the other hand, repetitive information managed in many ICS also draws attention and, although such information is thorough as regards some of the abovementioned topics, gaps in the same thematic axes (for example, social and economic conditions) are repeated. Consulted sites habitually mention overgrazing, forest logging or excessive irrigation as primary causes of desertification processes, but just as habitually they make no mention of other, more invisible, causes such as territorial imbalance situations, so important to the region.

In most cases it is also verified that general information about the countries is provided, but without succeeding in reflecting local or regional diversities. Perhaps these characteristics of the information may result in its being used and applied by a limited number of users, such as for example international, and some national, actors. In other words, as the information managed in these sites and networks is of a general nature, it is barely believable that affected actors, local governments, or even scientific sectors may profit from it given that, foreseeably, higher and better flows of information will be managed at such levels. Information is now always presented in comprehensible and friendly formats and, moreover, there not always exists great care for overcoming language barriers. On this account, although most agencies coincide that the objective of ICS relates to information democratisation and to the possibility of helping decision-making processes, such objectives could hardly be reached with the dominant formats, especially considering that "decision makers" in desertification matters are, in the first place, those directly affected and the local governments, many times lacking in the technologies required by the systems in use and far from the possibility of accessing existing formats in foreign languages.

Aside from being repetitive, of a general character, and inaccessible to some users, available information at international level tends to be homogeneous or, rather, to homogenize countries. In other words, said information is many times incapable of mentioning, considering and valuing the particularities exhibited by countries, and therefore –to some extent- their greater singularities and wealth are eroded. This fact, added to the existence of very poorly tackled topics, leads to the perception of LAC countries as being equal to other countries in the world (Panama appears as similar, for example, to Burkina Faso), and to restrict the only evident differences between Annex III and other Annexes to ranks by level of development (developed vs. developing countries). The above considerations in turn refer to two great topics that, deriving from the fieldwork, deserve to be highlighted because they will probably open new debates on desertification issues.

In the first place, it clearly emerges from collected data that, in the explicit and implicit discourse of international agencies, there predominates an outlook on development and underdevelopment that is not always about mutually related realities. In this respect, the countries affected by desertification, usually regarded as underdeveloped, are analysed as realities isolated from one another and, fundamentally, as realities unconnected to development poles. At the time of characterizing, for instance, desertification processes,

the list of degraded resources is consulted, general data on the country are mentioned and, as regards populations and technologies, describers are used, such as: primitive or traditional technologies, inappropriate resource management, overuse. However, the social and historical dynamics that make these phenomena understandable remain unclear, the relationship between development and underdevelopment is not mentioned, and no analysis is made of the role that power has played in furthering inequities worldwide. As a result, desertification processes appear as "the consequence of the bad practices of some people" and not as complex historical and political processes tied to driving forces that surpass them.

In the second place, it is very curious that, desertification being a world scale phenomenon and affecting developed and underdeveloped countries, the most promoted images are those tending to racialize the phenomenon. In other words, it is usual for international agencies to include in their Web pages images, and more particularly photographs, of desertification involving highly stereotyped and stigmatised populations: women, black or aboriginal people, and general poverty contexts seem to be the only scenarios where these processes occur. The aesthetics of these images is not however naïve, and they could feed old conceptions relating the idea of poverty to that of primitive populations that must be "helped" to reach the development levels others have achieved.

As previously mentioned, although the intention is not to consider the issue closed with these few lines, the present work aims at drawing attention on how fruitful it could be that international experts should take note of the consequences these messages entail, and of the power of the images depicted in the ICS.

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ROLE OF THE INFORMATION CIRCULATION SYSTEMS IN THE SCIENTIFIC AND PRACTICAL APPROACH TO COMBAT DESERTIFICATION

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Preliminary remarks

The present report has been elaborated in the framework of the *AID-CCD* initiative "*Active exchange of experience on indicators and development of perspectives in the context of UNCCD"*, from the information available on the Internet.

The authors of the report are solely responsible for it and it does not represent the opinion of the UNCCD Secretariat or its affiliates countries.

1. Introduction

1.1 Global information

The technological revolution started in the '90s creating the premises for a globalisation of information. Economy and trade were the first to be influenced followed by the environmental and social themes. The advent of faster and timely communication suddenly reduced the dimension of our world, and information began to circulate much faster than before.

Looking into the past, the world of the '90s seems to already be a part of history and not part of the present. It is even difficult to find our roots in what happened before, and the distance between generations has increased substantially.

The bases of our society have changed and the transformation has several main roots: one of them is technological and based on the parallel development of the new technologies. Created initially for military purposes, Internet migrated, at the beginning of the '90s, to the scientific community and then to the rest of world. Rapid exponential growth of Internet accesses, together with the number of websites and users, started in the USA.

The circulation of information increased dramatically both in terms of accessibility and speed. Information could be accessed everywhere in the world exactly like in your office; everybody is on easy reach, at all times. The number of PCs sold around the world increased from 175 million in 1993 to 588 million in 2003. Mobile phones are an other factor of change, capable of introducing a real revolution in the communication technology. In 1998 the number of users in the world increased from 317 to 1.340 million. China has the highest number of users (269 million) and the highest rate of increase is in Africa (more than 1.100%). Accessibility and speed are the two hints of this global revolution that are going to affect existing equilibrium.

In this global scenario the financial world can benefit from the potential of an information revolution, but the environment finds a new rationale.

The global dimension of the causes unleashing climate change and the breadth of these impacts are at the basis of such rationale. In recent years catastrophic events have increased in number and size, involving both developing and industrialized countries. These events were all monitored in real time in every part of the world, not only via television, but also through the new Information Systems.

The enhancement of scientific understanding and timely information spread appear essentials for identifying and facing environmental issues and global changes. In fact, systems and new technologies are able to provide assessment on current state of the environment, to monitor its trends and even to predict different scenarios of long-term

processes. Furthermore the Early Warning Systems (EWSs) concerning natural disasters are still evolving, thanks to the strengthening of analysis centres that collect, elaborate and transmit data and information in real time and diversified according to the needs of different end users. The fulfillment of sustainable development strategies, advocated by Agenda 21, also goes through the Information Circulation Systems, that should establish both technical and institutional networks among different users and producers of information, linking, integrating and exchanging know-how, multidisciplinary scientific resources and wealth of accumulated information and data on environmental issues at national and regional level.

2. Information collection and exchange in the UNCCD framework

The role of Information Technologies for sustainable development is emphasized in several international legal instruments related to the environment, first of all Agenda 21, Chapters 34, 35 and 40. Agenda 21 highlights the essential need of a scientific and technological information availability and an easy access to and transfer of environmentally sound technology to promote sustainable development: (Chapter 40, art. 40.1)

"*In sustainable development, everyone is a user and provider of information [...] That includes data, information, appropriately packaged experience and knowledge. The need for information arises at all levels, from that of senior decision makers at the national and international levels to the grass-roots and individual level.*"

As highlighted, to facilitate sustainable planning it is necessary to strengthen partnerships among national, regional and global capacities, to join and to involve different actors (scientists, decision-makers and local communities) and to build up mechanisms for the sharing and the exchange of multidisciplinary research and training. This could be gained:

- Unifying the language of information diffusion and data analysis;
- Developing and improving the regional and global networks based on national databases, in which also collecting, elaborating and disseminating high quality environmental information coming from regional and global programmes;
- Promoting open exchange of scientific and technological data and information and makes it available to the public.

By fulfilling these activities it is expected that the public and policy makers can make informed and timely decisions. Therefore specialized information systems aiming at supplying the information, adequate to specific users, should be the node of networks of clearing-house, defined as a central office for the collection and dissemination of information. These clearing-house networks would be improved or developed, if necessary, according to the different final users and their needs and should provide not only information on available technologies and their exchange, sources, assessments and products, but also referrals to other services, including news, training, workshops, etc. Scientific assessments on the state of environment and the evolution of Earth system could be effectively used in the decision-making processes suited to achieve the objectives of Agenda 21, even if it is necessary to overcome the communication gap often existing among scientists, decision-makers and public in general.

During the summit of Rio de Janeiro, in line with Agenda 21, the basis of important multilateral environmental agreements were reached:

- The *United Nations Convention to Combat Desertification* (UNCCD), that underline the relationship between desertification processes and poverty, food security and migrations;

- The *United Nations Framework Convention on Climate Change* (UNFCCC), that aims to the stabilization of gas emission and reduction of the greenhouse effect;
- The *United Nations Convention on Biological Diversity* (UNCBD), that highlights the need of conserving biological diversity.

Sustainable management, sustainable practice in land use and agriculture and sustainable use of biological diversity are the objectives that link the three Conventions. The same response policies or measures can, at the same time, concern desertification, climate and biodiversity goals. The UNFCCC, UNCCD and UNCBD provide the legal basis for an international response to the global environmental issues, concerning desertification, climate change and loss of biodiversity and contain guidelines about financial resources, technology transfer and capacity development.
The overlaps of scientific information among the Conventions can create accurate and relevant integrated information systems and gather scientific and technical expertises.
The World Summit on Sustainable Development (WSSD) recognized that the achievement of the goal of eradicating extreme poverty depends on combating land degradation.In particular, the United Nations Convention to Combat Desertification (UNCCD) emphasized the need to coordinate research efforts and action programs for combating desertification and drought and recommends, in Articles 16 and 18, the reinforcement of the exchange and circulation of information, as one of the instruments to rich the aim:"[…] *This would help accomplish early warning and advance planning for periods of adverse climatic variation in a form suited for practical application by users at all levels, including especially local populations*" (UNCCD, Part III, Section 2, Article 16).
Parties shall, in particular, "[…] *fully utilize relevant existing national, sub-regional, regional and international information systems and clearing-houses for the dissemination of information on available technologies, their sources, their environmental risks and the broad terms under which they may be acquired*" (UNCCD, Part III, Section 2, Article 18).

3. The Information Circulation System on the Annex IV

In the UN Convention to Combat Desertification affected countries were grouped taking in to account geographical and socio economical similarities, homogeneous conditions and priorities for action.
The Annex IV concerns Northern Mediterranean region. Its uniqueness is due to the ancestral human presence that has strongly influenced the environment and the landscape and intensified land exploitation and sub-sequentially degradation.
The main Parties of the Annex IV are Greece, Italy, Portugal, Spain and Turkey; they participate to the Convention both like affected and developed countries. Within the new affected countries, Albania, Croatia, Cyprus and Malta, they aim at planning strategies at national, sub-regional and regional level and cooperating with countries of other Annexes to alleviate and prevent desertification problems.
National (NAP), sub-regional and regional (RAP) Action Programmes are the main strategic planning instruments for a sustainable development and are intended to be a working documents, in which the consultative and participatory process and the sharing of information are fundamental to facilitate and accelerate actions.
Activities of Annex IV are also supported by "observer" countries not affected (France, Principality of Monaco and Republic of San Marino) and the European Community, that is one of the principal driving forces for the implementation of policies to combat desertification. From the first COP - Conference Of the Parties - and the first coordination meeting of the Annex IV countries several projects related to the study of

desertification causes and the definition and monitoring of vulnerable or sensitive areas to desertification have begun. One of the main aim is to help and facilitate both local, national and regional decision-makers to draw up Action Plans.
Information, data, experiences and conclusions of the research projects should be collected and used for the development of an integrated policy framework and for the harmonization and coordination of NAPs of members of the Annex IV. Although, at present, there are many projects concerning desertification, their huge quantity of data, products and information are not easy to use for three main reasons (ICCD/COP(5)/CST/6, 12 September 2001):

1 - "*the results of data collection and processing are disseminated among only a limited number of users who often form part of the same professional, scientific or technical milieu*";
2 - "*the products generated are only to a limited extent transformed into information that can be directly used in decision-making processes relating to the management of natural resources and the environment*";
3 - "*the information all too often remains dispersed, restricted and hard to access by users at both the national and international levels owing to a lack of suitable mechanisms for the circulation of information*".

Consequently, reinforcing communication, facilitating the exchange of information and establishing a common Information Circulation System (ICS) are the basis for the improvement of the capacity to program measures and policies, by converting information into actions, and for formulation, development, implementation and support of NAPs and RAPs.

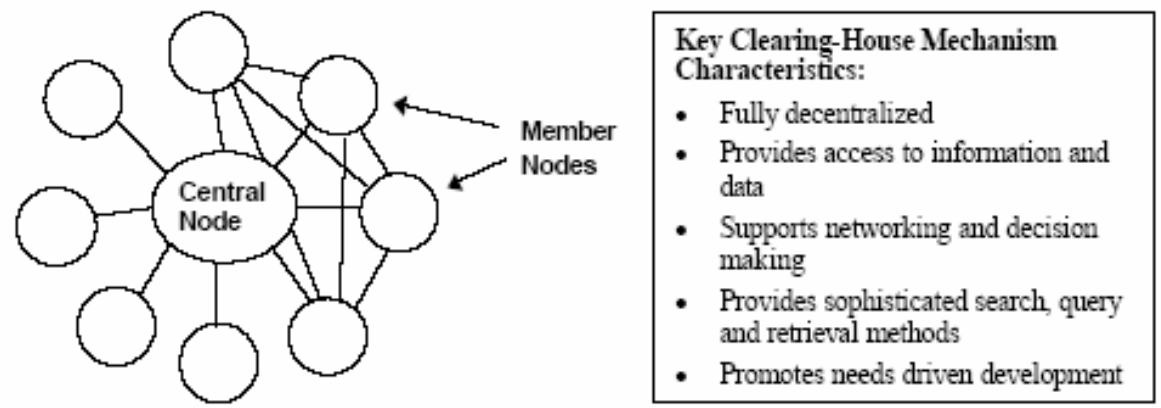
4. The Information Circulation System concept (glossary)

Clearing-House Mechanism (CHM)

A central office, as for the collection and dissemination of information. (Hazon, Orlando).
Nevertheless a CHM is not simply a database or a GIS or an instrument used to share scientific resources, even if it could include all of these; it is like a network for collecting, validating and diffusing information to promote and facilitate scientific, political and economic co-operation and common strategies between the different actors involved in the Action Plans and with other international Conventions (Climate Change, Biodiversity, etc.).
A CHM aims:

- to help local, national and regional decision makers;
- to encourage participation of stake-holders;
- to further the transfer of technologies and traditional knowledge;
- to encourage the exchange of experiences and results on environmental studies, in particular on desertification.

Decision-makers, authorities, international and national organizations, NGO, stake-holders, scientists, technicians and local communities are all potential users of the CHM; for this reason circulation of and access to information should be facilitated.
Each country party to UNCCD is encouraged to build a Clearing House Mechanism to create a network for an easier exchange of information at global level, concerning the state of the art of the Convention, the definition and collection of desertification indicators, the extent of the phenomenon, the references about Action Plans and projects.



Structure and Characteristics of the CHM. - UN Environmental Program.

Communications System
A coordinated assemblage of people, devices or other resources designed to exchange information and data by means of mutually understood symbols. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Data exchange
A reciprocal transfer of individual facts, statistics or items of information between two or more parties for the purpose of enhancing knowledge of the participants. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Database
A data base is a single organised collection of facts, records and data normally set up to meet the information needs of major parts of an organisation and to make specific items easy to find. Databases are usually organised around an identifier, or key, which can be anything from an account number to a surname. The use of this sort of identifier means that individual data items can be accessed rapidly and efficiently with the minimum of fuss. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Decision-support System
A coordinated assemblage of people, devices or other resources that analyses, typically, business data and presents it so that users can make business decisions more easily. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Early Warning System
Any series of procedures and devices designed to detect sudden or potential threats to persons, property or the environment at the first sign of danger; especially a system utilizing radar technology. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): General Multilingual Environmental Thesaurus)

Environmental Information Network
A system of interrelated persons and devices linked to permit the exchange of data or knowledge concerning natural resources, human health and other ecological matters. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Environmental Information System
A coordinated assemblage of people, devices or other resources designed to exchange data or knowledge concerning any aspect of the ecosystem, the natural resources within

or, more generally, the external factors surrounding and affecting human life. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Gateway

In a communications network, a network node equipped for interfacing with another network that uses different protocols. (ATIS TELECOM GLOSSARY 2000 - http://www.atis.org/tg2k/)

Geographic Information System

An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyse, and display all forms of geographically referenced information that can be drawn from different sources, both statistical and mapped. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Indigenous knowledge

An acquaintance with facts; the perception, awareness or consciousness (of anything); or a general state of being informed that originates in and is characteristic of a particular region or country. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information Clearing-House

A central institution or agency for the collection, maintenance, and distribution of materials or data compiled to convey knowledge on some subject. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information Exchange

A reciprocal transference of data between two or more parties for the purpose of enhancing knowledge of the participants. (EEA, European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information Infrastructure

The basic, underlying framework and features of a communications system supporting the exchange of knowledge, including hardware, software and transmission media. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information kit

A set or collection of materials compiled to convey knowledge on some subject and usually placed in some type of container. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information Network

A system of interrelated persons and/or devices linked to permit the exchange of data or knowledge. (EEA, European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information processing

A systematic series of actions performed by a person or computer on data elements including classifying, sorting, calculating, summarizing, transmitting, retrieving and receiving. (EEA, ETC on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

Information source
Generally, any resource initiating and substantiating the reception of knowledge or specifically, the origin of a data transmission. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Information System
Any means for communicating knowledge, such as by simple verbal communication, or by completely computerised methods of storing, searching and retrieving of information. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Information Transfer
The communication or conveyance of data or materials for the purpose of enhancing knowledge from one person, place or position to another. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Internet
A global system of networked computers that allows communication between users and the transfer of data from one machine to any other on the network. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Metainformation
Data assembled to describe or define another body of data, a document or any information element. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Referral Information System
A coordinated assemblage of people, devices or other resources organized to provide directions leading people to sources known to provide knowledge or assistance on a specified topic or request. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Selective dissemination of information
A service provided by a library or other agency that periodically notifies users of new publications, report literature or other data sources in subjects in which the user has specified an interest. (European Environment Agency (EEA), European Topic Centre (ETC) on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Statistical Information System
A coordinated assemblage of people, devices or other resources enabling the exchange of numerical data that has been collected, classified or interpreted for analysis. (EEA), ETC on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))
Telecommunications
The science and technology of communications by telephony, radio, television, etc. (European Environment Agency (EEA), European Topic Centre on Catalogue of Data Sources (ETC/CDS): INFORMATION, EDUCATION, CULTURE, ENVIRONMENTAL AWARENESS (Thesaurus))

5. State of the art

5.1 Objectives

The quantity of information available as of today is a unique wealth for the implementation of the UNCCD and it can be promptly employed thanks to a closer

collaboration among the projects/institutions called to produce a demand-driven information.

The increase of projects related to desertification, drought and land degradation has allowed to store up, in the last decade, a wealth of information and data, most of which stored in databases that are isolated or not accessible to all users. Nevertheless policy actions and decision support based on scientific data depend on the availability, circulation, exchange and updating of information, and require its integration.

To be effective, a framework of a typical communication system should be based on some main components (Fig. 1):

1. collection of data;
2. elaboration of data;
3. production of information;
4. exchange and dissemination of information.

Nevertheless the final link in this chain is often the weak one.

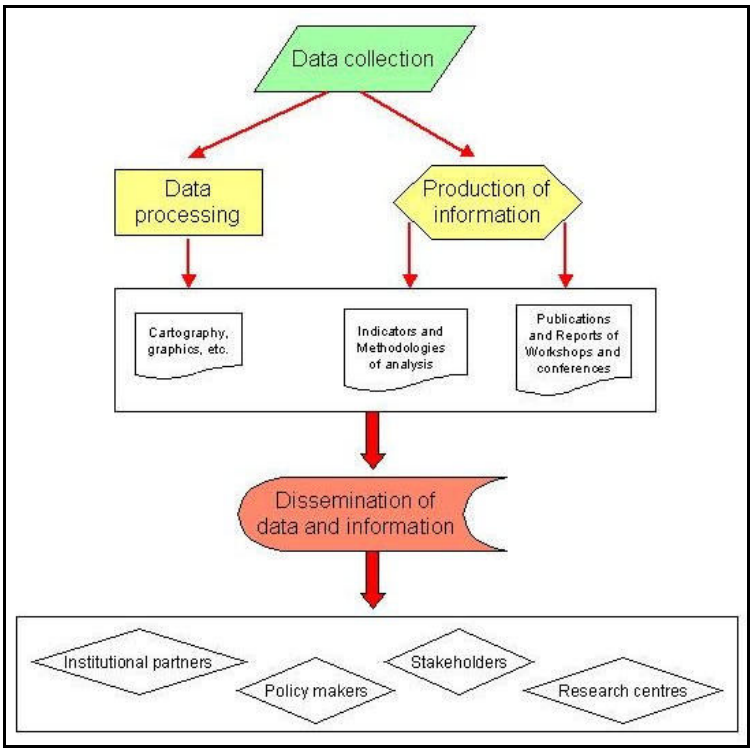


Figure 1: Framework of an Information Circulation System.

In the "net" we can find several information concerning local, national and regional desertification and drought projects, even if most of these only describe the expected objectives and the results achieved from the research works, indicate the partnership involved or events calendar and provide links with institutional or related web sites. In some cases documents of technical workshops and scientific conferences, publications, intermediate and final reports of the projects are available for the download, and wide space is given to the indicators, the methodology of analysis and the results of the research. Actually indicators are the core of the technical-scientific work and the intermediary step between the input data and the final information level.

In other cases it is possible to gain free access to the information databases, in which are collected input data, metadata, data elaborations, maps, graphics and so on, and among the lot of them only few web sites have arisen with the specific aim to manage and to disseminate information and data of scientific and technical researches to assist the

harnessing of local know-how and the implementation of appropriate programmes and legal instruments in the field of desertification and land degradation.
However the exchange of information and data collection and processing mainly remains internal to the partnership of the project, who often includes not only scientists and technicians, but also institutional partners, at local or national level.
Since the complexity of the phenomenon and the multidisciplinary processes of desertification, the need of co-operation among different institutions and specialized research centres, both at national and regional level, has driven to use statistical approach or complex one integrating data from various sources.
Taking into account the need for a multidisciplinary approach, and considering how heavily the technical constraints can affect the choice of a methodology of analysis, it is clear the necessity to create a network enabling to integrate, to homogenize and to make available a lot of different information. Although priority should be given to the development of those applications that would be really suited to the end users.
Based on this framework a comparative analysis of the Information Circulation Systems (ICS) operating in the Internet and related to the Annex IV countries of the UN Convention to Combat Desertification in northern Mediterranean region has been undertaken.

5.2 Users

The target of an Information System concerning desertification and drought is generally of varied culture and interests, but the main actors are the decision makers that need information for the identification of vulnerable areas the definition of strategies of intervention, policies and priorities of actions.
From local to international level they are:

- local administrators;
- national services;
- national focal points;
- governments;
- international partners;
- UNCCD national Committees.

Moreover other users, such as international NGOs (OECD, OCSE, etc.) or the international community, first the European Union (EU) and its various organisations, could either intervene or co-ordinate their intervention with the national authorities.
Finally a completely different group of users are the scientific and research community, interested in receiving data and information to support the development of new methodologies or techniques, and the general stake-holders and monitored populations, directly involved in combating land degradation.

5.3 Products (existing Information Circulation Systems)

The analysis and classification of the Systems is based on the following parameters:

- description of aims and objectives;
- target users;
- availability of documents and reports;
- broad access to the databases;
- download of cartography and/or satellite imagery;
- Availability of tools of data elaboration and description of applied methodologies;
- degree of information updating;
- user-friendly interface;
- metadata availability;

- link with other related websites;

A list of Web sites related to the information dissemination projects in the Northern Mediterranean Region is given:

- CLEMDES
- DESERTLINKS / DIS4ME
- DISMED
- DESERTNET
- DESERTWATCH
- MEDACTION
- RIADE

CLEMDES - *Clearing House Mechanism on Desertification for the Northern Mediterranean Region*

	Characteristics
Project Partners	◆ *INEA* - Italian National Institute of Agricultural Economics; ◆ *GNCCD* - Greek National Committee for Combating Desertification; ◆ *BIDR* - Blaustein Institute for Desert Research, Department of Evolution,Systematics & Ecology Alexander Silberman Institute of Life Sciences, Israel; ◆ *APAT* - Agenzia per la Protezione dell'Ambiente e per i servizi Tecnici, Italy; ◆ *DGF* - Direcção-Geral das Florestas Gabinete de Desertificação – DISMED, Portugal; ◆ *CSIC* - Consejo Superior de Investigaciones Cientificas Centro de Investigaciones sobre Desertificacion (CIDE), Spain; ◆ *GDRS* - General Directorate of Rural Services Koy Hizmetleri Genel Mudurlugu, Turkey.
Description of Aims and Objectives	The project aims to promote the development of a network with a broad social participation through the implementation of a "Clearing House Mechanism" (CHM). The main objectives are: • Promote and facilitate technical and scientific cooperation, within and among the countries of Annex IV and other affected countries of the Mediterranean Region; • Develop a mechanism for the participation of NGOs, local stakeholders and scientific community to the exchange and integration of information on desertification; • Disseminate all research results available; • Establish a central (portal) Web site prototype of the Clearing House Mechanism (CHM) on desertification for the Northern Mediterranean region; • Develop a tool kit to assist in the establishment of national Internet data-base; • Develop of synergies with other existing initiatives of the Climate Change and Biodiversity convention. The creation of the network of CHM should increase the accessibility to information and, at the same time, the creation of a national meta-data base should improve the achievement of the better accessibility. The use of Internet allows to share existing knowledge on the issue of desertification (Fig. 2).
Web site	http://www.clemdes.org/
Target users	National focal points of the UNCCD, experts on information, NGOs, decision makers and members of the scientific community.
Available documents and reports	The "Documents" section contain downloading documents on desertification and related issues.
Broad access to the databases	The information collected in the CHM are available to all users, with not restricted areas.

Available data: cartography, images, statistics and/or satellite imagery	-
Available tools and/or software for data elaboration and description of applied methodologies	-
Degree of information updating	The CLEMDES portal Web site enable users to update different sections adding themselves news, documents, links, projects, events, etc., that are checked and approved before the inclusion in the CLEMDES database.
User-friendly interface	The database is organized into 11 sections: Events, Experts, Projects, News, Documents, Links, Funding opportunities, All forms, National Background, Newsletter, Contacts. For each section it is possible querying or searching needed information. The information is available in the national languages rather then in English.
Meta-data base	The structure of CLEMDES allows to query the database to find projects, documents, links and events through their metadata (type of implementing Agency, region, country, source of founding, area of expertise, date, sector, etc.)
Link with other related websites	The project proposes to set up a Northern Mediterranean Internet portal linked with a network of a CHM at country level.

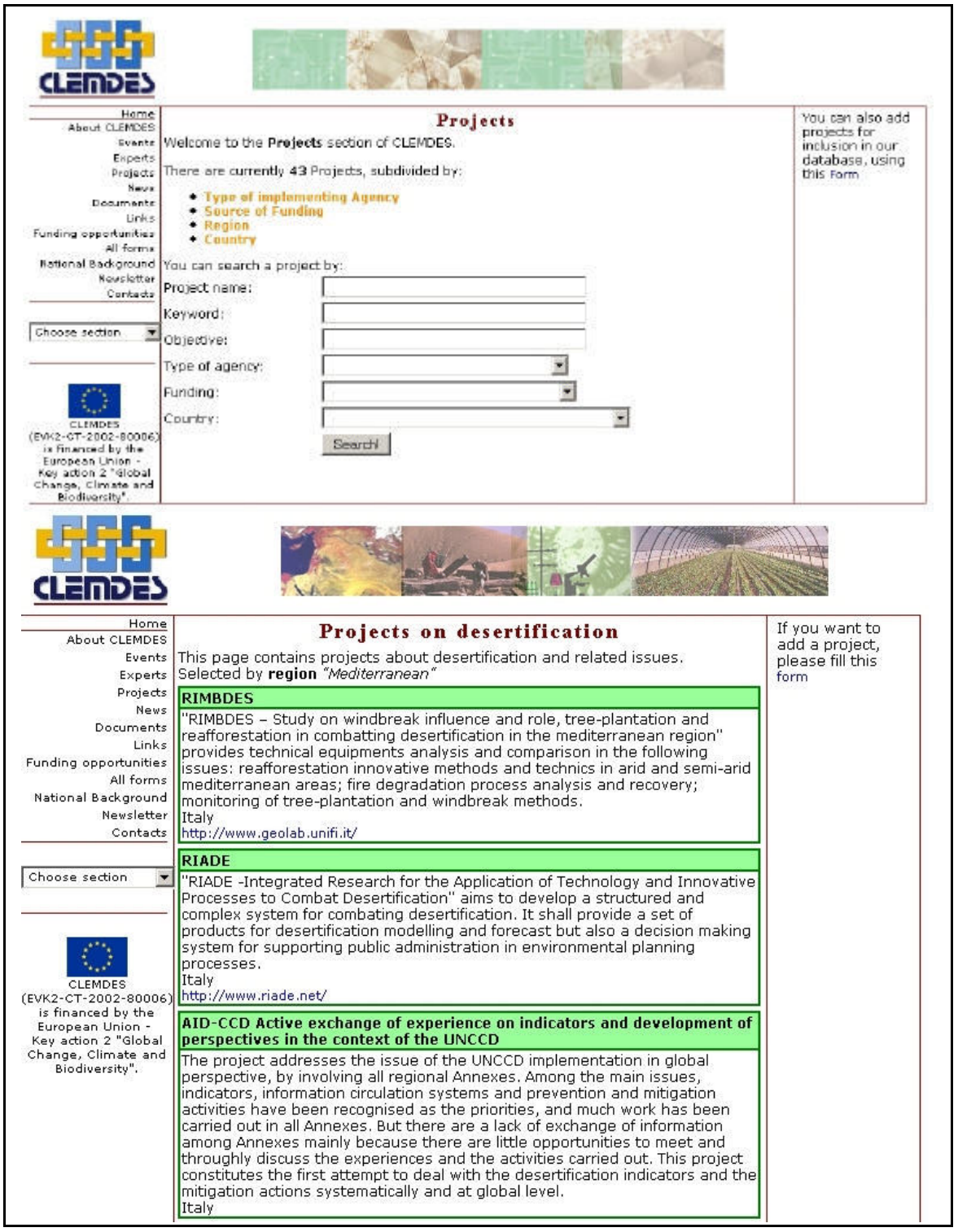


Figure 2: Example of the CLEMDES website structure.

DESERTLINKS / DIS4ME

	Characteristics
Project Partners	◆ *DESERTLINKS Project Office*, Oaklands House, United Kingdom; ◆ Dipartimento di Produzione Vegetale, Università della Basilicata, Italy; ◆ *EC* Environmental Change, Netherlands; ◆ School of Geography, University of Leeds, United Kingdom; ◆ Agricultural University of Athens, Dep. of Natural Resources and Agric. Engineering, Soils Laboratory, Greece; ◆ Physical Geography, Universidad de Murcia, Spain; ◆ Dipartimento Tecnico-Economico per la Gestione del Territorio Agricolo-Forestale, Università della Basilicata, Italy; ◆ Direccion General de Conservacion de la Naturalezza, Spain; ◆ Departamento de Geografia e Planeamento Regional, Universidade Nova de Lisboa, Portugal; ◆ *NRD* - Nucleo Ricerca Desertificazione -c/o Dipartimento di Scienze Zootecniche - Università degli Studi di Sassari, Italy; ◆ Environment Institute, Soil and Waste Unit, *EC-JRC*, Italy.
Description of Aims and Objectives	Its primary objective is to contribute to the work of the United Nations Convention to Combat Desertification by developing a desertification indicator system for Mediterranean Europe. What it was planned as a Desertification Indicator Manual on paper would become accessible as an interactive website. The project has develop a combined desertification indicator system, offering a common methodology for Mediterranean Europe, for the identification and use of indicators to identify high risk areas and explore options for their management. The principal product of DESERTLINKS project is a **Desertification Indicator System** for Mediterranean Europe, which has been tested and evaluated by both the local stakeholders and the Annex IV National Committees. A Candidate Indicator List was begun, gathering indicators from the National Action Programmes, from various national and international organisations that had existing indicator lists, from past and contemporary research projects, and from workshop consultations with groups of local stakeholders. The series of workshops discussed driving force, pressure, impact and response indicators and finally evaluated the completed system. Gradually the indicator list was reviewed by the DESERTLINKS partners, seeking new indicators to fill in gaps, and losing some indicators that could not be either described or measured or used in a practical way. The indicator system will be used by local stakeholders to explore alternative management scenarios and by the National Committees for national and regional management and monitoring. A *conceptual and database framework* will be developed for these and the other indicators identified in the project. Internal to the project is **DIS4ME - *Desertification Indicator System for Mediterranean Europe***. The DIS4ME site, gives access to some 148 indicators of relevance to Mediterranean desertification. It is being designed to provide a tool to enable users from a wide range of backgrounds to: • identify where desertification is a problem; • assess how critical the problem is; • better understand the processes of desertification.
Web site	http://www.kcl.ac.uk/projects/desertlinks/ http://www.kcl.ac.uk/projects/desertlinks/indicator_system/introduction.htm
Target users	Local stakeholders (such as farmers), policy and decision makers, members of the scientific community, members of UNCCD.
Available documents and reports	In the DESERTLINKS website we can download brochures, posters, information booklets, reports, technical papers on the methodology of the work packages, guidelines and manuals related to the project and in particular the identification, development and application of indicators for combating desertification. In the DIS4ME section there is the description of the ESI methodology, the RDI

	model and their comparison. In the "disseminating information" section a booklet entitled "What is Desertification?", written in non-technical language, is available.
Broad access to the databases	The access to DIS4ME - Desertification Indicator System for Mediterranean Europe is subordinate to gain a password. Through the DIS4ME web pages we can find the **individual indicator descriptions**, and enter the system as a guest, with a read-only access to the database resources. An off-line version of DIS4ME can be downloaded. However, access of part of the web site is restricted to project members.
Available data: cartography, images, statistics and/or satellite imagery	It is possible to download the ESA (Environmental Sensitive Areas) data set for all target areas plus the independent layers of parameters and indices in geotiff format, that can be opened in ArcGIS environment (versions 8-8.3-9) where you have the ability to categorize with colours each one of the images and see the data outputs for each cell. Other maps of land cover, vegetation, soil erosion and salinization risk are only available in image formats.
Available tools and/or software for data elaboration and description of applied methodologies	Tools developed to use and combine indicators are: – **ESI tool** - ***Expert system for evaluating the Environmental Sensitivity Index of a local area***. It is a tool to calculate the desertification risk, as updated version of that which was developed and tested in the MEDALUS III Project, for a local area or for particular land uses. For each of these land uses, the relationships between a small number of key indicators can be examined (Fig.3) and customers can obtain: ⇒ an evaluation of the quality of the environment being examined for the four main components of vegetation, climate, soil and management; ⇒ the estimate of the Environmental Sensitivity to desertification of the area; ⇒ an evaluation of the most critical factors that are present in the area; ⇒ an evaluation of the critical interactions among factors that are present in the area. Another tool calculates desertification risk due to salinization. – The ***Regional Degradation Index*** (**RDI**) ***model*** for Europe is taken in to account. It is a physically based model for estimating long-term average rates of soil erosion by water, at regional scales. – **ManPrAs** tool for ***Agricultural Management Practices Assessment*** (Fig.4) to suggest a method, based on the indicators list in DIS4ME, to assess the sustainability of agricultural practices through its Soil Conservation Index (SCI) and economic results (Gross Margin-GM), and to simulate the impact on soil degradation, farm profitability and socio-economic features of alternative crops in a specific context. The tool is strongly user-orientated, and allows assessment of the environmental and economic aspects of agricultural practice, giving a powerful simulation tool to farmers and stakeholders involved in land management. ManPrAs can be used, for explorative goals, even when not all the parameters are known. In such cases, for all the data not available, the worst values are automatically used for calculation(prudential approach). – A DIS4ME **database** that includes all the indicators selected. – **ManData** is a database of current, past and potential land use management practices in each target area of desertlinks project. It reports all the technical and economic details about the full range of different crops and techniques that can be observed in the Northern Mediterranean countries.
Degree of information updating	The information updating reflects the work progress of the project.
User-friendly interface	The web-based ESI tool uses a simplified interactive interface strongly user-orientated. The interface consists of a set of pull down menus from which the classes of a series of physical, environmental and socio-economical indicators (e.g. type of vegetation, annual rainfall, soil depth, land use intensity, etc.) can be selected. English is the main language of the web site, however some information are available in Spanish, Italian, Portuguese and Greek.

Meta-data base	Metadata related to the indicators are included in their description.
Link with other related websites	DESERTLINKS is part of a cluster of ongoing research projects on the general theme of desertification. The other projects in the cluster are MEDACTION, MedRAP and GeoRange; other links concerning European researches on desertification are available too.

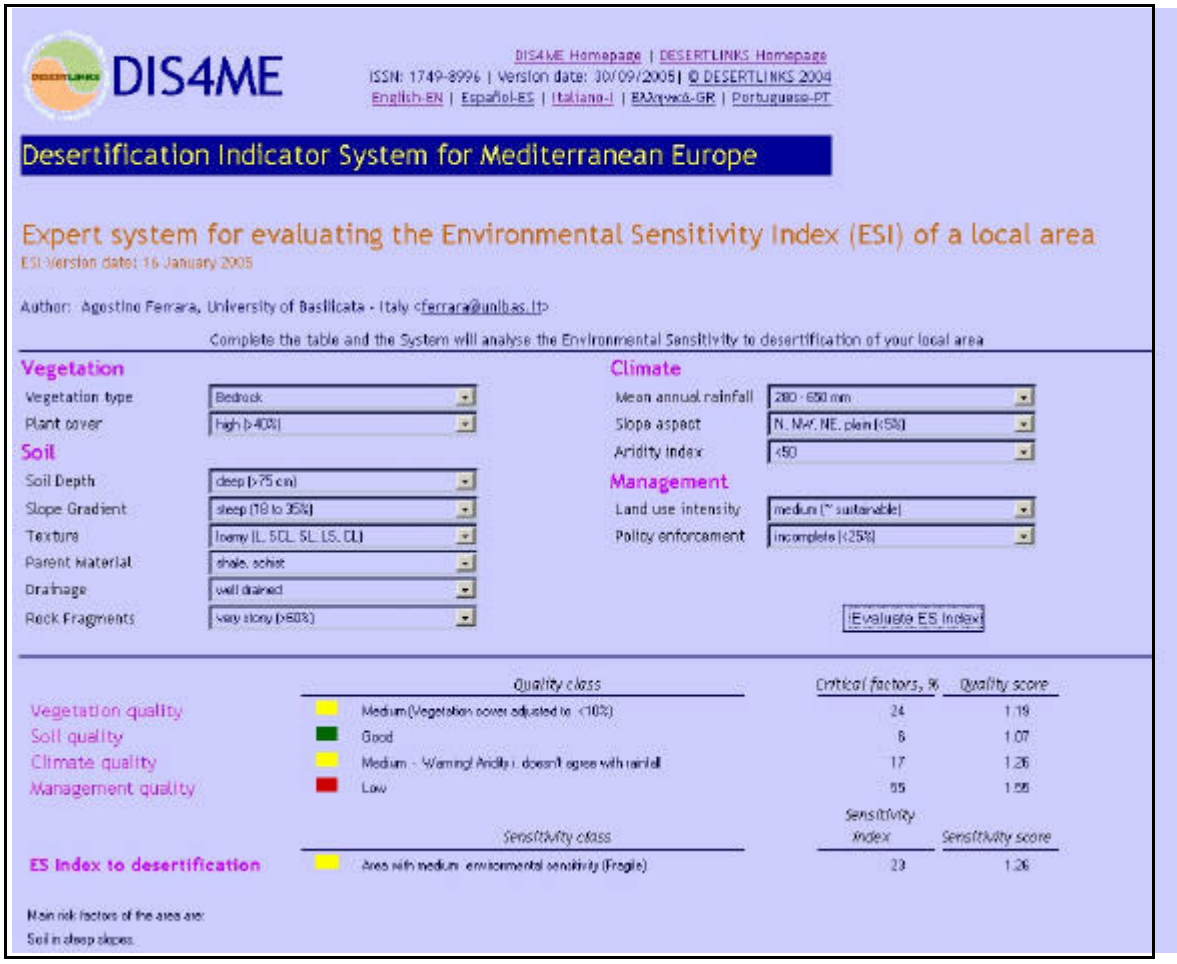


Figure 3: Interface of the expert system for evaluating the Environmental Sensitivity Index.

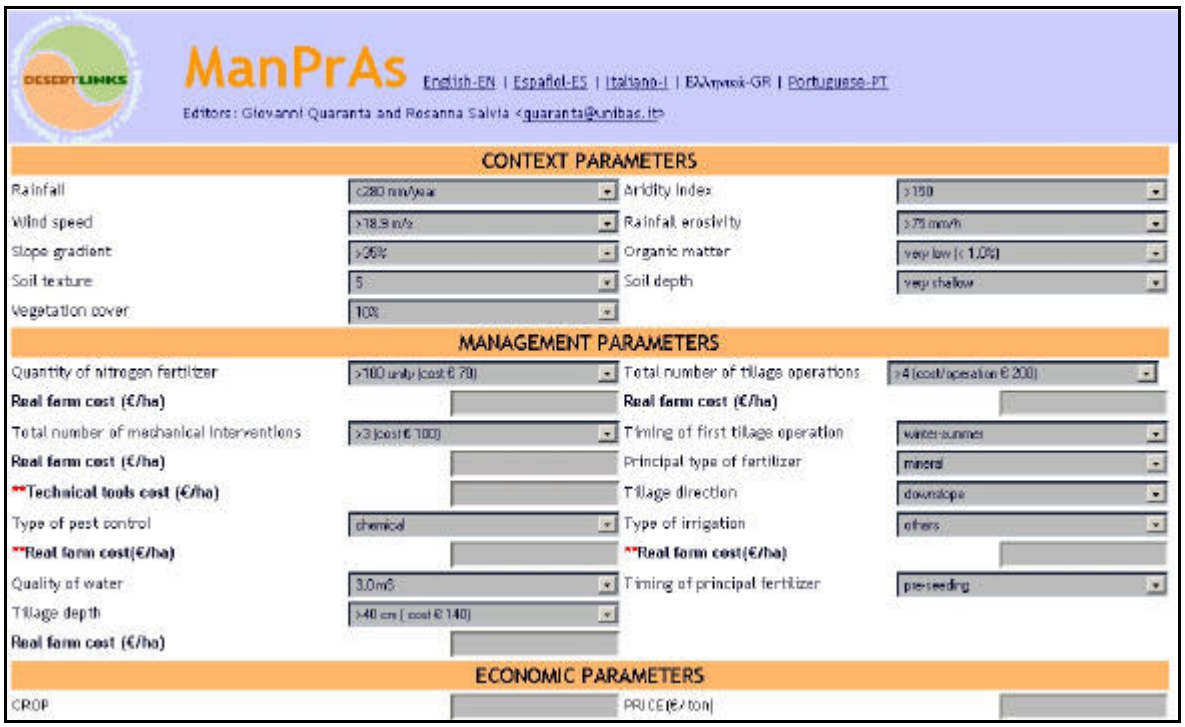


Figure 4: Web page of the ManPrAs tool.

DESERTNET

	Characteristics
Project Partners	DesertNet Project involves 10 italian regions, 2 spanish regions and scientific international partners: • *NRD* : Desertification Research Group - University of Sassari, Italy; • *Regione Liguria* - Settore Assetto del Territorio e Controllo tecnico; • *Regione Campania* - Area Generale di Coordinamento rapporti con organi nazionali ed internazionali; • *Regione Calabria* - 1° Dipartimento della Presidenza della Giunta Regionale; • *Regione Toscana* - Dipartimento dello sviluppo economico; • *Regione Siciliana* - Assessorato Agricoltura e Foreste; • *Regione Emilia-Romagna - ARPA*, Servizio Meteorologico Regionale; • *Regione Basilicata* - Dipartimento Ambiente e Territorio; • *Regione Sardegna - Ersat* (Ente Regionale di Sviluppo e Assistenza Tecnica in Agricoltura); • *Comunidad Autonoma de la Region de Murcia* - Consejería de Agricultura, Agua y Medio Ambiente, Spain; • *Region de Andalucia*, Spain; • *ENEA* - Divisione BIOTEC; • *APAT* - Dipartimento Strategie Integrate; • *Università di Cagliari* - Centro Interdipartimentale di Ingegneria e Scienze Ambientali (*CINSA*); • *Republique Tunisienne* - Institut des regions arides.
Description of Aims and Objectives	The general aim of DesertNet Project is the creation of a common and homogeneous groupware platform for the implementation of national and Community Policies to combat desertification, as established by the UNCCD, and sustainable management of natural resources (in particular soil and water), through: • the realization of a system of different pilot areas/actions in each region taking part of the project; • setting up of indicators and models homogeneous; • the development of a common Ge ographic Information System;

	• a net of technical-scientific support for the exchange, sharing and dissemination of knowledge and experiences acquired, for the final customers. A groupware platform, a net of Pilot Actions and users and an Interregional Observatory to combat desertification should be the main products of the project; besides a common product should be the regional map of sensitive areas (scale 1:250.000), based on the indicators selected. In detail the specific objectives can be summarize in four points: 1. identifying the current state of scientific knowledge on the causes/effects of desertification processes in the European Mediterranean Regions and on the measures to reduce it; 2. establishing a net of subjects and institutions connected with similar initiatives local, national and international, for the exchange, sharing and diffusion of knowledge and project results and sensitization of local population; 3. creating a system of thematic pilot actions to study in detail on the field methodologies and techniques of prevention, monitoring and sustainable management; 4. defining common indicators and models to monitor desertification at different scales in specific pilot areas/actions.
Web site	Official web site: http://www.desertnet.org/ Web sites of some partners: http://www.unibas.it/desertnet/ http://www.ibimet.cnr.it/Case/desertnet/ http://nrd.uniss.it/sections/desert-net/ http://telegis.unica.it/progetto/desertnet/progetto.html
Target users	The final users of the project should be local, national and international institutions and scientific community.
Available documents and reports	Actually in the official web site sections related to reports, maps and pilot actions are not active and the access to the groupware platform is only allowed to the project partners. Documents of technical workshops and intermediate and final reports are available to the download in the websites of some project partners.
Broad access to the databases	The access to DESERTNET groupware platform is subordinate to gain a password. Only members of the project can access to the platform in writing mode.
Available data: cartography, images, statistics and/or satellite imagery	Part of the whole cartography produced in the project is stored in the groupware platform. Some of the partners have created, internally to their web sites, a section dedicated to the project and their pilot action in which maps are available as image or also as GIS format.
Available tools and/or software for data elaboration and description of applied methodologies	-
Degree of information updating	The updating of the groupware platform is still in progress.
User-friendly interface	The groupware platform have a structure that permit an easy access to the information. The only language of the website is Italian.
Meta-data base	The groupware platform should include metadata of all the products obtained from each partner, specially concerning input data and maps.
Link with other related websites	Actually neither partners nor official websites links are available. Information concerning partners of the project is given in form of e-mail, fax and telephone numbers.

DESERTWATCH

	Characteristics
Project Partners	◆ European Space Agency (ESA) Earth Observation Application Department- *EOP/AEP* ◆ *ACS* : Advanced Computer Systems SpA, Italy; ◆ *CSIC-EEZA* : National Research Council (CSIC) - Arid Zones Research Station (EEZA), Spain; ◆ *ENEA-Casaccia* : Ente per le Nuove Tecnologie, L'Energia e l'Ambiente, Italy; ◆ *NRD* : Desertification Research Group - University of Sassari, Italy; ◆ *RIKS* : Research Institute for Knowledge Systems, Netherlands; ◆ *UTRIER-RSD* : University of Trier - Geography/Geosciences - Remote Sensing Department, Germany.
Description of Aims and Objectives	DesertWatch is a work in progress project, started in 2004 and ending in 2006. DesertWatch project aims at developing a user-tailored, standardised, commonly accepted and operational Information System based on Earth Observation (EO) technology to support national and regional authorities of Annex IV countries in reporting commonly to the UNCCD and assessing and monitoring desertification and its trends over time. This will contribute to: o The creation of standard and comparable geo-information products from country to country about the status and trends in desertification; o The creation of a common framework for reporting to the UNCCD for Annex IV countries; o The creation of a common basic infrastructure as a base for further developments where EO plays a key role; o The development a common methodological approach for all countries in Annex IV to assess and monitoring the desertification problems and identify trends and potential scenarios; In particular, the project shall be implemented on 4 of the largest countries in the Annex IV of the UNCCD (Greece, Italy, Portugal and Turkey). Based on the final definition of the System, the Contractor shall develop, implement, validate, demonstrate and integrate in the user facilities an end-to-end Information System, which responds to this set of requirements and allows users to derive, accurate, updated and timely information in a cost-effective manner. From a methodological viewpoint the project shall exploit the most consolidated scientific results derived from the several research and application projects funded by the EC, ESA and the R&D national programmes in the last years (e.g., TESEO-Desertification, DISMED, LADAMER, DESERTLINKS, MEDALUS, DEMON, RIAD, MEDRAP, etc.). In this context, the project aims at bringing the gap between the extensive research work carried out in the last years and the operational needs of the user community.
Web site	http://dup.esrin.esa.it/desertwatch/project.asp
Target users	DesertWatch addresses mainly the information needs of the following user sectors: 1. At national level: National Focal Points of the UNCCD, Ministries of the Environment, National Environmental Agencies, etc.; 2. At local level: Regional and local authorities, regional technical centres, etc.
Available documents and reports	Actually on the Web site some documents of the project are available. At the end of the work a **DesertWatch User Handbook** should be printed and distributed to all the National Focal Points of the UNCCD in the Mediterranean area. This manual should be a tutorial for users on the concept and use of the DesertWatch Information System.
Broad access to the databases	This web site should provide also a direct access (though a WebGIS tool) to the different products developed during the project.
Available data: cartography,	The ultimate goal of the DesertWatch system is to provide users with the necessary tools to derive reliable geo-information products responding to their information

images, statistics and/or satellite imagery	needs. The preliminary DesertWatch products, based on the user requirements are listed in the Fig. 5. At the end of the project, a **Promotional CD-ROM** should be delivered to all the different National Focal Points of the UNCCD as well as to other key international and national agencies and NGOs. The CD-ROM should contain a demonstration supported by Flyby animations, short movies, examples of the derived products and a tutorial about the DesertWatch system concept and about the use of EO within the context of the UNCCD.
Available tools and/or software for data elaboration and description of applied methodologies	Three elements essentially form the DesertWatch Information System (Fig. 6). The core of the System should be a **Basic Historical Database** containing a **common basic set of geo-information** related to: – Climate; – Soil; – Vegetation; – Land use, policies and management; – Socio-economic data; – Base information (road network, administrative boundaries, etc.). The database should have the same structure for all the countries that allows users to perform a comparable analysis from country to country of trends in the desertification processes. The database should be built in function of a baseline or a year of reference (i.e., 1984) and populated with information from different years (at least, 1884, 1994 and 2004) for comparison and analysis of the trends and desertification processes evolution in the last 20 years. As a second component of the system, it should contain **adequate retrieval, analysis and geo-statistical tools**, in order to derive suitable environmental and socio-economic indicators (i.e., intermediate products) about the causes and effects, status and evolution of desertification. As a third component of the system, it should include the necessary **modelling tools**, to process the suitable indicators and the available historical geo-information in order to describe the desertification processes in place, predict their evolution and potential scenarios and generate the required output products.
Degree of information updating	A web site for the project shall be developed. This web site should be maintained and updated also during 2 years after the end of the project.
User-friendly interface	The Information System will be user oriented and should give an operational respond to the needs and requirements of the user community.
Meta-data base	At the end of the project in the Information System all the data should include their respective metadata.
Link with other related websites	In the DesertWatch Web site is available a web page of other relevant web sites concerning similar projects, partners, or official Organisations.

Scope	Product	Year	Scale	Map unit	Area
Pan-European	Susceptibility Map (DISMED)	2004	1:1,000,000	1Kmx1Km	Turkey
National	Risk Map	1984, 1994, 2004	1:100,000	Administ. unit	Approx. 350,000 Km². Portugal Italy Greece Turkey
	Severity/Recovery Map				
	Pressure Indicators				
	State Indicators				
	Impact Indicators (trends)				
	Potential Scenarios map				
Sub-National	Risk Map	2004	1:50,000	1 Ha.	Approx. 175,000 Km². As above
	Severity/Recovery Map				
	Pressure Indicators				
	State Indicators				

Figure 5: Products expected from the DesertWatch project.

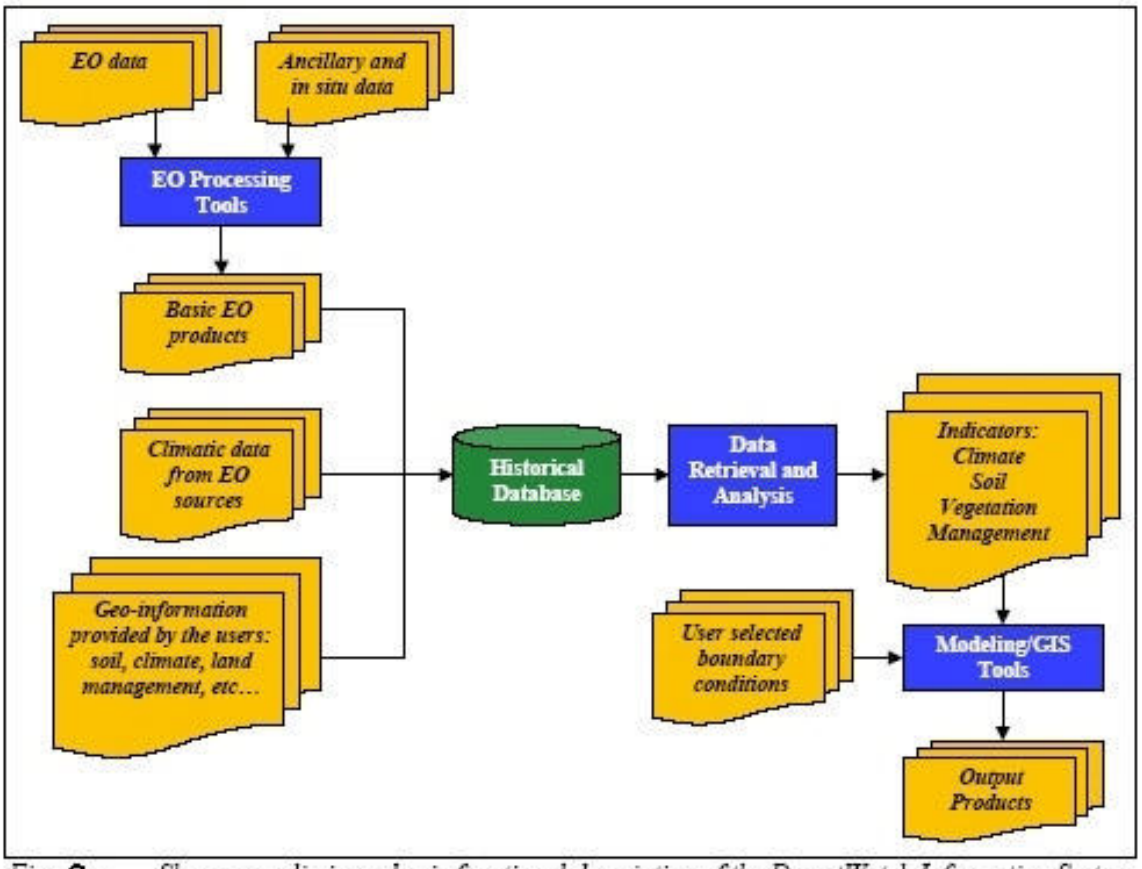


Fig. 6 - Shows a preliminary basic functional description of the DesertWatch Information System

DISMED

	Characteristics
Project Partners	The initiative has been promoted by Mediterranean-bordering countries Algeria, Egypt, Libya, Morocco and Tunisia (Annex 1 countries) and Greece, Italy, Portugal, Spain and Turkey (Annex 4 Countries) through the participation of representatives of National Coordination Bodies (NCB) and of the national scientific community, and by France as observer. Furthermore the UNCCD secretariat, with the support of the European Environment Agency (EEA), the Foundation for Applied Meteorology (FMA/IBIMET) and Sahara and Sahel Observatory (OSS), has facilitated the launch and management of the initiative.
Description of Aims and Objectives	The project aims to establish an operational Information System for planning purposes, to potentially service all Mediterranean partners, taking into account the existing local capacities and facilities. They also urged countries to establish a close collaboration for the harmonisation of the methodologies of exchange of information related to all aspects of land degradation: a) to co-ordinate their existing information systems and to develop and strengthen a permanent system of communication among the different actors involved in combating desertification and in the reduction of drought effects; b) to harmonise the existing database processing and to facilitate reciprocal understanding among the different partners and actors involved in combating desertification; c) to strengthen collaboration and co-operation among the worlds of science, economy and policy, towards effective implementation of the Convention; d) to promote and strengthen the transfer of technology between the Mediterranean parties involved in the fields of analysis, processing and monitoring of the physical and socio-economic processes of areas at risk, assess the extent, severity and the trend of land degradation and desertification. Actions should focus on the following three areas: ▪ Designing and developing a system for the management of data and the dispatching of information at the regional level. This system will lie in standardised and homogeneous databases; ▪ Developing methodologies for the assessment of desertification at the regional, national and local scale. These methodologies will lead also to the definition of a reference framework for the monitoring of trends; Providing decision-makers with a series of operational tools and outputs, which could be directly used for planning. The expected results are of institutional and technical nature. The *institutional expected results* are as follows: ▪ Information is circulated and exchanged between the relevant institutions at regional level; ▪ Interactions between scientific institutions and decision-makers are recognized at the national level; ▪ Available information is suitable for planning purposes at the national level; ▪ New information technologies are diffused in national services. The *technical expected results* are as follows: ▪ Standards and procedures for: - vulnerability mapping, - impact indicators, - databases, are agreed for the Mediterranean area; ▪ Homogeneous and standardized data are available; ▪ Methodologies to produce information suitable for planning and monitoring purposes are fully available, in particular for: - crossing data of different types from different sources;

	- managing of analysis at different scales; - producing information in useful format. ▪ The common information system on desertification is set up and operational.
Web site	http://dismed.eionet.eu.int/#
Target users	Stakeholders, in particular decision-makers and national scientific institutions.
Available documents and reports	Reports and documents of work progresses, methodologies and results achieved from researches, are available for the download in the DISMED Central Data Repository.
Broad access to the databases	The DISMED Central Data Repository is based on Reportnet architecture developed by EEA. The Central Data Repository is like a bookshelf, containing data deliveries provided by participating countries (Fig. 8). The information system has to be based on a minimum set of agreed common indicators for the Mediterranean area, which are: ▪ Already available or that may be immediately derived from the existing information; ▪ At low cost, to allow a frequent updating; ▪ User-friendly and of immediate understanding for the decision-makers; ▪ At a suitable scale, in order to enable planning at a national and regional scale; ▪ Comparable and congenial at the regional level.
Available data: cartography, images, statistics and/or satellite imagery	In the Central Data Repository are stored all the maps of environmental and socio-economic indicators and final maps of sensitivity to desertification for each country and for the whole Mediterranean Region (Fig. 9). Moreover maps of the NDVI (Normalized Difference Vegetation Index) trend analysis on the Mediterranean Basin are available.
Available tools and/or software for data elaboration and description of applied methodologies	For most of the products of the project a description of the methodology applied to obtain the maps are available.
Degree of information updating	Updating of the Central Data Repository is limited to the end of the project, even if the section dedicated to the news from related sites is still active.
User-friendly interface	The project does not provide for any new structure, on the contrary it aims at facilitating the relationships among the existing institutions in order to make their action more serviceable and effective. The web site is created to be user-friendly above all for decis ion makers that are not well versed in technical and scientific issues. For this reason all the information is organised in sections and the architecture of Central Data Repository consist of an environmental information infrastructure aiming at streamlining reporting as well as making it less burdensome (Fig. 7). The language of the website is English, even if for the main framework is available French too.
Meta-data base	For each map or report included in the Central Data Repository there is a brief description of the content, the period and location of the analysis, the date of delivery and the activity log. In some cases a metadata file related to the map is available.
Link with other related websites	The main links are: EEA (European Environment Agency) and UNCCD. Actually are also available national gateways of Italy and Portugal.

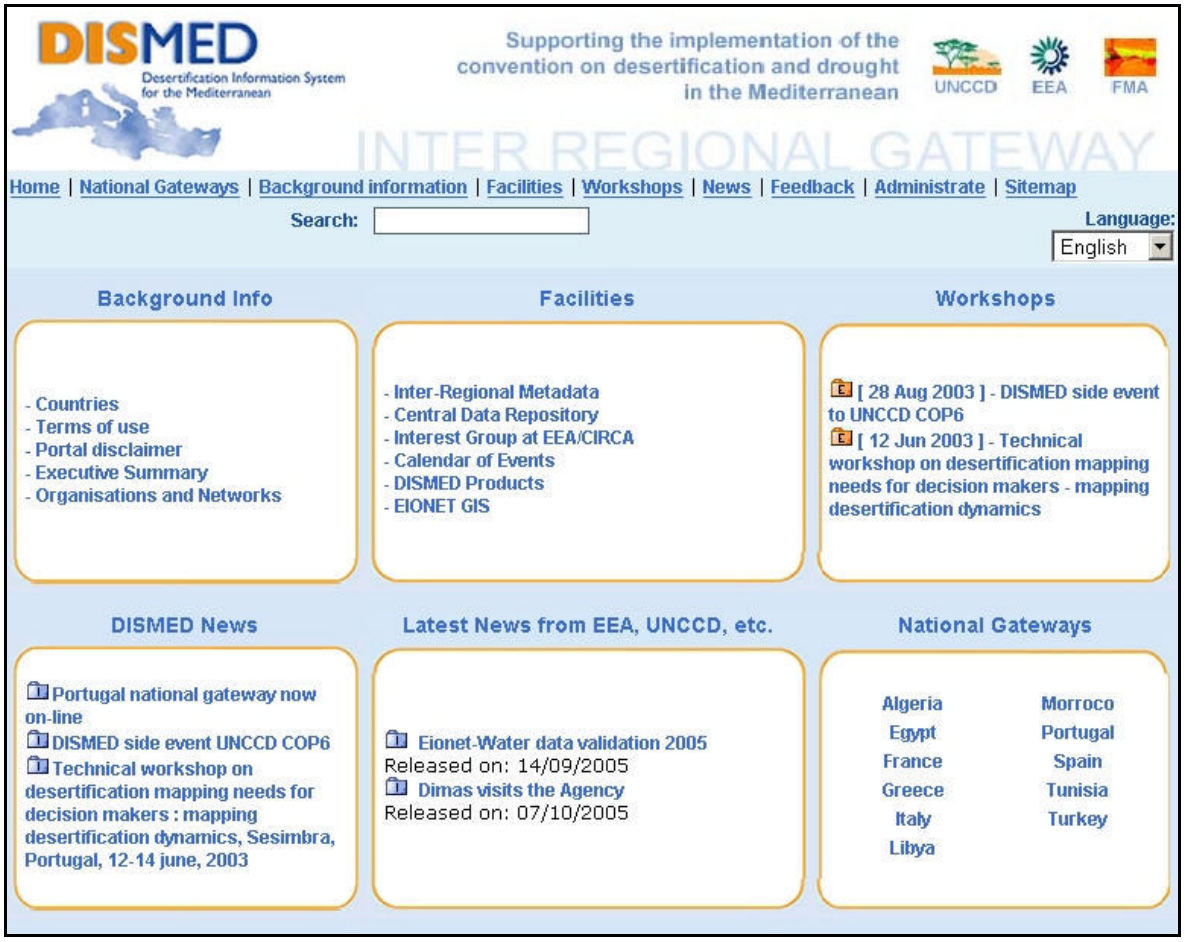


Figure 7: Home page of the DISMED Gateway.

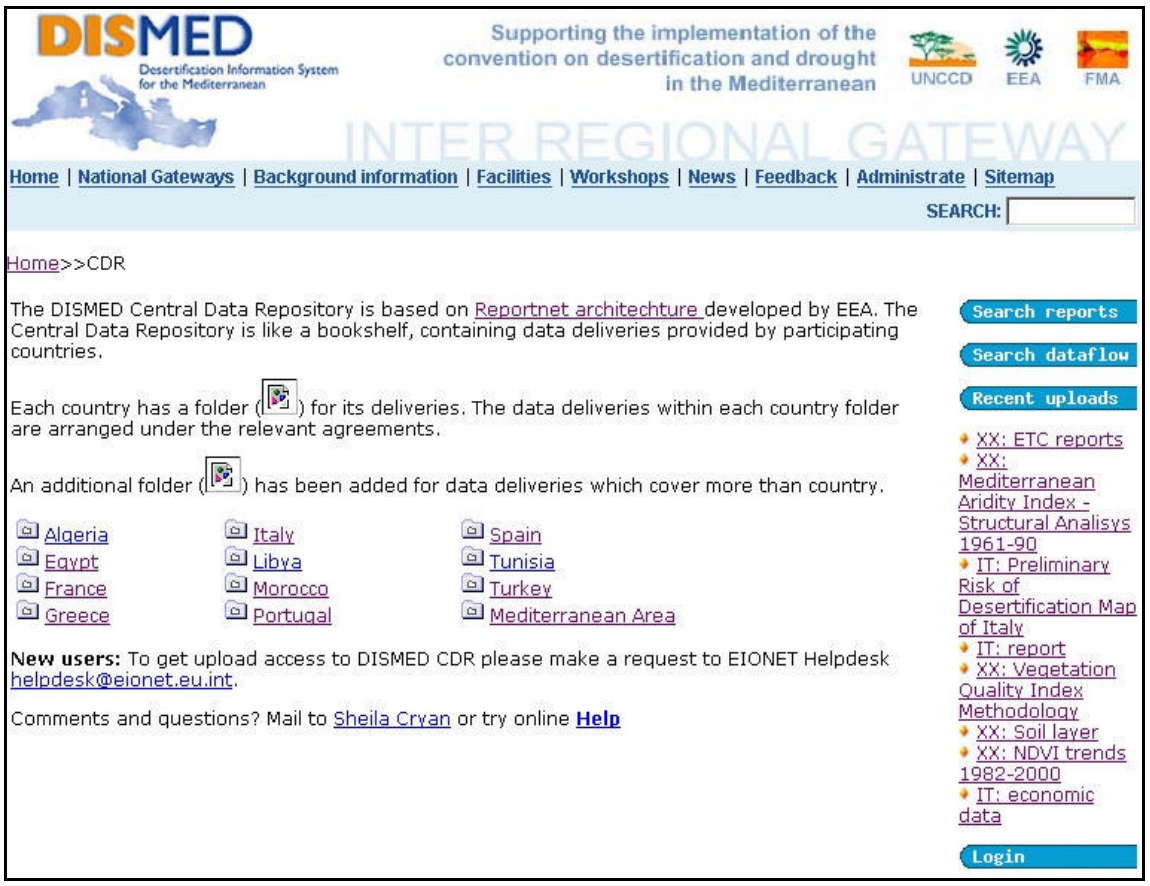


Figure 8: Central Data Repository web page.

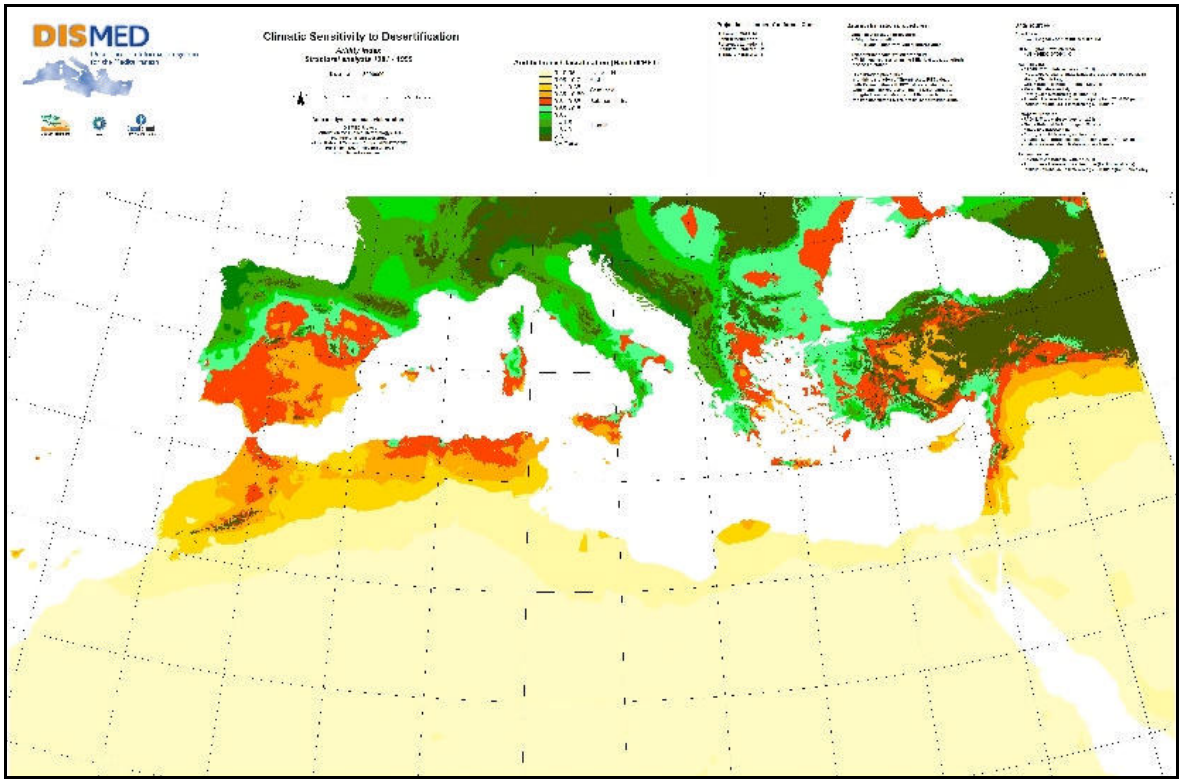


Figure 9: Example of map products.

MEDACTION

	Characteristics
Project Partners	13 participants from 6 European countries: Greece, Italy, Netherlands, Portugal, United Kingdom and Spain: ◆ ICIS - International Centre for Integrative Studies at Maastricht University ◆ Department of Geography, King's College, London, UK ◆ IDRGA - Instituto para o Desenvolvimiento Rural e Gestao Ambiental, Lisbon, Portugal ◆ INEA - Istituto Nazionale di Economia Agraria, Italy ◆ Agricultural University of Athens, Department of Rural Economics & Development, Athens, Greece ◆ UAM - Universidad Autónoma de Madrid, Ecology Department, Madrid, Spain ◆ UEM - Universidad Europea de Madrid, Madrid, Spain ◆ UPM - Universidad Politécnica de Madrid, Madrid, Spain ◆ Water Resources Research Laboratory, Department of Civil Engineering, University of Newcastle Upon Tyne, UK ◆ RIKS bv - Research Institute for Knowledge Systems bv, Maastricht, The Netherlands ◆ Department of Geography, University of Leeds, UK ◆ Department of Geography, University of the Aegean, Lesvos, Greece ◆ EKKE - National Centre for Social Research, Athens, Greece
Description of Aims and Objectives	MEDACTION develops an information and decision-support base on land degradation, to assist decision-makers from the local to the European level in the formal and informal decision and policy making processes to combat desertification in the Northern Mediterranean region. It is an integrated, multi-disciplinary research project, involving social and natural scientists as well as the principal stakeholders in the Northern Mediterranean region aiming to: – Develop land use change scenarios at various scales; – Analyse effects of past policies in four target areas; – Analyse the costs of land degradation and benefits of mitigation measures; – Develop options for land use policies, mitigation strategies, and incentives to combat desertification. The project is divided into four modules which roughly follow the "Pressure - State - Impact - Response" model. Modules 1 and 4 will deal with the larger spatial and time scales and the wider issues, while Modules 2 and 3 will address land management concerns, local scenario-generation and policy formulation specific to the four target areas selected. **Module 1: Land use change scenarios** In this module land use change scenarios are developed at the European, Mediterranean, and local scale levels to aid local decision-making with regard to policy formulation for sustainable land management in the target areas. **Module 2: Effects of past policies** In this module the effects of the implementation of a variety of past policies on land use and land degradation across the physically, culturally and economically diverse four target areas are analysed. **Module 3: Decision Support Systems** Decision Support Systems will be used to develop guidelines on, and contribute towards, policy formulation for land use in the four target areas. **Module 4: Policy Support Framework** This module analyses policies affecting land use, and desertification in the EU and the four countries - Greece, Spain, Italy and Portugal - and aims to produce a framework for their improvement, integration and synthesis. The Modules are composed of Work Packages (WP) that are interconnected according to the following Pert Diagram (Fig. 8): **Deliverables** The most important among the more than 35 MEDACTION deliverables are:

	– European, Mediterranean and local land use change *scenarios*; – *Reports* on the effects of past desertification policies in the four target areas; – *Decision Support Systems* to analyse the effects of land use change scenarios, management and proposed policies in the target areas; – Overview of the costs of land degradation and benefits of mitigation measures; – *CD ROM* and *user manuals* with guidelines for sustainable land management at local scales; – An *interactive Internet interface* based modelling system for estimating land degradation risk; – A *Desertification Policy Support Framework* with guidelines for policy design at the level of the European Union and the four Mediterranean countries.
Web site	Official site: http://www.icis.unimaas.nl/medaction/ Web sites of other partners: http://www.inea.it/medaction/index.cfm Web site related to DSS (Decision Support System) Model: http://www.ncl.ac.uk/medaction/
Target users	The users of the Web site are the stakeholders involved in the target areas of MedAction that include representatives of the main actors related to land management and desertification issues: members of national institutions, members of regional institutions, members of local communities, representatives of non-governmental organisations, farmers. Moreover the DSS web site may be of interest to anyone concerned with desertification. EU planners, decision-makers and citizens interested in the effects of global climate change might find these pages useful to visualise the impacts of different policies and different land-use scenarios.
Available documents and reports	For each module public documents concerning research work are downloadable.
Broad access to the databases	All the MEDACTION partners have access to restricted documents and can upload their own documents using their password.
Available data: cartography, images, statistics and/or satellite imagery	Images and graphics related to the input data maps, simulated land use changes and the results of scenarios applications are given in the DSS web site (Fig. 11).
Available tools and/or software for data elaboration and description of applied methodologies	A detailed description of the methodology adopted for the **DSS** (***Decision Support System***) is given in the project section of the School of Civil Engineering and Geosciences-University of Newcastle upon Tyne Web site and is downloadable too (Fig. 12). The DSS can be used as a predictive tool to determine the type of agriculture sustainable under future climates, and to explore the effects of different agricultural practices and policies. Two target river catchments were chosen for simulation of the DSS, that integrates a physically based hydrological and sediment yield model, a vegetation growth model, a socio-economic model and a database (containing climate, physical and socio-economic data) for the given target area.
Degree of information updating	The information is referred to the results of the project.
User-friendly interface	The Web site is built up to easily navigate through the different sections and the DSS Web site have an user friendly interface suitable for EU planners, decision makers and not expert citizens customers interested in the effects of global climatic change.
Meta-data base	Metadata information are available for the DSS model through the WRINCLE project link.
Link with other related websites	MEDACTION forms a cluster with other projects: GEORANGE, MEDRAP and DESERTLINKS. Other websites dedicated to desertification are also available and is possible to send other related links for adding in the list.

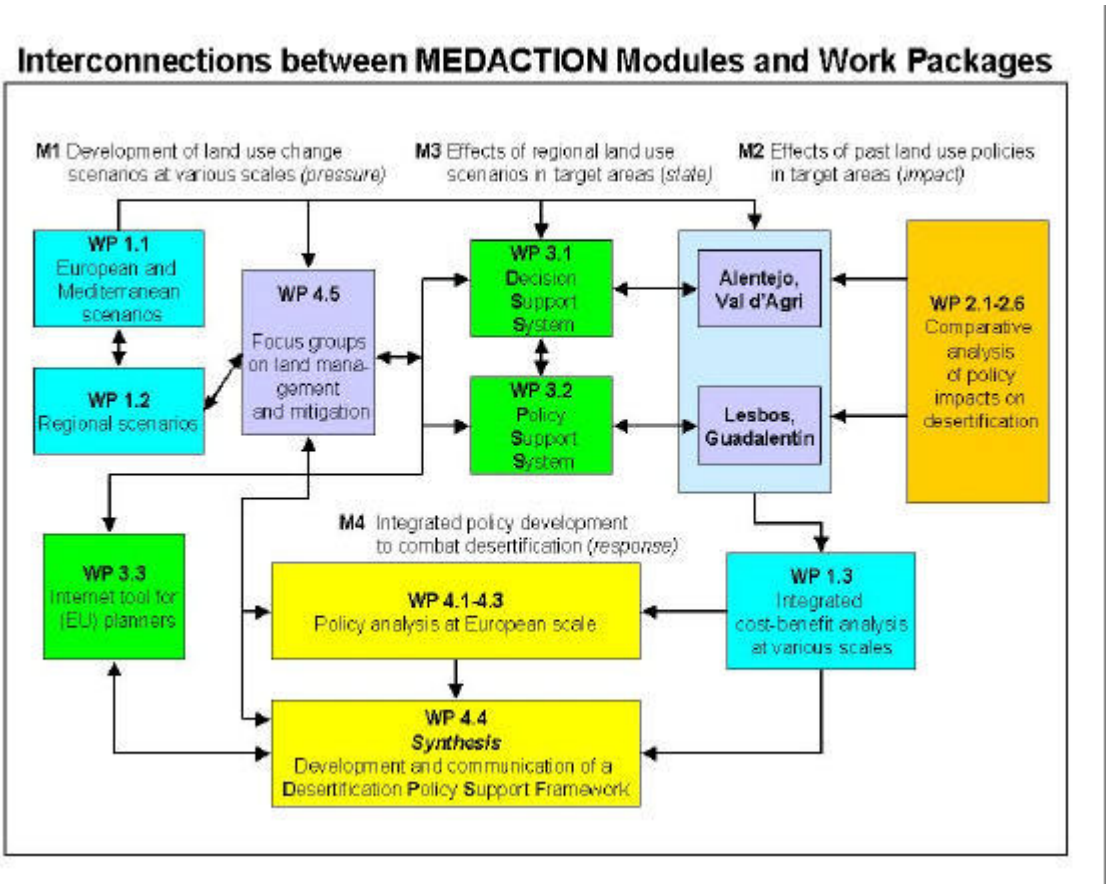


Figure 10: Framework of project organisation.

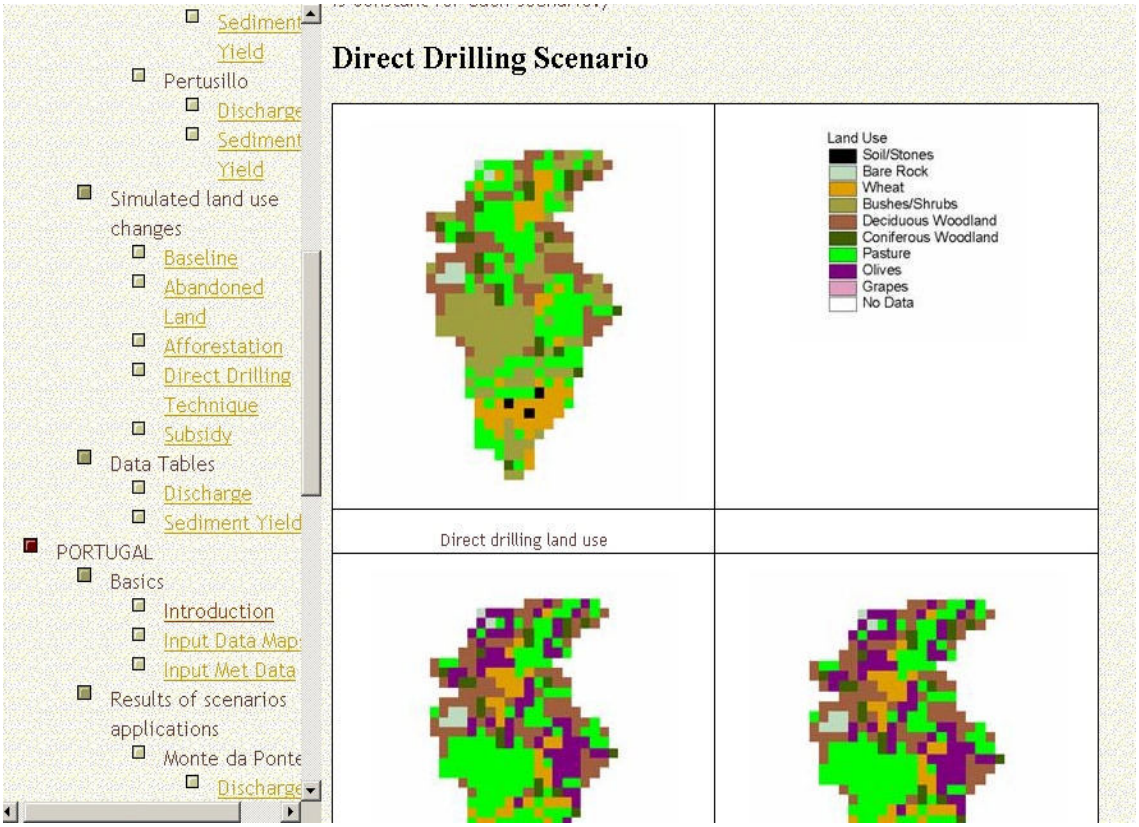


Figure 11: Maps example of the DSS web site.

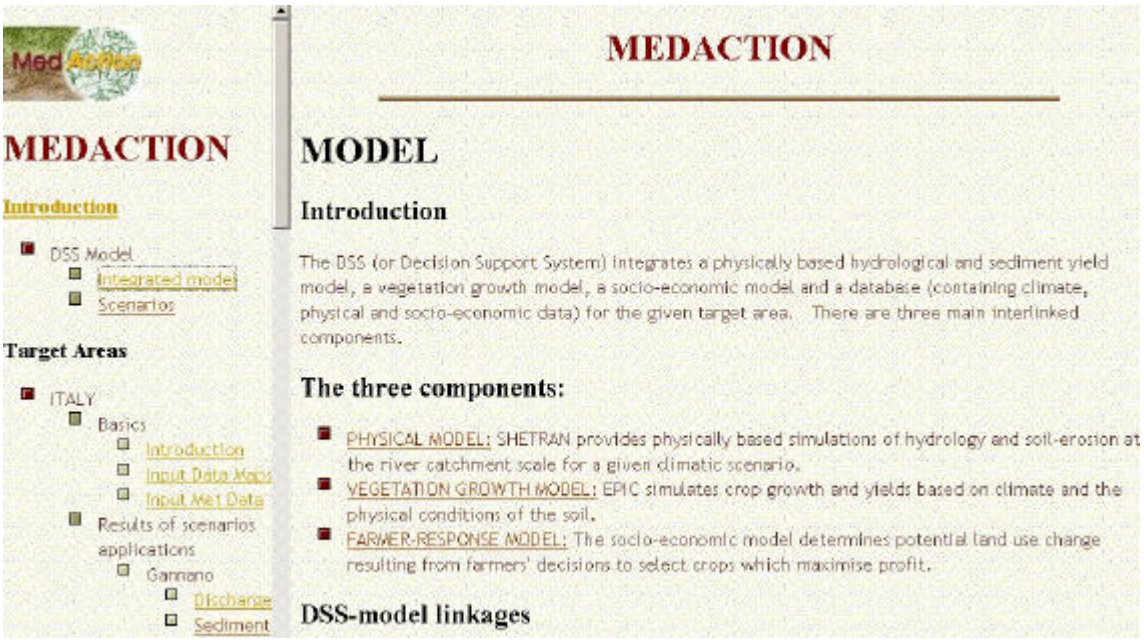


Figure 12: Web site of the DSS model.

RIADE - *Integrated Research for Applying new technologies and processes for combating DEsertification*

	Characteristics
Project Partners	• *ACS* - Advanced Computer System Company; • *ENEA* - Italian National Agency for New Technologies, Energy and Environment; • *NRD* - Desertification Research Group (University of Sassari - Italy)
Description of Aims and Objectives	The project objective is the development of an integrated and technologically innovative system for monitoring desertification processes localized in the southern areas of Italy, able to contribute at determining the cause/effect relationship in the observed phenomena, and to promote interventions towards the territory safeguard (Fig.13). Such "*geomatic platform*" will provide a set of products for desertification modelling and forecast to be used by researchers, but also a decision support tool to be used by public administrations in environmental planning processes. The activities of the project are: 1. Analysing the different types of desertification processes that characterise Southern Italy, selecting study areas most representative of the different phenomena, and setting up monitoring systems. 2. Developing innovative procedures for monitoring key aspects of desertification processes (e.g., use of radar data to estimate characteristics of rain, use of laser spectroscopy and isotopic analyses to evaluate soil erosion and underground water dynamics, analysis of historical satellite data to reconstruct vegetation dynamics, analysis of satellite data to map climatologically relevant variables). 3. Developing key indicators, and modelling desertification processes. 4. Developing a decision support system that allows audiovisual representation of desertification processes, historical reconstruction, and forecasting, based on different climatic/economic scenarios. Expected results: **Scientific results**: knowledges and methodologies that enrich the patrimony of the scientific community engaged in the fight against desertification. In particular on:

	• the understanding of the cause/effect relationships of the most important processes of desertification and definition of interpretative models to use for the simulation of the phenomenon, as a support to the decisions taken by the local administrators appointed to plan and manage the territory; • the adjustment of techniques of analysis and of innovative processes for the survey, the extraction and determination of climatic, environmental and anthropological variables, and development of innovative methods of data processing. **Software instruments**: research and development of software products, partially dedicated to the analysis of the desertification processes, as studied by researchers, and partly to the decisional support for the local administrators. The geomatic platform will be essentially composed by three sections: ◆ ***Web GIS***, for the on-line use of geographic information related to the data of study areas (Fig.14). ◆ ***RVA- Repository Visual display unit Analyser***, that is a centralized archive system with functions of advanced data analysis and visualization that will be used by different typologies of customers, such as researchers, administrators, etc., in order to find out relationships of cause/effect among the phenomena observed in the archived data (Fig.15); ◆ ***SSD-Decision Support System***, for Public Administration, supported by a model of simulation able to estimate the environmental and socio-economic effects of the interventions assumed, and to evidence the better solution in terms of integrated and sustainable management of the area in examination.
Web site	http://www.riade.net/
Target users	The final users of the geomatic platform of RIADE are essentially divided in to three categories: – general external users; – internal users (partners of the project); – receiver users (Public Administration and territorial bodies involved in the project)
Available documents and reports	Detailed description of each work package, deepening, reports and events are available only in the Italian section, even if documents can be in Italian or English language.
Broad access to the databases	Users have free access to the Web GIS, that will contain all the information progressively produced. The Repository Visual display unit Analyser is not directly accessible on the net, but is possible to download simplified *demo* to give to each kind of user an idea of the developed technologies. This software system is specifically dedicated to the expert users involved in the research. Also the Decision Support System, developed for Public Administration, have not free access to all the other general users.
Available data: cartography, images and/or satellite imagery	External customers can only visualize maps through the Web GIS. Instead desertification experts can use the RVA for the visualization and analysis of all the data acquired during the survey phase.
Available tools and/or software for elaboration of data and statistics, and description of applied methodologies	The Repository Visual display unit Analyser (RVA) give a large spectrum of tools for the analysis of all the data contained in the Repository. It is possible, for example, to change the projection systems, clip and filter digital images, fit curves and surfaces, make statistical analysis and data interpolations, create synthetic variables from the combination of primary variables, etc. Explanations of the methodology applied to develop the geomatic platform and the description of the potential of each single software is given in details, especially in Italian.
Degree of information updating	All the information of the study areas progressively produced will converge in the geomatic platform.
User-friendly interface	The geomatic platform, and the webGIS in particular, is a system characterized by scientific contents, public availability and strongly intuitive interface.

	The main language of the website is Italian, nevertheless most of its sections are available also in English and French.
Meta-data base	All the data collected are equipped with metadata information.
Link with other related websites	A list of principal links concerning official websites (or sections of a multidisciplinary websites) of national and international Agencies and Organisations or projects on the topic of the desertification are listed.

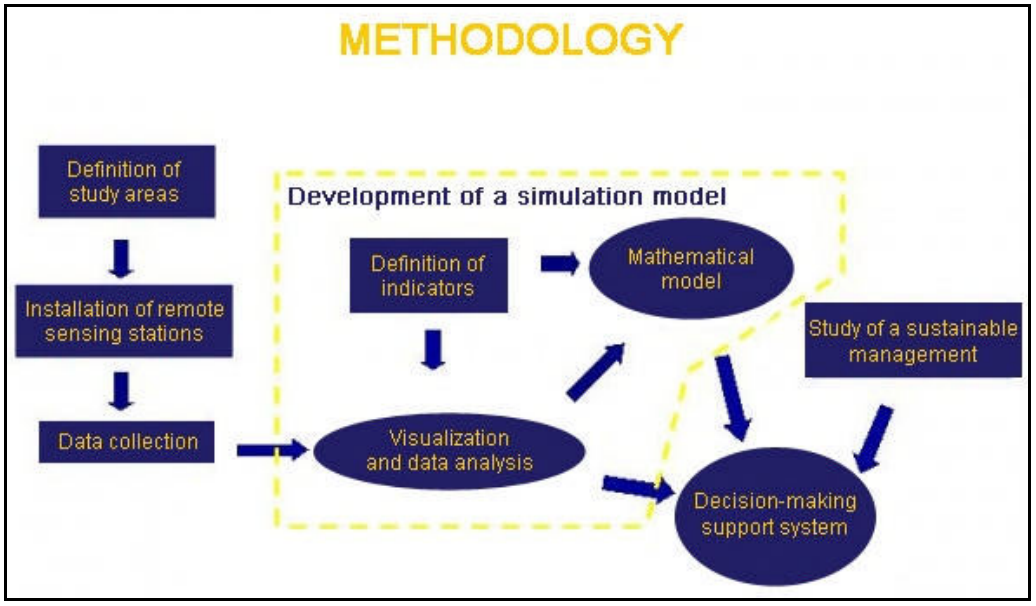


Figure 13: Flowchart of the research methodology.

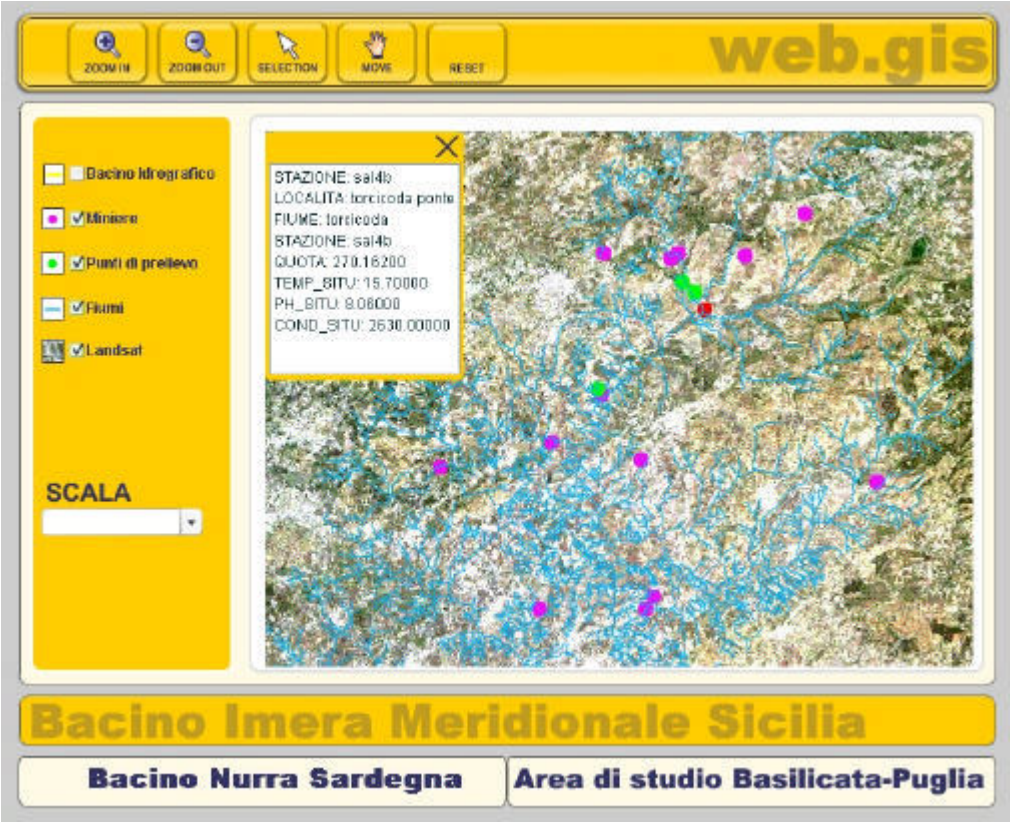


Figure 14: Demo version of the web GIS.

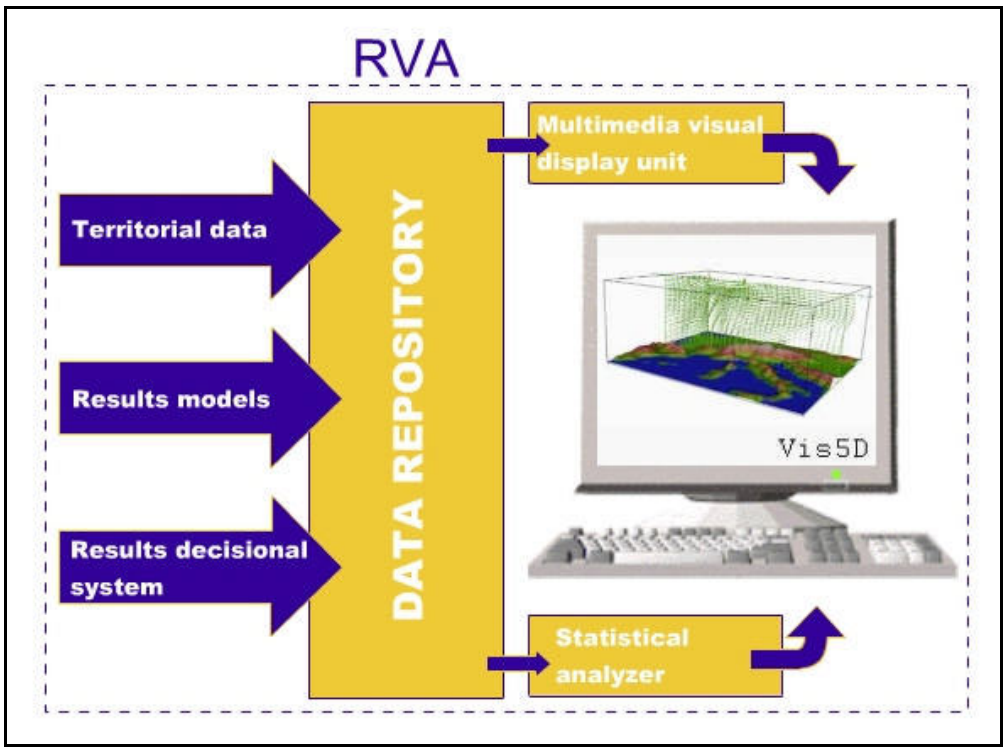


Figure 15: Framework of RVA software.

6. Conclusions and perspectives

Many country Partners, as well as most of the organizations, have established their Clearing Houses, Circulation Information Systems and Websites, while others are in the process to finalize them.

These Mechanisms, Systems and Websites are often based on initiatives connected to trans-national projects instead of strategic funds of each country (save exceptions).

For this reason differences exist between services on the capacity to provide information and data. In fact informative layers and databases produced in the projects are not homogeneous and not always available to all users; moreover, in spite of the huge quantity of information, institutions in charge of them hardly ever cooperate into projects of clearing house or put services on the net.

From the analysis of the availability and use of information in internet has emerged that in most of cases products accessible through different gateways are not tailored as regards to specific users; in particular a gap often exists towards higher levels of customers, that are decision makers. This mean that consultation of data and results is mostly of scientific type and not decision making, and information given through the Web site is not immediately legible/interpretable from policy makers that cannot directly use it as support instrument for decision/planning.

In some cases, such as for example DESERTLINKS, MEDACTION and RIADE projects, handbooks or tools are/will be developed to support actions, but currently they are not available in internet and are only distributed to the institutions that are involved in the projects. In spite of progresses made till now, a further effort is necessary to implement existing systems and supply wider range of customers with both informative layers related to the study of land degradation processes and their spatial and temporal evolution, and guidelines that would be really helpful to the accomplishment of all NAPs and RAPs.

6.1 Target users, their needs and information availability

A Circulation Information System should respond first of all to the user needs. It should not only furnish indications concerning structural and trend analysis of desertification processes through the use of indicators, cartography, graphics, etc., but particularly it should give prompt and suitable planning support to the decision makers of the whole Annex IV countries.

In the next table there is a comparison between the different systems built up with different objectives, but in the same operational context. The analysis is based on the availability of information through Internet for the main target user: the policy maker.

6.1.1 The Pros and cons of the systems

CLEMDES

Pros: born as a portal Web site of the Clearing House Mechanism on desertification for the Northern Mediterranean, the System develops a central database in which information on projects, actors, existing knowledge on the desertification issues and policy actions of the Annex IV area are stored and available to all users; moreover is possible to continuously update the database and querying it through the metadata, making the search easy. Technical and scientific information are indirectly available through the links of desertification projects.

Cons: the particular architecture of the CHM do not give any type of direct information about numerical or image data and elaborations, such as maps, indicators, graphics, etc.; any type of tools or guidelines for technical users or public administrations are furnished.

DESERTLINKS/DIS4ME

Pros: this system aims to make common and accessible to local stakeholders, policy makers and member of the UNCCD a methodology for the identification and use of indicators to detect high risk areas in the North Mediterranean region and explore options for their management. In the *DIS4ME – Desertification Indicator System for Mediterranean Europe* two tools are available: the *ESI* tool that allow to evaluate the level of desertification risk for a local area or particular land uses, and the *ManPrAs* (Agricultural Management Practices Assessment), that is a powerful simulation tool to farmers and stakeholders involved in land management for an assessment of the environmental and economic aspects of agricultural practices.

Cons: the access to the DIS4ME is subordinated to gain a password and however part of the database is accessible only to the project members. Moreover is not possible to create interactively maps of the ESI methodology, that on the contrary are available for the pilot areas and as application in other projects (OLIVERO, DesertNet, DISMED).

DESERTNET

Pros: the groupware platform built up inside the project should permit to gain access to the whole cartography produced by the partners and the others results, such as reports, posters, workshops.

Cons: the language of the official web site is Italian and the access to the groupware platform is subordinated to gain a password. No links with other official organisations or project partners are available on the web site. Some project members give free access to reports, documents and images on theirs web sites.

This mean that information cannot be used by international stakeholders and the target user is reduced.

DESERTWATCH

Pros: one of the goals of the DesertWatch Information System creation is to standardize a basic set of geo-information (derived from several research and application projects), that allows authorities and technical centre to perform a comparable analysis from country to country through geo-statistical and modelling tools and derive accurate, updated and timely information in a cost-effective manner about the assess of desertification issues and the identification of trends and potential scenarios.

Cons: until the end of the project, cartography derived from the analysis given by the Information System will not be available.

DISMED

Pros: the Central Data Repository contains all the data, maps and reports furnished by participating countries; this provides decision makers with a series of operational tools and outputs directly used for planning. The System does not provide for any new structure, but facilitates the interaction between scientific institutions and policy makers and the circulation and exchange of information between the institutions.

Cons: the DISMED System should be used also as a portal that allows the access to other national gateways, but currently only the Portuguese gateway is available.

MEDACTION

Pros: stakeholders involved in the project can use a DSS model (Decision Support System) to determine the type of agriculture sustainable under future climates, and to explore the effects of different agricultural practices and policies.

Cons: there is not free access to the database or the DSS tool; the official Web site only provide general information about the project and its results; actually the interactive internet interface based modelling system for estimating land degradation risk is not available too. The analysis, studies and simulation were given for the target areas. Moreover guidelines for sustainable land management at local scale are available on CD ROM support.

RIADE

Pros: the geomatic platform is the main result of the project, built up to improve the analysis and studies of the desertification processes and support decisions of local administrators, through a webGIS, a Repository Visual display unit Analyser and a Decision Support System, that allow advanced analysis of all data acquired during the survey phase and the simulation of the effects of interventions assumed to evidence the better solution in terms of sustainable management of the territory.

Cons: The RVA and DSS tools are not available on the Website, because of the particular target users (partner, scientists and above all Public Administration); a demo of the RVA potential is downloadable. The System has been studied and developed for a specific and restricted group of users, but this does not prevent it from being example for larger uses and areas.

Therefore, in most of the ICS analysed, considerable tools have been developed for supporting decisions and giving more effective actions of policy makers at different level, but wide, free and total access to the information via Web for all potential customers of the Annex IV still lacks.

Available products	***CLEMDES***	***DESERTLINKS DIS4ME***	***DESERTNET***	***DISMED***	***DESERTWATCH***	***MEDACTION***	***RIADE***
Documents and reports			Only in the web sites of some partners				
Methodology description							
Database		Indicators description	Password needed		At the end of the project		
Cartography and satellite images		Only for the pilot areas and example projects	Only in the web sites of some partners		At the end of the project		
Images and graphics		Only for the pilot areas and example projects	Only in the web sites of some partners				
Desertification risk indicators							
Tools and software					At the end of the project		For technical users and public administrations
Links with other related Web sites							

Countries	***CLEMDES***	***DESERTLINKS DIS4ME***	***DESERTNET***	***DISMED***	***DESERTWATCH***	***MEDACTION***	***RIADE***
Italy	■	■	■	■	■	■	■
Spain	■	■	■	■	■	■	
Portugal	■	■		■		■	
Greece	■	■		■		■	
Turkey	■			■			
France				■			
United Kingdome		■				■	
Netherlands		■			■	■	
Germany					■		
Egypt				■			
Morocco				■			
Algeria				■			
Tunisia			■	■			
Libya				■			
Israel	■						

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INFORMATION CIRCULATION SYSTEM TO COMBAT DESERTIFICATION IN PORTUGAL

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General Direction of Forest Resources

Abstract
Portuguese ICS is described as a continuum process of scientific and technical experts involvement. Participation at concrete projects, calling personal responsibility of each one is determinant. Results are satisfactory. No need to create, like recommendation of COP 7, a scientific focal point: its role is played by the UNCCD Focal Point.

Key words
Participation, attitude, synergies

The Portuguese ICS was created through the work developed since the beginning of CCD application (1998), and it's being reinforced at each new project. In fact, the way adopted is founded on a constant participation of both stakeholders and scientific people, with the preoccupation of always enlarge the number of participants and to open the set of expertise.

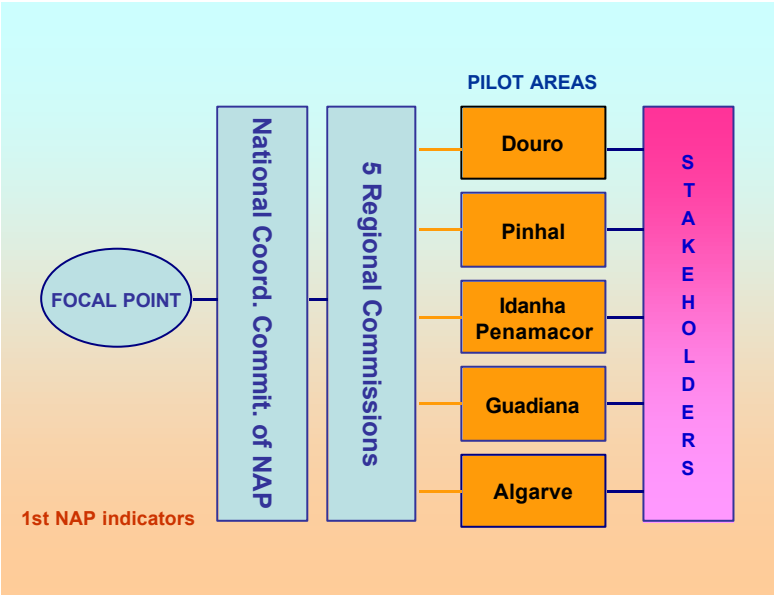

Figure 1: Portuguese internal organization and relationship with stakeholders

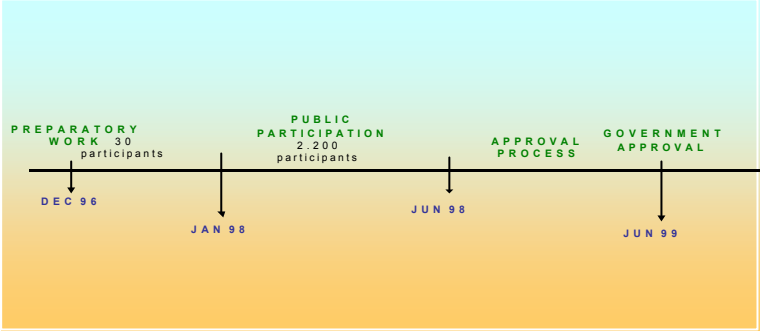

Figure 2: Successive events enforcing participation

MEDRAP – Concerted Action on support of Focal Points to the Regional Action Plan on Mediterranean Region (Annex IV) had a significant role, by the participation of about 30 Portuguese stakeholders and experts on the 5 workshops (2001 - 2003). The but was "to provide concrete technical and scientific contribution to the Focal Points and to the National Committees (…) in the five pioneer Country Parts of Annex IV; knowledge about the main constraints linked to desertification in the different Countries, and about the respective experiences on monitoring and mitigation can in fact contribute to attain a common and strategic view for the elaboration of an effective RAP" (Enne *et al.*, 2004).

In special, Mediterranean project DISMED – Desertification Information System to support National Action Programmes in the Mediterranean region had a relevant role. Among their objectives was the reinforcement of cooperation between all partners and facilitate exchange of information and the establishment of a common information system to monitor physical and social-economical conditions at affected areas. Adopted means were elaboration of thematic maps, establishment of metadata bases and access to I&D MED projects. The capacity to involve the 10 National institutions that produce relevant information by the participation of some respective experts and showing to their maximum leaders the interest of the common work that was being done, has permitted an effective involvement of the team. Starting from a set of 19 indicators identified in Enne and Zucca (eds) (2000), the team leaded by an experimented and proactive and well oriented expert, identified and characterized the Information that was available.

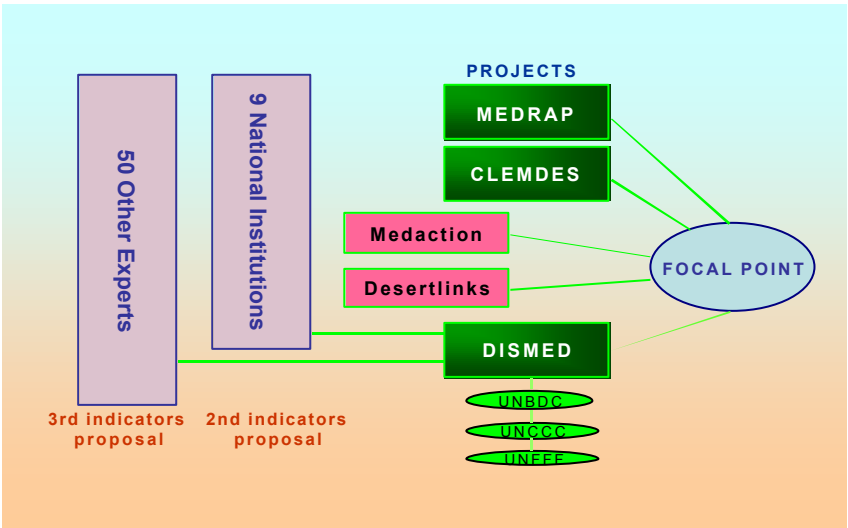

Figure 3: Relationship between the Focal Point and several projects

On the basis of that relevant information, the team produced a proposal that have been discussed by about 50 scientific and technical people in 4 thematic expert workshops (soil, vegetation, clime and socio-economic aspects). Today more than 130 experts have participated or are participating on NAP process.
But those invited experts have been also confronted with the result of 4 workshops at local level that have been realized to create the pilot-areas on NAP: participating people (between 26 and 65, respectively) identified the respective desertification signs, and how they thought desertification should be combated. Experts have been asked to answer with appropriate indicators.
The result of those thematic workshops have been deepened by the initial team, with specific participation of some of those experts, and the final sensitivity map to Desertification and Drought has been produced and adopted by the National Coordination Body at June 2003.
So, the development of the DISMED process have involved in Portugal:

- the institutions and their regional services represented on the NCB/NAP
- the producers of basically geographical information concerned
- local people at pilot-areas level
- a large number of research and development institutions
- environmental NGO representatives.

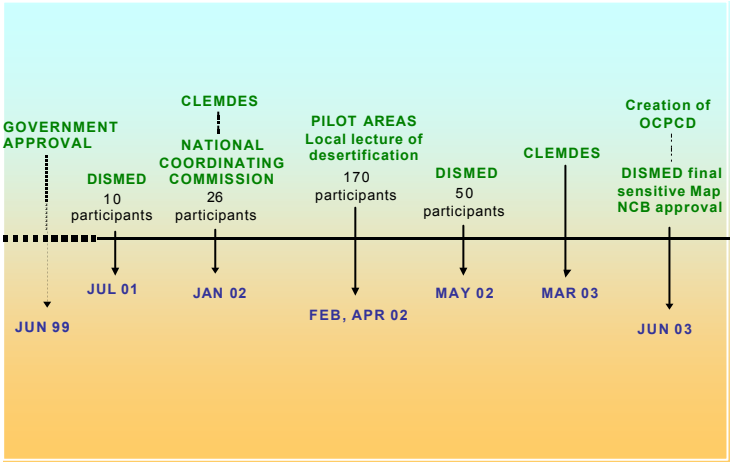

Figure 4: Successive events enforcing scientists and technicians participation

The adoption of realistic objectives has been determinant to the success of the project:

- priority in short term results while considering medium/long term objectives;
- adoption of pragmatic ways of approach on what concerns the definitions of activities and products;
- building up activities based on products, methodologies, infrastructures, documents and standards already existing;
- providing the participation of experts and a real cooperation between them, while sharing responsibilities;
- developing processes of approach step by step, in order to improve the effectiveness of results;
- promote synergies with other relevant programs at international, national and regional level;
- strengthening the cooperation with specialized institutions working with desertification and in the Mediterranean region.

As a natural development of this scientific development, it has been decided (June 2003) to create the OCPCD – Portuguese Scientific Organization to Combat Desertification: a no formal association on the basis of scientific and technical people collaborating or participating on UNCCD/NAP events and works leaded by a elected direction for two years. The aim of OCPCD is to maintain scientific and technical people informed about desertification and drought news and projects; and to promote events to have the active participation of that people at some works.

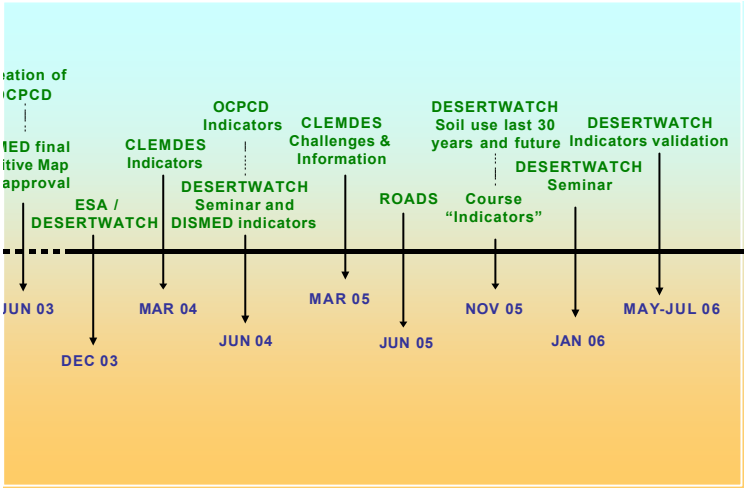

Figure 5: Successive events enforcing scientists and technicians participation

Meanwhile (Dec 2003) European Spatial Agency (ESA) has decided, with the cooperation of National CCD focal points, to throw a new project to assess desertification at Mediterranean region Earth Observation-based – DesertWatch. In a certain view it continues the DISMED process, taking in account the recommendations presented at DISMED side-event at UNCCD COP 6 (Havana, Aug 2003): new developments with local approaches for regional planning and for municipality plans; development of dynamic indicators of desertification and drought at regional, national and local levels; Iberian approach to establish coherence and consistency in the large scales of work in border areas; establishment of basis of a perennial Information System of Indicators on Desertification at Mediterranean region.

The work done at DISMED process was able to prepare the Portuguese participation on DesertWatch project team (unfortunately it has not been possible to present a proposal as Contractor consortium, as a consequence of strange institutional reasons). A number of experts have answered to the invitation of OCPCD direction in cooperation with CCD Focal Point to discuss the new ESA project and to constitute the Consortium. Through this preparatory process it has been easy to choice the Portuguese representative to the Expert Group and the host institution, despite various candidate institutions.

During DesertWatch life information from the Portuguese designated Expert has several been given to the National Coordinating Body of NAP. At actual phase is the time to validate at sub-national level the indicators proposed by the project. We'll do that with the cooperation of a lot of technicians among some participants at a DesertWatch seminar prepared to present the results at this stage (Lisbon, Jan 2006).

In spite of the success of all this work, a lack could be identified: Portugal had not a scientific organ to act formally on desertification and drought issues. So, part of university people working on DISMED and DesertWatch, belonging at OCPCD, has

created a new organization: ROADS – Observation and Analysis Network on Desertification and Drought (June, 2005), on the basis of formal decision of 5 Universities and university Institutes. At this time ROADS is going with 4 short courses on GIS and Remote Sensing and is preparing two main actions in the framework of the International Year of Deserts and Desertification: a scientific project and an international conference on Forest Fires.

Natural and attentive evolution of Portuguese ICS is not exempt of feeblenesses, difficulties and fragilities. For example, it has been difficult to accede now at existing soil maps to validate the indicators produced by DesertWatch System: but discussing with the responsible of the Agricultural institution producer and owner of these information, that is a member of the National Coordinating Body, it has been possible to solve the problem in a satisfactory way.

Anyway the system is able to fulfil the main objectives of desertification and drought combat:

- to deepen knowledge;
- to propose solutions and instruments;
- to participate at appropriate *fora*;
- to develop initiatives.

In this sense we are convinced that it answers to the preoccupation of COP about CST: we don't need a *focal point* to the scientific level to facilitate the participation of scientists and experts – that is the part that UNCCD Focal Point has to play. Because in Portugal, differently from other affected countries, there is not a National Scientific Body, directed by a person nominated by the Government, and integrated by nominated persons: we work on a voluntary basis, where each one is asked for a single thing: to give his know-how and working time to a common aim, where each one foresee interest for the common aim and for himself.

Application of ICS for decision-making - the most relevant example is the elaboration of Desertification Sensitivity map at national scale:

- it has been used by the Government to define areas where a positive discrimination has been adopted to support forestation of agriculture abandoned lands, and to discuss at European level *criteria* to classify lands under social and environmental constraints;
- it is a main instrument to sensitise public opinion, and these is essential to encourage decision-makers to adopt active measures to combat desertification.

Lessons learnt

At Annex IV level we there are divers national organization models related with the participation of scientific and technical expertise and the relation between this sector and national coordinating bodies. Quality of this relationship is also divers.

Also at UNCCD level the problem is not solved. CST has a lot of difficulties. COP 7 has decided to" *encourage* country Parties to select a science and technology correspondent to the CST under the coordination of the national focal point", to face part of those problems.

The main point on ICS is a question of attitude:

- involve experts (scientists and technicians) seriously and actively, proposing them to reflect on concrete problems and to discuss with other experts to build real and useful products;
- openly recognize his role;

- involve their institutions, specially those that produce information, demonstrating what they can obtain by participating on common issues, underlining everywhere the role played by those institutions and experts;
- act always as a team, where each one has his responsibility to the common objective, and where all people can get the utility of the results;
- solving difficulties by the inclusion of each one, refusing exclusion actions;
- getting opportunities to promote participation of experts, at national and international level.

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SESSION V

Experiences and lessons learnt implementing ICS: views from Multilateral initiatives

METHODOLOGICAL FRAMEWORKS FOR INTEGRATED KNOWLEDGE MANAGEMENT AND DISSEMINATION ON NATURAL RESOURCES MANAGEMENT, RURAL DEVELOPMENT AND FOOD SECURITY

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1. Introduction

The sustainable development of the biosphere has in recent years become an issue of increasing concern, as the international community, scientists, resource managers and policy makers have become aware of the impacts generated by the changing scale of interactions between human activities and the environment. The ever increasing pressure of human activity on to the earth's natural resources is showing severe long term implications on the viability of the ecosystems that sustain life on the planet, and on their productive potential. Evidence of the magnitude and scale of problems such as the deterioration of the world's natural resources, poverty and hunger, global warming and climate change are raising public awareness and mobilizing the political will that can help to guide nations towards sustainable development. It is estimated that some 630 million of the world's poor people live in marginal agricultural lands, forested areas and drylands where desertification vulnerability is highest (Nelson et al. 1997). However, the solutions of problems such as soil degradation and desertification are less evident and imperfectly understood, mostly because of the complex interactions between human activity, the physical environment and climatic factors, making the prospects for sustainable development increasingly problematic. Desertification has been identified as a global problem since the 1970's, and was brought to the forefront of world attention due to the devastating impacts of recurrent droughts. The map of the regions of the world threatened by desertification shown in Figure 1 confirmed the global nature of the problem beyond the Sahelian context.

As a process, desertification can be seen as a risk of land degradation in many regions of the world associated with numerous causes, but for certain regions the vulnerability is particularly acute (Figure 2), such as semi arid regions, characterised by ecological conditions such as aridity, intense human activity, irregular but intense precipitation, frequent extreme events such as droughts, all of which combine to generate sensitivity to physical land degradation, erosion, salinization, and deterioration of soil structure and vegetation cover (Perez-Trejo, 1994).

Today, the patterns of land use around the world no longer reflect the long established practices of a traditional rural culture. Instead, they result from the multiple decisions of land owners and managers concerning the expected financial returns of different crops, livestock, and plantations, and of locational decisions relating to the distribution centres of industrial

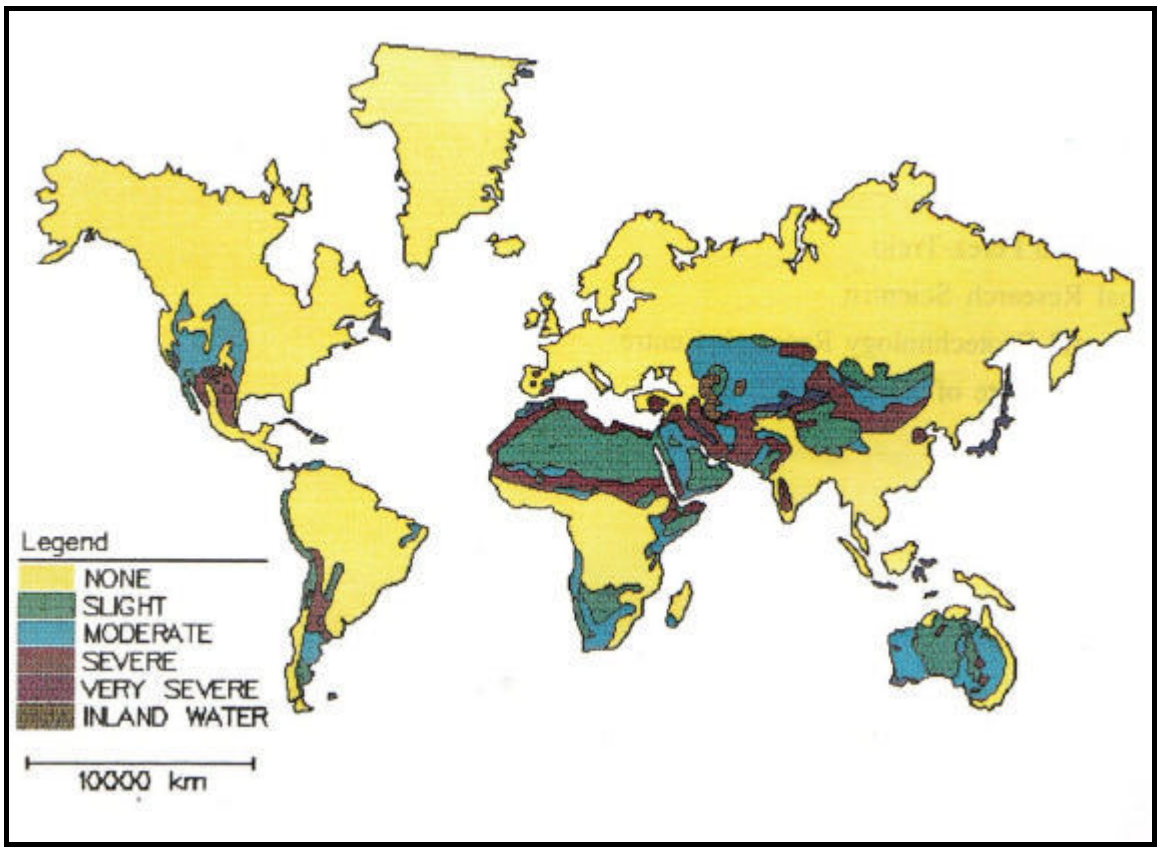

Figure 1: World map of the status of desertification, (Dregne, 1991)

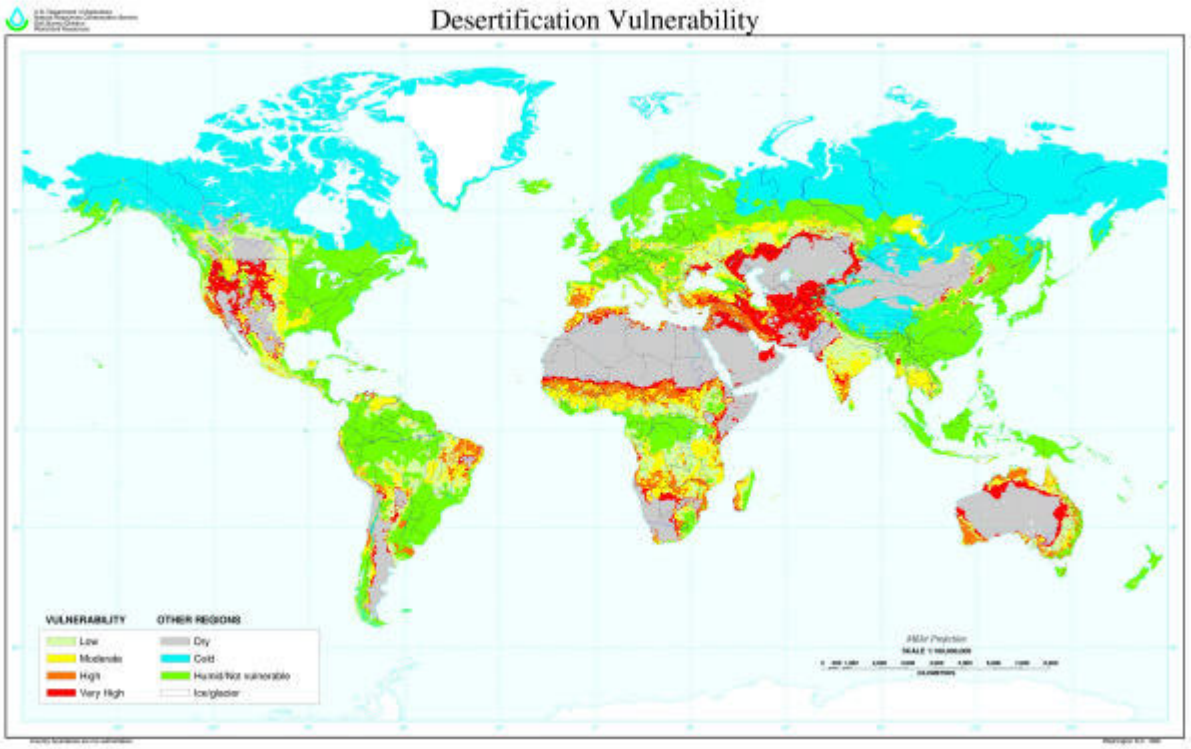

Figure 2: World map of desertification vulnerability (USDA-NRCS, 1998)

and commercial firms, new urban developments and infrastructure, motorways and tourism developments. In addition, the transformation of traditional methods of agriculture, fishing and forestry, to intensive mechanised agricultural systems and increased grazing pressure on marginal soils, has been exacerbated by growing populations whose ever increasing consumptive needs are affecting ecosystems far beyond their physical borders.

The purpose of this paper is to provide the elements of an integrated methodological framework that can integrate the principal issues ecological, physical, social, economic and cultural which are collectively contributing to the increasing risk of desertification.

We shall present a view of desertification processes from a complex systems perspective as a means for better understanding the question of causality. Finally, a methodological framework is presented as a knowledge and information exchange platform that can include all sectors of society and focuses especially on improving access and empowers the poor marginalized rural populations who are one of the key actors in reducing land degradation and desertification.

2. Conceptual framework

Form a definitional point of view it is important to stress that desertification cannot simply be relegated to questions of diminishing productivity, and thus conceived as a purely physical phenomenon driven by processes such as erosion, salinization, deterioration of soil structure or pollution, possibly aggravated by changing climatic conditions; it is rather, a perceptual question embedded in value systems and other social criteria, reflecting cultural political and economic aspirations. These can range from self centred individual expressions motivated by self-interests and personal gain, to those that are expressions of collective decisions based on common needs, to those which are the outcome of diverse governmental policies.

In order to make progress towards sustainable development we must contend with the fact that attitudes towards land degradation and desertification will tend to incorporate a divergent set of approaches to issues such as sustainability, productivity and marginal returns all of which reflect various degrees of similarity and conflict between the value systems of land managers, policy makers and individual farmers. Thus, from a socio-economic perspective, with agricultural systems and productivity tied to government policy directives, land degradation and desertification is inescapably a political question. In assessing desertification we can partition the problem into three sets of interlinked processes: physical, biological and socio economic. The most prominent physical indicators are those relating to soil structure degradation, reduced infiltration capacity, and salinization. These processes tend to increase with the severity of erosion, as well as changes in groundwater and surface water quality.

The biological processes can be divided into those processes which have a direct effect on vegetation and animal population dynamics. As far as vegetation is concerned, the most obvious visual signs of degradation are to be seen in decreasing plant cover which exposes the soil to extremes of temperature and precipitation. An important consequence of such shifts is an alteration of key plant and grazing distributions and, ultimately, a general loss of community structure and species diversity.

The interaction of plant communities and grazing is one of the major structuring forces in the evolution of land ecosystems. In fact, controlled grazing in some cases can act to enhance plant vigour; plant communities have coevolved with grazing and have developed reproductive strategies that are adapted to grazing pressures and fire events.

The principal socio economic processes of desertification are to be seen in a number of related processes, though the chains of causality linking them are rather complex. The

most obvious of these is reflected in the dramatic intensification of land use over the last several decades, largely as a consequence of the innovations in mechanisation of agriculture, urban growth and the development of tourism, which in the case of Spain. Tourist development, and particularly hotel construction, has in many cases replaced prime agricultural land and indirectly lead to land abandonment, as people have taken opportunities to move to the relatively more lucrative jobs in tourist related activities, rather than the uncertainties of subsistence farming in low wage rural environments (Clark el al. 1995). The resulting abandonment of terraced landscapes has severely increased the risk of erosion of soils. These changes in land use, moreover, lead to a change in the allocation of water, with the demands of the tourist sector being fulfilled, often at the expense of local agricultural needs.

We might usefully summarise the most relevant symptoms of desertification as resulting in a reduction of biological and economic productivity as well as land value and increased water scarcity (Perez-Trejo 1994).

- reduction of yield or crop failure in irrigated or rainfed farmland;
- reduction of perennial biomass produced by rangeland and consequent depletion of food available to livestock;
- reduction of available woody biomass and consequent extension of the distance to sources of fuelwood or building material;
- reduction of available water due to decrease of river flow or groundwater resources;
- encroachment of sand that may overwhelm productive land, settlements or infrastructures;
- increasing flooding, sedimentation of water bodies, water scarcity;
- disruption to human life due to deterioration of livelihood systems; need for affected society to seek outside help (relief aid) or to seek haven elsewhere (migrating environmental refugees).

The causes of these various types of land degradation - desertification and their corresponding socio economic disruptions, can be thought of as a combination of:

- human exploitation that oversteps the natural carrying capacity of the land resource system and sometimes under exploitation and abandonment of land due to population migration;
- the inherent vulnerability of the ecosystem; and
- adverse climatic conditions, including severe recurrent droughts in particular.

Additionally, excessive human pressures on natural resource systems relate to:

- increase in urbanization of the population and escalation of human needs;
- socio political processes that bring pressures on rural communities to orient their production towards national and international markets;
- contradictory or conflicting sectorial policies which impact on land use practices
- socio economic processes that reduce the market value of rural products and escalate
- the prices of rural people's needs;
- processes of national development, especially programmes for expansion of farmlands for production of livestock and cash crops, that exacerbate conflicts over land and water use and often reduce areas available to marginalized communities;
- The overriding socio-economic issue in desertification is the imbalances of power and access to knowledge, information, and to strategic resources between different groups in society.

Declining productivity and resource degradation can also be exacerbated by the economic and social aspects of production, particularly in the case of private land ownership, where the emphasis is on profit maximization. Short term capital investment

and intensive cultivation often results in degraded land; profits often are not returned for the purposes of land conservation, but are simply reinvested in another area. Additionally, a number of other factors contribute to resource degradation such as market forces and world markets. All these, with their diverse motives, act in varying degrees to promote chains of economic dependencies which often severely compromise efforts directed at long term sustainable productivity. The causal-loop diagram in Figure 2 illustrates how producers to try to remain competitive with world markets, and often induced by subsidies, land use practices lead to intensification of production, localized and concentrated, which can provoke out migration of the unemployed to urban areas, extended fields to accommodate larger machinery, leading to soil degradation, making farmers even more dependent on mechanization and agrochemicals to maintain yields. All this technology requires substantial funding, and subsidies make it more attractive. But only to reduce costs to try to amortize an ever increasing financial burden, that generates an ever increasing problem of soil exhaustion and desertification. Each of the components of this causal loop diagram are actually a complex set of sub components that have been the subject of extensive studies as itemized causes of land degradation, however the causal loop diagram illustrates the necessity to consider the linkages and processes that make up the structured dynamical nature of the whole system, where no single cause is really responsible for the desertification, but instead it is the interplay of many of the components.

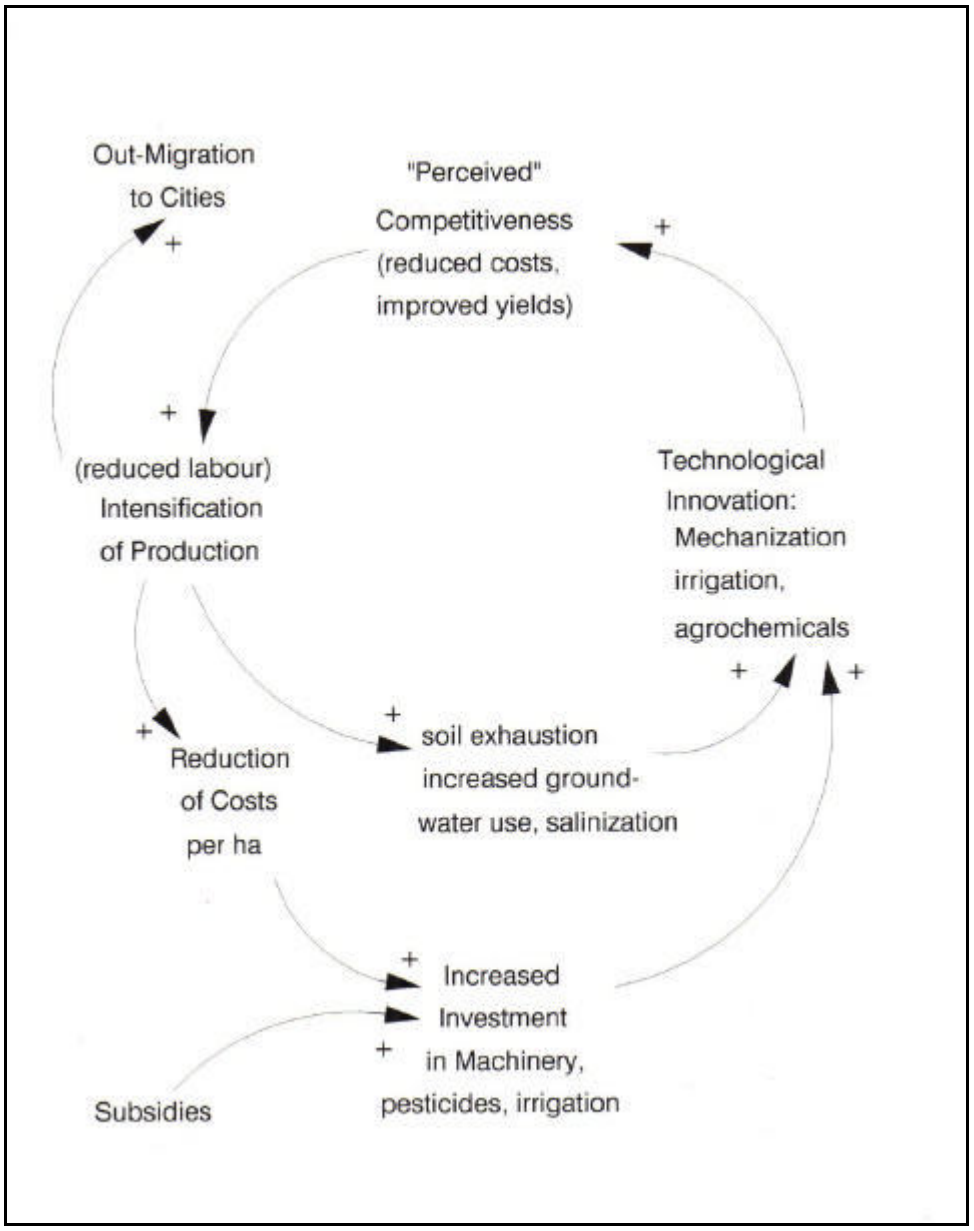

Figure 3: Causal linkages between profit-driven technological intensification in agriculture and land degradation (Perez-Trejo 1994).

Given the above, it is clear that the environmental sensitivity of the semi arid regions make them particularly susceptible to processes generated by over exploitation of the land that can be amplified by climatic fluctuations.
Reviewing the different causes of land degradation and desertification highlights the complex nature of the interactions between socio-economic, environmental, physical and climatic factors make it evident that effective programmes to combat desertification require an integrated and participatory systems approach, and most importantly, a knowledge and information exchange framework starting from the local community and reaching every decision-making level.

3. Knowledge and information exchange. A methodological framework for sustainable agricultural development.

The methodological framework on knowledge and information exchange described below is proposed as a means to improve decision-making while considering the high degree of interaction between the natural, physical, social and economic processes in a systematic way. The methodological framework includes the spatial dimension of systems in an explicit way, as it is a strong determinant of how these interactions actually unfold and of their ultimate effect on specific locations of the landscape. The methodological framework focuses on a process-oriented approach, where the overall system (socio-economic, ecological, environmental) is characterised in terms of processes at different temporal and spatial scales. In this way, a hierarchy of processes as illustrated in Figure 4, can provide a way of understanding what are the driving forces of land-use changes in landscapes and how policy can act most effectively to mitigate the effects of land degradation and loss of biological potential that these changes might bring about.

The interactions among these processes are represented in dynamic simulation models where we give explicit spatial dimensionality to variables such as available land for any given economic activity, the choice of residence or migration of the population, and most importantly to the choices that the different sectors of the economy or consumers make in purchasing goods and services locally, from other regions, or from international markets; depending on location, price and choice of supplier. It consists of two sets of actors (or agents) – business firms which invest in different regions in response to economic signals, and households which can migrate between regions, largely responding to perceived benefits relative to their current situation. As each set of agents varies its behaviour it achieves impacts on regions which alter the behaviour of the other set in a continuous cycle of activity.

For example, the decision of households to migrate from region i to region j in response, say, to a perception of improved income-earning opportunities will alter relative economic conditions between the two regions, which in turn will alter relative investment behaviour of firms. If as a result, investment increases in region j, then there will be further incentives favouring migration from i to j and (possibly) further investment.

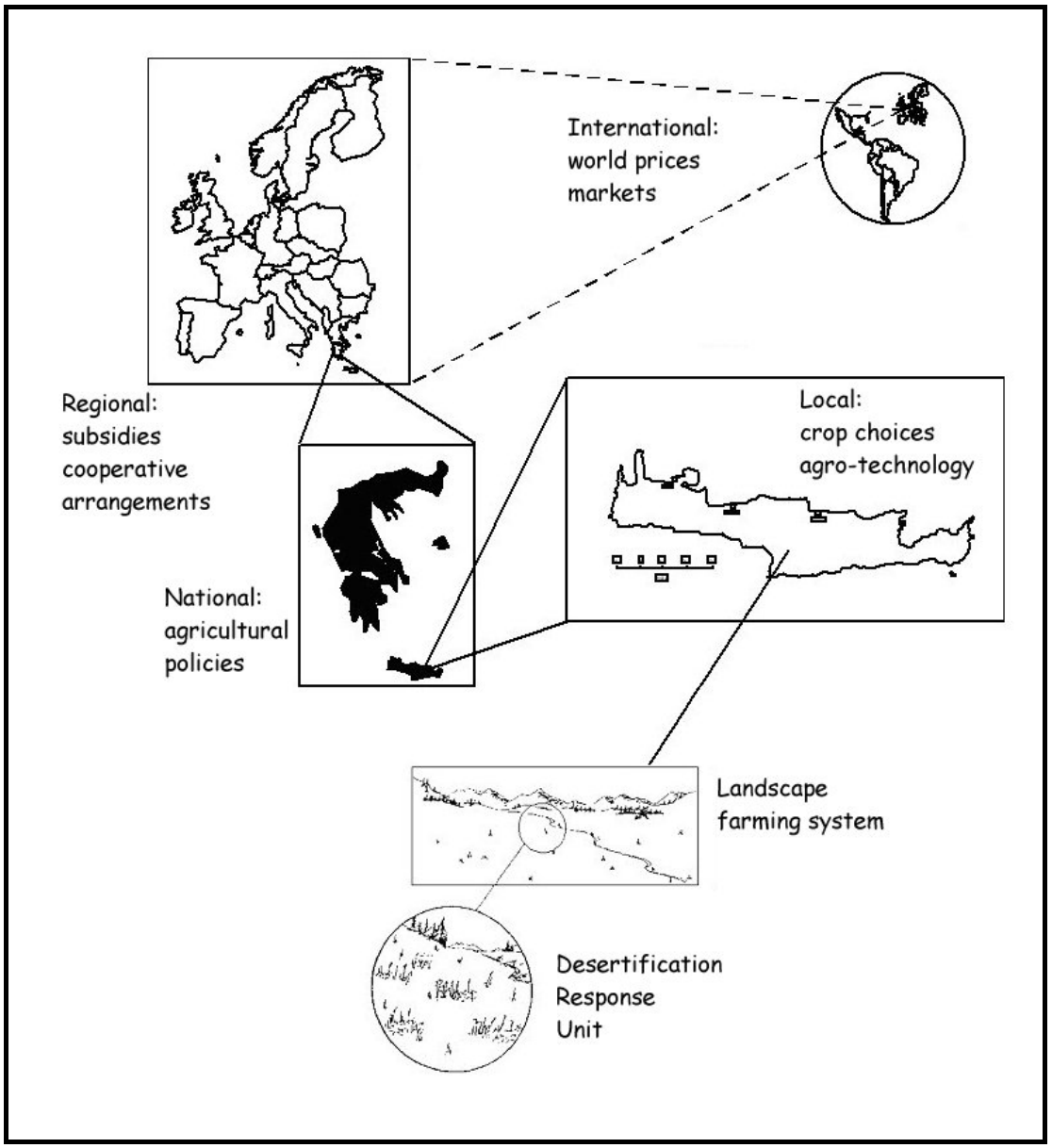

Figure 4: Hierarchy of processes driving land-use change (Clark et al. 1995)

Such a positive feedback loop may well continue until some other factor, say water scarcity, turns the balance in a different direction, and so on. In this way the dynamic model is capable of simulating the structural changes which result in fundamental transformations in the way in which people earn their living and the very different economic environments in which the dynamics of economic activity unfold. These in turn, generate changes in employment opportunities, and land-use, changes which are then analysed and displayed in map form by the graphical display component of the modelling framework.

As an example, let us consider a model that was developed for the island of Crete (Clark et al. 1995) which consists of three sectors (agriculture, industry and services) and two internal regions: the urban centres, consisting of Iraklion, Hania and Rethimnon; and the rural parts of the island. Each of these regions is represented in the model in terms of the amount of area available for any economic activity to take place and grow, and the costs that they incur in terms of rent. The model also includes the movement of the population from one region to the other, which follows their place of employment.

Finally, it allows for international influences by the inclusion of a 'rest of the world' region whose behaviour is determined exogenously.
The model provides a tool which reveals intriguing scenarios where the growth of the tourism sector leads to an exponential increase in water use, with a sever impact on the productive potential of agricultural land, particularly in terraced areas with high labour requirements for maintenance.

4. Knowledge Management

Knowledge Management (KM) focuses on corporate knowledge as a crucial asset of an organization and aims at its optimal use and development now and in the future, as well as safeguarding its loss over time.
The Strategic Framework Strategic Objective E1 of the FAO Strategic Framework (1999), "Generating knowledge of food and agriculture, fisheries and forestry", places knowledge as one of the main components of the work of the Organization essential for achieving the goals of the 1996 World Food Summit and the Millennium Development Goals. With the advent of information and communication technologies, FAO is strategically placed like never before for mobilizing its knowledge resources to fulfil its mission. This paper proposes a number of elements for defining the conceptual framework on knowledge and information exchange.
The majority of FAO's services to its Members in each of its areas of works are based on the technical knowledge of its officers and staff. The Organization would certainly benefit from a more explicit and strategic focus on the knowledge systems and processes to harness knowledge more effectively and enhance the transfer of knowledge to target audiences and partners and to enable them to build sustainable food and agricultural systems.
A first step in developing a conceptual framework would be to define Knowledge Management in the context of the United Nations MDGs. It is not the intention of this paper to provide a review of the many definitions of Knowledge Management which have been put forward in the literature. The following definition adapted from Swann et al. (1999) for Knowledge Management, could be a starting point:
"Knowledge Management, in the context of the Untied Nations MDGs, is defined as any policy, process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance of the organization in achieving its strategic goals." (Perez-Trejo, 2005)
The term "wherever it resides" is taken to include tacit knowledge (that resides in people's heads, whether they are in FAO or not, with particular reference to local knowledge). This means that the conceptual framework needs to consider the processes and practices with all key partners, reaching even local communities where knowledge may reside.
In developing an appropriate definition of Knowledge Management in the context of the fight against desertification, the conceptual framework considers the implications of defining knowledge as a resource, as an input to its programme of work, and also defining knowledge as an output of its programme of work, contributing to the achievement of food security and poverty reduction.
In its conventional private sector context, KM encompasses identifying and mapping intellectual assets, generating new knowledge within a firm in order to have a competitive advantage with the external environment, making vast amounts of corporate information accessible, sharing of best practices, and utilizing the appropriate information and communications technology that enable all of the above. This private sector perspective of knowledge as an asset essential for competitiveness does not apply

to a UN convention, such as the UNCCD, but could be adapted in order to help us articulate better the UN's unique role within the UN system in achieving the Millennium Development Goals. Of particular relevance is the consideration that knowledge management involves the establishment of the appropriate corporate culture, value and reward systems that measure and reward the application of intellectual capital to achieve remarkable performance.
The conceptual framework considers three ways of defining the knowledge relevant to the work on the MDGs; these include knowledge as a "product", as a "process" and as an output". Each of these perspectives translates into different requirements that need to be considered in the knowledge management programme.

5. Knowledge as a product
Considering knowledge as a product implies that knowledge is a thing that can be located, delimited, codified and manipulated as an independent object. Considering "knowledge as a product" means treating knowledge as an entity, separate from the people who create and use it. The goal is to take documents (or media) with explicit knowledge embedded in them - memos, reports, presentations, articles, etc. - and store them in a repository where the knowledge can be easily retrieved. A knowledge repository has very distinc functionality which allows user to access knowledge that can be readily applied. Examples of efforts that aim at a continual enhancement of a knowledge base - the collection of best practices, methods and work products - include UNPD's SURF database, IFAD's FIDAMERICA, the Country Analytic Work best practices database, led by the World Bank, and FAO's TECA technologies database.

6. Knowledge as a process
The definition of knowledge as a process emphases ways to promote, motivate, encourage, nurture or guide the process of knowing, going beyond the idea of trying to capture and distribute knowledge. Considering knowledge as a process emphasises enabling the development and flourishing of communities as a key element for exchanging and putting knowledge to work in an organization. This is an area where we would benefit greatly by developing the systems platforms that would support knowledge exchange.
Programmes based on enhancing the knowledge processes focus on the creation of communities of interest or practice (self-organised groups which communicate with one another because they share common work practices, interests, or aims), to address knowledge generation and sharing. The emphasis in knowledge as a process is on providing access to knowledge or facilitating its transfer among individuals.
For example, the DIMITRA network is strengthening collaborative environments that nurture knowledge communities, in order to facilitate the exchange of ideas and collaboration across women's communities around the world.
Another example is the Climate Change Knowledge Network, set up to brings together expertise, experience and perspectives from research institutes in developing and developed countries active in the area of climate change. It provides a forum for rigorous research on the issues within the international climate change structure and a means for furthering dialogue between countries as they deliberate on means and ways to address climate change.

7. Knowledge as an Output: Addressing the Millennium Development Goals (MDGs)

Considering knowledge as an output means that it is seen as one of the essential elements for attaining food security and reducing poverty. FAO's Strategic Framework objective E, "Generating knowledge of food and agriculture, fisheries and forestry" actually considers knowledge as an objective. In this sense, the Organization's knowledge outputs can be regarded as FAO's contribution to meeting the Millennium Development Goals (MDGs), similar to mobilizing financial resources or providing policy advice.

Many of the outputs of FAO's programme of work relating to MDGs are knowledge and information products. There is an important body of knowledge and information produced by the Organization which is of direct relevance to groups targeted by the UN's initiatives on MDGs.

The conceptual framework on knowledge organization should address the role of knowledge and information in achieving the MDGs, and the significant contribution that these knowledge resources can make in support of the livelihoods of poor and hungry people. The majority of these knowledge and information resources are not readily available, as they are highly specialized, sectoral knowledge and information products, dispersed and fragmented across many Organizations' Departments, research institutions, universities, NGOs. And when delivered they are not packaged in an appropriate way to meet the specific knowledge needs of the target audiences and partners working towards sustainable rural development.

Knowledge and information products from FAO, WHO, WMO, and others, could significantly enhance the impact of the UN's work on sustainable development if new ways could be found for delivering and exchanging knowledge within an integrated, systematic, inter-disciplinary framework, focusing on the low input-low cost requirements of the poor, who in many cases may be illiterate.

The systematic, inter-disciplinary framework required to integrate the many databases and information resources already available is based on similar contexts, such as farming systems and ecological conditions that can capture the communalities of the types of problems and solutions that characterize livelihoods across the world. The knowledge materials produced need to be generic, aimed at communication and training, not specific for specialized sectoral audiences. This constitutes an area of knowledge management that if developed as a common corporate practice would greatly enhance our effectiveness in meeting the MDGs.

8. What could be done

It is clear that the emphasis of an initiative on Knowledge Networks would need to focus on some key priorities. First, the relevant technical programmes working with partners in every aspect of sustainable rural development and food security would need to identify the needs and requirements (much has already been done in identifying knowledge and information requirements for poor and hungry people), and put together a selection of relevant materials, many of which already exist in digital format. One key consideration for this is that much of the relevant knowledge required in such an initiative is actually local knowledge. Therefore, a strong emphasis would need to be placed on collaborating with key partners in order to tap, organize, store and mobilize relevant local knowledge, and create and strengthen mechanisms for improving access and use of the knowledge among the target audiences.

9. The Issue of Up-Scaling and Reaching the Totality of the Vulnerable, Hungry and Poor.

For an initiative on Knowledge Networks to have an impact on reducing poverty and land degradation, an essential first step would be to agree on a common work plan together with all the key partners in order to achieve the relevant geographic coverage, including the coordination mechanism which would enhance effectiveness in reaching the totality of the populations living in vulnerable arid and semi-arid regions. These include socially or culturally marginalized populations, women heads of house-holds, with several children.

The recently published paper on Eradicating Hunger (FAO 2004) points out that the accumulated experience of FAO indicates that emphasis should be placed on national initiatives at the appropriate scale that target the entire population of hungry and poor people, and not on pilot projects which tend to have little impact on actually reducing poverty and hunger. This message definitely applies to the work on knowledge management.

10. Considerations for Implementing the Conceptual Framework

The challenge we face is to effectively exploit the intangible knowledge assets that add value to every aspect of the work: technical know-how, design and delivery of outputs, marketing and presentation, understanding of countries needs, etc., so that knowledge enhances the impact of every outputs, and creates new value by designing and developing outputs in the future that will meet the evolving needs of countries.

This requires that the conceptual framework considers all three dimensions (approaches) of knowledge management, namely as a product, a process and an output. The conceptual framework should focus on the knowledge assets and of countries. It should link strategic, normative and operational issues in a consistent manner, and provide guidance for the policies, mechanisms, processes, and work flows that would stimulate and nurture a knowledge culture, and strengthen and reward networking at all relevant levels as a common corporate practice.

In order that a corporate initiative on knowledge management enhances the impact of the work, it should focus on strengthening KM capabilities in four major areas:

- Strategy: the strategic issues of knowledge management should be embodied in the Organization's vision, policies, and values.
- Structure: the organisational structures required for facilitating knowledge management, such as learning and incentives for the staff, knowledge managers, communities-of-practice, and different kinds of knowledge networks.
- Processes: the business processes dedicated to knowledge capture, knowledge organisation, knowledge transfer and application of knowledge; and
- Systems: all the information and communication technology systems that support knowledge processes.

Knowledge management approach is essential in order to have a community that learns and transfers its knowledge to achieve sustainable development and food security. Knowledge management is not an end in itself, but rather a means to an end; the end is performing work better, more effectively, and enhancing the role of knowledge in eradicating poverty, reducing land degradation and promoting sustainable development.

11. Knowledge and Information Exchange Platforms

The World Agricultural Information Centre (WAICENT) in FAO has been working over the past years in the development of a knowledge and information management framework and Internet-based tools for improving access and use of knowledge and

information. One of the areas where the institutional learning role of WAICENT is most evident is with respect to food security and natural resources management, where the explicit linkages among the variety of disciplines are being articulated in order to enhance the impact of FAO's broad expertise in a more coherent, integrated manner.
In this way WAICENT can contribute to the interdisciplinary programmes with a structured approach; a framework for organizing the many dimensions of the problems associated with sustainable development and food security, and the tools for managing and visualizing the vast amount of knowledge and information. And most importantly it can help to better understand the linkages between all these facets, connecting sectorial agriculture to socio-economic factors and environmental constraints. This section presents several of the most salient examples of existing knowledge networks. The Land Degradation Assessment in Drylands (LADA) initiative of FAO) aims to assess causes, status and impact of land degradation in drylands in order to improve decision making for sustainable development in drylands at local, national, subregional and global levels. In order to better respond to the needs of all stakeholders concerned by land degradation, and in particular the ones involved in the implementation of the action programmes of the Convention to Combat Desertification (UNCCD). An example of a knowledge exchange platform is the LADA i Virtual Centre designed to serve as an information exchange platform for all stakeholders involved in the LADA project.

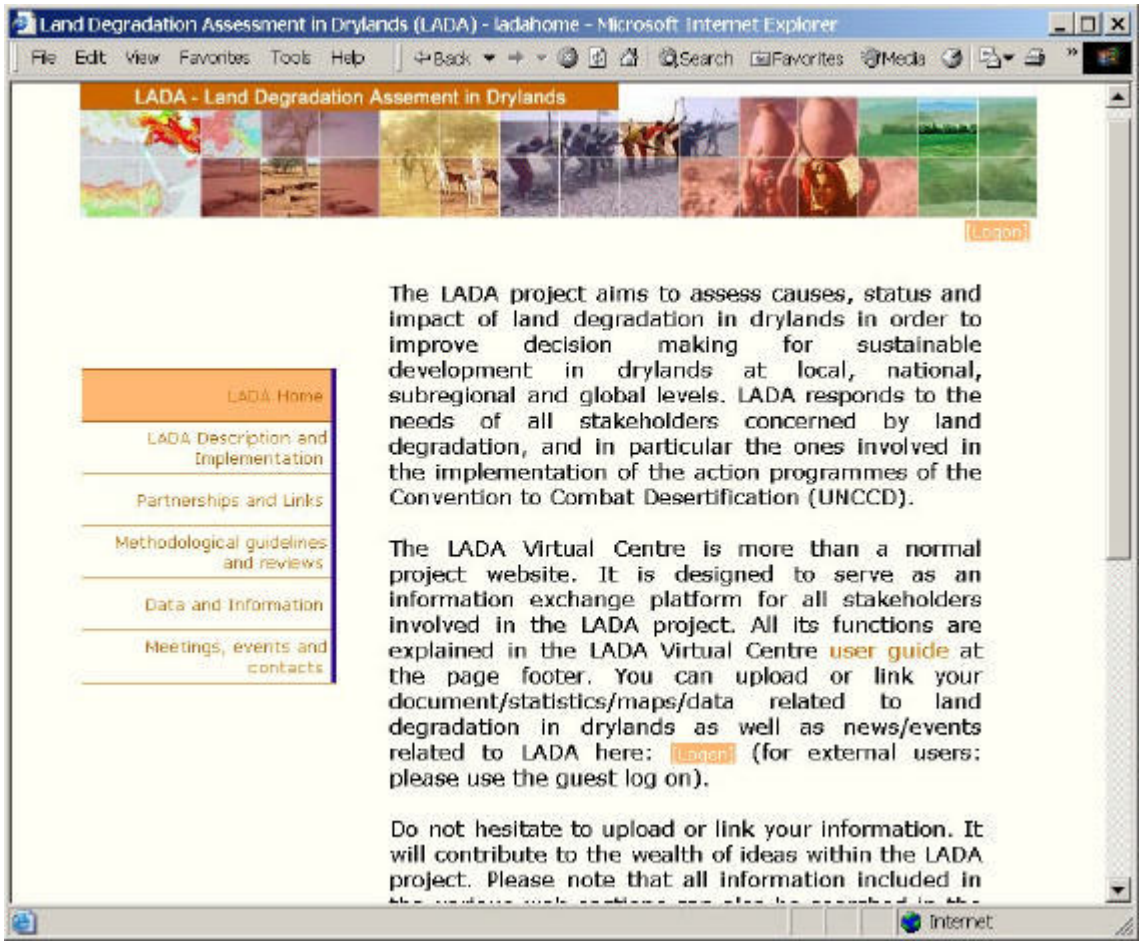

Figure 5: The LADA Virtual Centre Website

The Livestock, Environment and Development (LEAD) - Virtual Research and Development Network, where they have established regional platforms dealing with the issues and problems in each region, West Africa, Latin America, China, and others to

provide decision support and advice to policy makers, farmers, donors and other stakeholders.

Each regional platform focuses on regional, political and cultural issues. A platform is a way of organizing and prioritizing knowledge and information according to key thematic areas, regions and languages. The functions of a platform are:

- Provide an institutional framework (focal points and networks)
- Improve access to relevant information with a regional emphasis
- Promote information exchange and collaboration among key stakeholders (private sector, government, NGOs, researchers, universities, civil society, farmers cooperatives, and indigenous populations)

The LEAD Spanish-speaking platform, brings together key actors in Latin America to address issues relating to tropical forest-livestock interactions, including deforestation and livestock production, biodiversity.

Figure 6: The LEAD Spanish-speaking Platform

Another example of an FAO Knowledge Network is the Locust and other migratory pests group who have established a network for monitoring and advising governments and regional organizations on prevention, management and control activities, research and programmes to minimize the threat of locust breakouts, and impact reduction programmes for the communities who are affected.

Figure 7: The Locust Website

The Regional Animal Disease Surveillance and Control Network (RADISCON) for North Africa, the Middle East and the Arab Peninsula (Figure 8) is an initiative to develop and strengthen knowledge networks on animal diseases surveillance and control. One of the main aims of the RADISCON network is to exchange knowledge and information in the fields of disease information, veterinary epidemiology and data management in order to strengthen the capacities of the members to develop a strong network that can more effectively control animal diseases (http://www.fao.org/ag/aga/agah/id/radiscon/default.htm).

One of the key elements for success of knowledge networks is to foster the cohesion, confidence and trust between network partners, which can be achieved though training workshops and other fora organised through RADISCON in order to provide the means for all animal health professionals involved in the project to develop a common language and to share their experience in handling animal health issues.

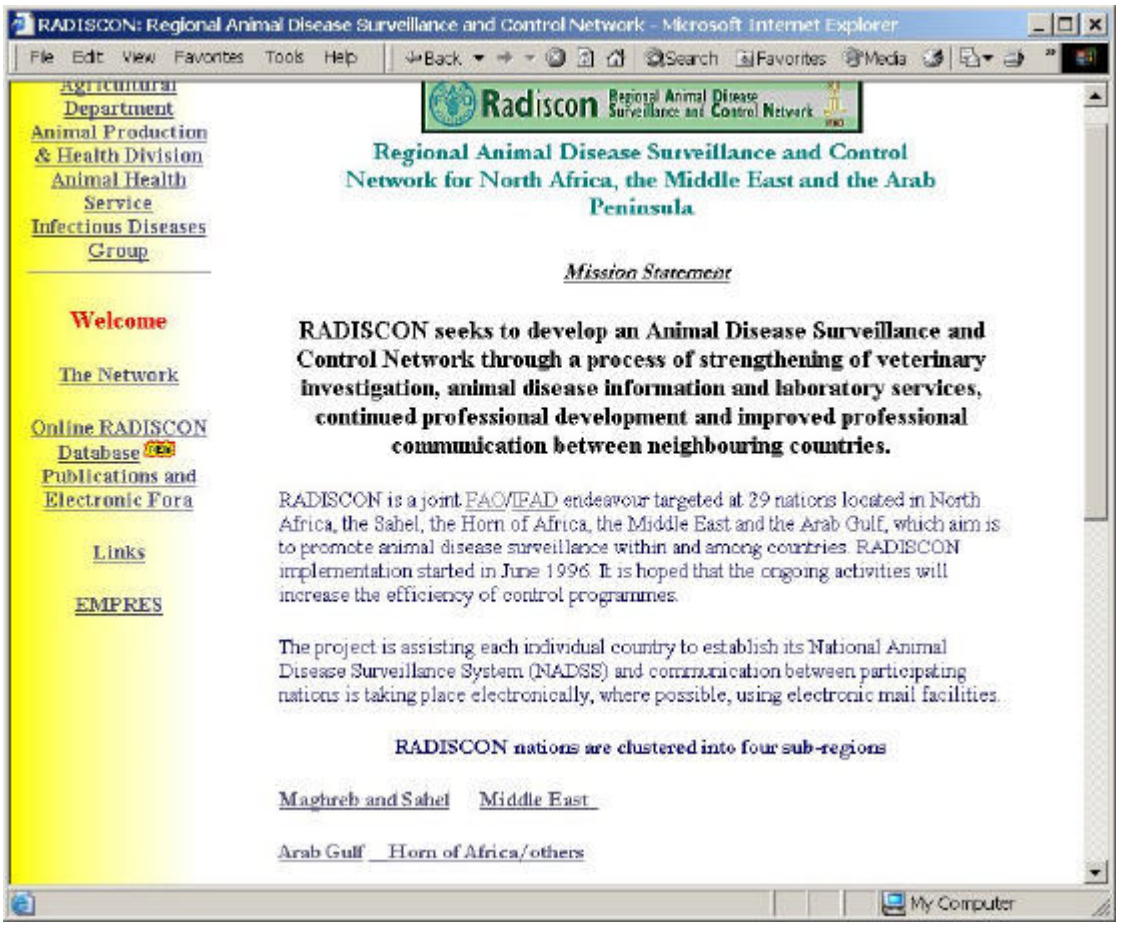

Figure 8: The RADISCON Website

12. Conclusions

Knowledge and information exchange are essential elements for achieving sustainable development and particularly for dealing with the complex interactions that can bring about land degradation and desertification. The methodological framework presented here for integrating ecological, physical, social, economic and cultural components can provide the conceptual and operational platform for knowledge and information exchange among all members of society, in particular the rural communities living in vulnerable arid and semi-arid regions of the world.

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SCIENCE FOR GOOD GOVERNANCE: SCIENTIFIC INFORMATION AND COMMUNICATION SYSTEMS IN THE CONTEXT OF THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION

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Abstract
Desertification related information is becoming more and more available through a number of Clearing House Mechanisms, Environmental Information Systems, networks, or WebPages. Those initiatives are strongly encouraged by the Article 16 and 18 of the Convention. However, too often, there is lack of a clear link between those initiatives and the implementation process of the Convention, the governance.
In order to advance the matter further, it is primordial to understand the flows of information in the context of the Convention and more specifically how this information is conveyed to and from the Committee on Science and Technology (CST). Four levels of information are addressed: National, Sub-Regional, Regional and Global and three major flows of information are identified. Scientific information should feed this process at all levels. For that purpose it is necessary to define common and strong scientific messages, not advocating, but informing policy makers about policy options and the possible impact of those options.
However, Desertification is a complex issue that needs a multidisciplinary and bottom-up approach, anchored into traditional knowledge and using modern technologies. Independent scientific networks, at all levels, should be major tools for addressing this issue, and defining and conveying the necessary messages from people to decision makers and other key stakeholders. In this regard, Article 25 of the Convention calls for the elaboration of an international scientific network that would support the implementation of the Convention.

Keywords: Desertification, science and governance, scientific networks, UNCCD

1. Introduction

Jump Caletous working on the Millennium Development Goals was reporting that "S*cience and technology are so central to the implementation of the Millennium Development Goals that they should be considered as the driving force behind the achievement of the goals. Keeping leaders engaged with this process means that they need to be continuously informed and updated on the latest developments in science and technology. That means that they need mechanisms for receiving scientific advice, which should be considered just as important as economic advice"* (Juma C., UN millennium project, 2005).
Information circulation systems (ICS) are major tools in order to face this challenge. Within the scientific UNCCD framework they should reflect the UNCCD specificity: an intergovernmental approach based on a bottom-up approach. The conciliation of these two characteristics, that may appear contradictory, should drive our work and be taken into account into the development of adequate ICS.
The Convention, in its article 16, specifies a framework for ICS on desertification. Information does exist. The question is how to communicate it and more specifically, in the UNCCD framework, how can it fulfil its determining role in the implementation process.
Before to advance further, it is important to know where the information is necessary and in which context, in order to define what are the needed ICS to develop science for good governance.

2.The scientific information framework of the UNCCD

2.1 The flows of scientific information

We can distinguish three major flows of scientific information within the framework of the Convention (figure 1).

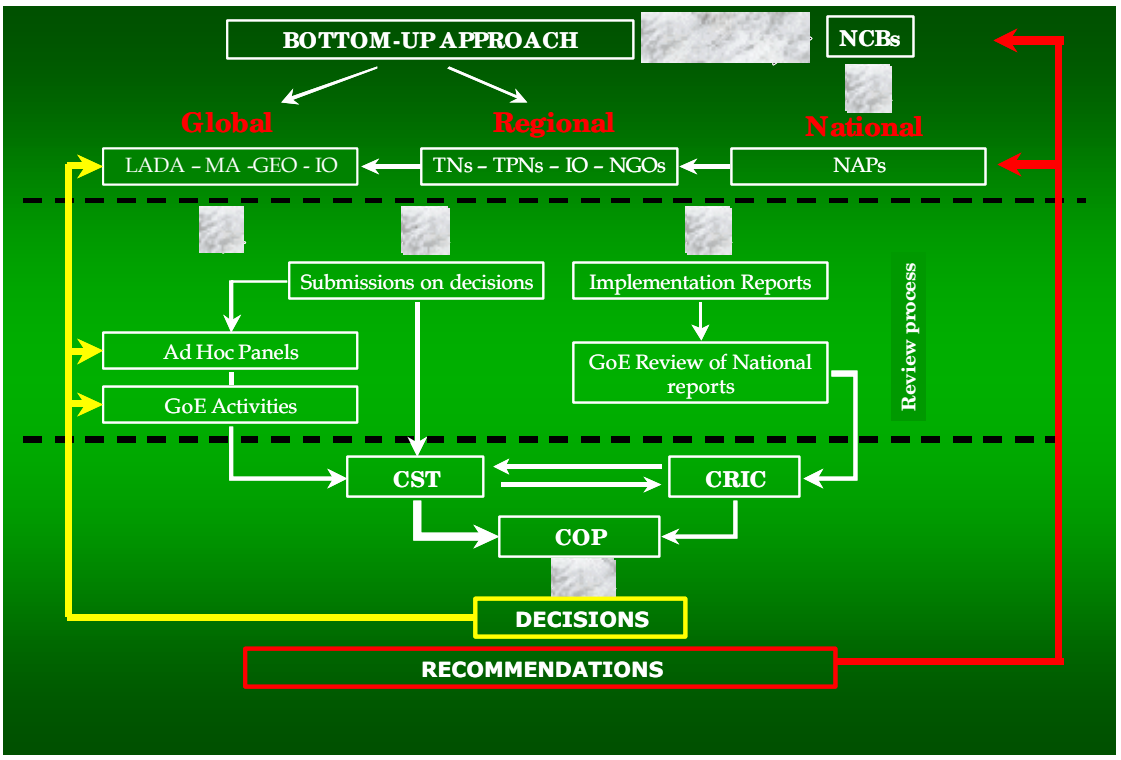

Figure 1: Scientific Information Flow Chart

1. Through the review process of the implementation reports prepared by Parties and all accredited organisations;
2. Through the submissions of reports on specific issues discussed by the CST as defined in the decisions. Country Parties and accredited organisations at national, regional and international level may be encouraged to submit reports;
3. Through the ad hoc working group of experts and the Group of Experts (GoE) activities.

The analysed information is coming from a wide range of sources including Country Parties, Non Governmental Organisations (NGOs), International Organisations (IO) and Scientific Institutions, and is coming from all levels of intervention (Local, National, Regional, and Global). Then different outputs will be delivered to the COP. Firstly decisions; these decisions will define the future work of ad hoc working groups of experts, define the programme of work of the GoE and arouse new issues for submissions. Within these decisions, recommendations will be adopted that will influence the whole process. By the end, the UNCCD logical framework should provide consensual scientific recommendations based on a broad, multi-level and multi-actor consultation. But for this purpose all organisations and more specifically the scientific organisations, must be involved and provide necessary information and recommendations to the concerned bodies and institutions.

This means an involvement of the scientists at the national level within the National Coordinating Bodies (NCBs) and the National Action Programme (NAP) elaboration, an involvement in the Sub-Regional Action Programmes (SRAPs) and Thematic Programme Networks (TPNs) and in the international initiatives, in order to provide adequate material in the information flow. This material will be used by the ad hoc working groups of experts, the GoE and the CST for the drafting of decisions and recommendations. This means a sound

involvement of scientists in the process that should be accompanied by the development of adequate ICS. In this regard, the text of the Convention put a strong emphasis on the importance of communication of reliable scientific and technological information, and of networks (Article 6,10,12,16,18,25: see Annex 1).

2.2 Information circulation in the text of the Convention

Article16, on "*Information Collection, Analysis and Exchange*" give a framework for ICS. Member countries shall, as appropriate:

1. Facilitate and strengthen the functioning of global network of institutions and facilities for the collection, analysis and exchange of information, as well as for the systematic observation […];
2. Ensure that the collection, analysis and exchange of information address the needs of local communities and those of decision makers;
3. Make full use of the expertise of competent intergovernmental and non-governmental organizations;
4. Exchange and make fully, openly and promptly available information from all publicly available sources relevant to combating desertification.

The text also emphasise the importance of the property rights in the framework of knowledge exchange:

(g) […] exchange information on local and traditional knowledge, ensuring adequate protection for it and providing appropriate return from the benefits derived from it, on an equitable basis and on mutually agreed terms, to the local populations concerned.

The article 25 put the emphasis on the creation of a global network.

To make information available and become a right for people, this info has to be conveyed. For this purpose ICS have been widely developed. Some of them were developed in the context of the Convention.

3. Examples of Information Systems addressing scientific issues in the UNCCD context

3.1 UNCCD website

The UNCCD website provides a thematic section related to scientific information.

This section presents the general documentation prepared for the COP regarding the different thematic areas addressed during the CST sessions. It also presents the activities of the CST and its Group of experts, the roster of independent experts and the results of the survey and evaluation of existing networks, institutions, agencies and bodies working on desertification.

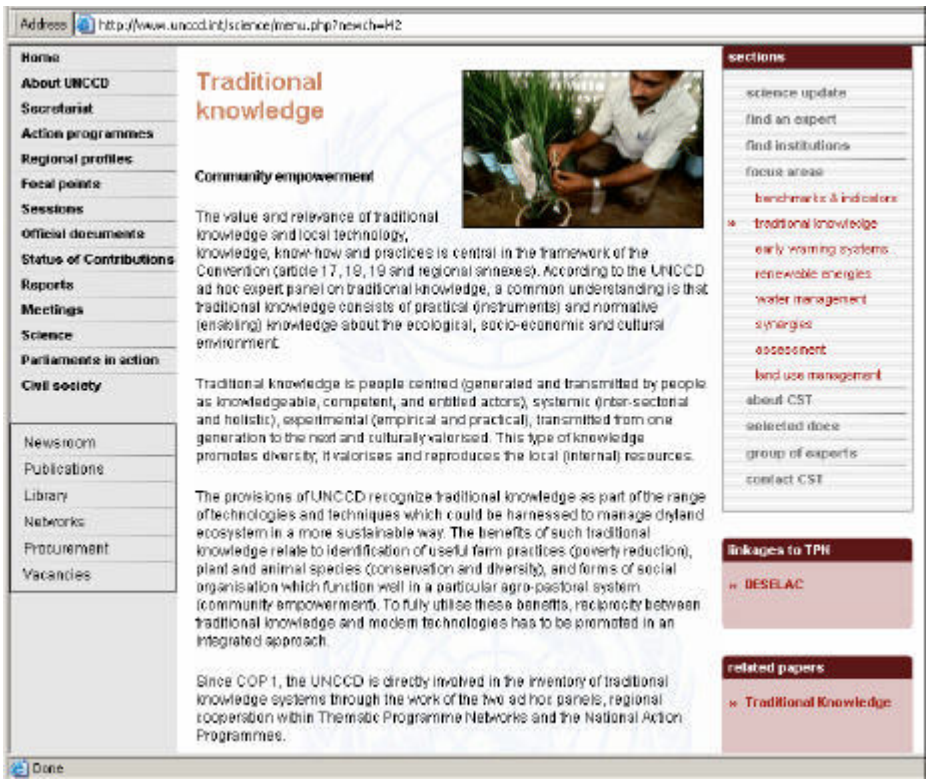

Figure 2: UNCCD website

3.2 Deselac portal

The Deselac portal, developed in the context of the Thematic Programme Network 1 for the Latin America and the Caribbean region is providing information on the implementation process and related scientific information in the region.

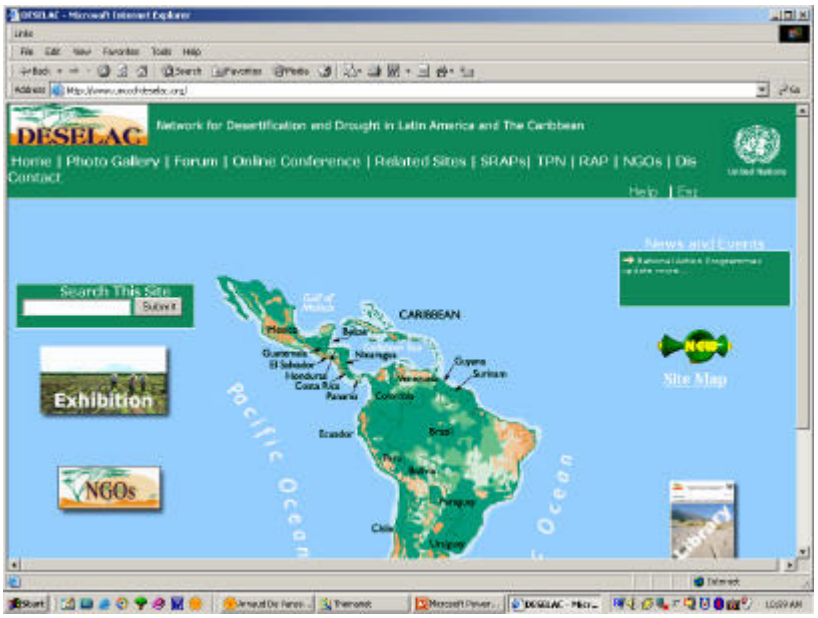

Figure 3: Deselac website

3.3 Themanet

The development of an adequate scientific information system on desertification will be a major step in helping the CST and its Group of Experts in achieving this challenge. This as been underlined by the COP that included communication in the Programme of Work of the Group of Experts:

1.3 Develop a clear communication strategy between the activities of the Group of Experts, the end users and the research community at large;

1.2 Develop a web-based glossary of terms (through a UNCCD-hosted server);

1.3 Develop a mechanism for an interactive and thematic data/metadata network.

The main objectives of THEMANET are to:

1. implement the Information and Communication mechanism;
2. improve NCBs information and communication activities;
3. facilitate exchange data, experiences and results among NCBs;
4. facilitate efficient information flow among NCBs and the Roster of Independent Experts.

Figure 4: Themanet website

3.4 LADA virtual library

Land Degradation Assessment in Drylands (LADA) is a project lead by a consortium in which UNCCD is part. FAO is the implementing agency. On aim of LADA is to support UNCCD implementation.

Within the project, a database of information on drylands and desertification has been developed: the "Properties and Management of Drylands" virtual library (http://www.fao.org/ag/agl/agll/drylands/index.htm).

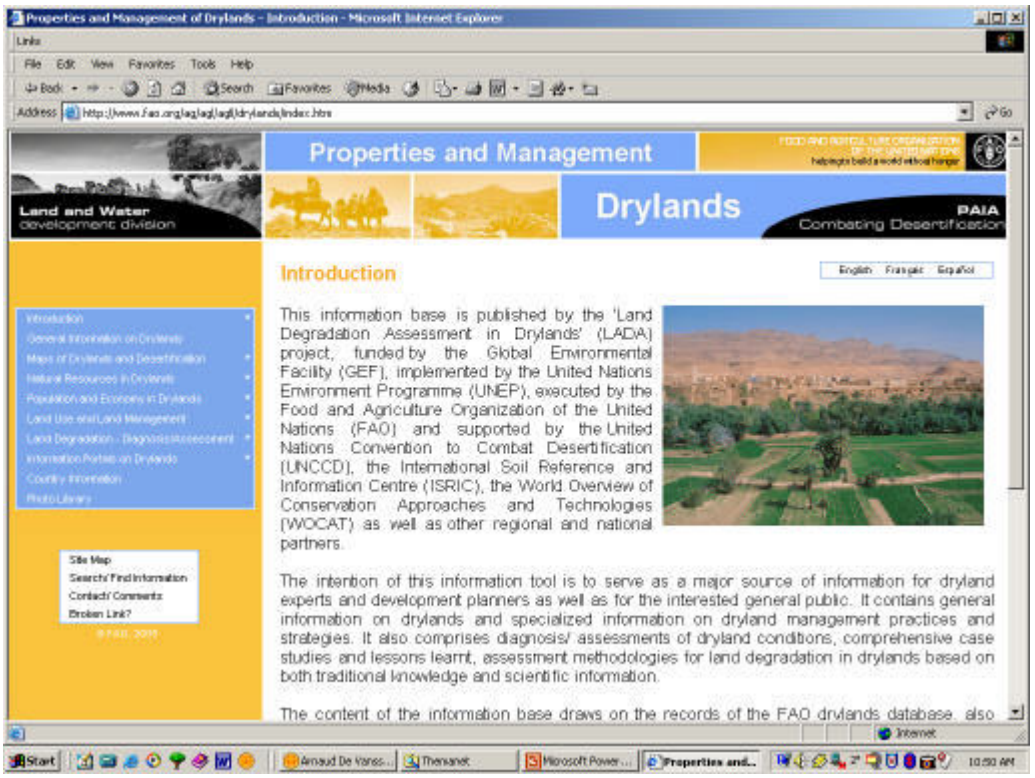

Figure 5: LADA website

The intention of this information tool is to serve as a major source of information for dryland experts and development planners as well as for the interested general public. It contains general information on drylands and specialized information on dryland management practices and strategies. It also comprises diagnosis/ assessments of dryland conditions, comprehensive case studies and lessons learnt, assessment methodologies for land degradation in drylands based on both traditional knowledge and scientific information.
This project, already references 1 500 documents online. Information comes from approximately 150 different websites and portals of institutions, organisations, organisms and projects on drylands and desertification. Information is public domain.
The LADA project and Themanet have some similarities. Options for collaboration and synergies between the two projects could be reviewed in order to enhance development opportunities and ensure a better sustainability of the systems.

3.5 The roster of independent experts network

Following decision 13/COP7, an e-mail network of the roster of independent experts has been implemented and a first e-mail has been sent. Information on the CST and GoE activities, the IYDD and progress made in the implementation process will be delivered.

3.6 A need for better coordination and circulation of information

As highlighted in the previous pages and other papers of these proceedings, numerous ICS at national, regional and international level were developed. They address more or less directly desertification. But most of those concerning desertification are under development. Therefore, we are at a critical and determining point for the coordination of those initiatives in order to avoid duplication of initiatives and try to develop a global strategy for the ICS on desertification. This may be a major step for their sustainability and efficiency. The different systems reviewed here are mostly providing information and do not really allow a circulation

of the information. Furthermore, too often, there is lack of a clear link between those initiatives and the implementation process of the Convention, the governance. The information provided as such will not be sufficiently and/or adequately taken into account into the flows identified in the *figure 1.* Sharing scientific information is not enough. In order to reach policy makers, an adequate packaging and dissemination of the information is primordial. For that purpose it is necessary to define common messages. The question is what kind of message should be provided and how to draft and convey them?

4. Defining the message from scientists to policy makers

4.1 Adequate research will have better chance to reach policy

In its article 17 the Convention defines a framework for the involvement of scientists in the research on the combat of desertification. This article states that member countries shall support research activities that:

1. Respond to well defined objectives;
2. Address the specific needs of local populations;
3. Lead to the identification and implementation of solutions that improve the living standards of people in affected area.

Improving the living standards of people, means community empowerment and the involvement of local communities. This and well define objectives mean the development of a demand driven research and the integration of traditional and modern technologies that cannot be achieved without strong communication between scientists, local communities and decision makers. This communication process will help to adequately define projects and activities that will directly help the communities and respond to the politician concerns.

Promoting the dialogue between scientists and decision-makers at local level points and at strategic decision points is essential. The National Action Programmes is one of these strategic decision points. In fact, prepared by the National Coordinating bodies, with all the involved stakeholders, their drafting is based on dialogue.

The Implication of the scientists in this process and at local level points could improve two points:

1. The definition of the research projects on a demand driven base. Article 17 of the convention precise that research priorities on desertification should be based on NAPs priorities;
2. The understanding and accessibility of research products for decision-makers and tradition-based end-users.

It may also allow a better integration of modern technologies with traditional technologies that is another mean to enhance the appropriation of research results.

And we know that Research carried-out with a clear focus on meeting the needs of end users will have the greatest chance of influencing policy makers (IUFRO, 2005).

Therefore, scientists are in a good position to convey messages from communities to decision makers and they can strengthen the messages by numbers, figures and maps that cannot be ignored by politicians and force concrete decisions.

4.2 Two concrete examples from Herrmann and Hutchinson, 2005

First example

The changing understanding of the climate variability and its influence on desertification could have a major influence on political decisions. In the 1970s, internal forcing such as biophysical feedback mechanisms between land surface and precipitation (as albedo), provided the main explanation of droughts. However with the recent satellite measures, large-scale changes in STT (stratosphere-to-troposphere transport) patterns are felt to be the major driving forces that promote changes in atmospheric circulation. However, although a new

understanding of climate variability has emerged, the understanding of the causes of variability is still unfolding and most probably there is no single explanation.
If internal feedbacks are judged to be the cause, there is an implicit assumption that removal of the perturbing factor (e.g. overgrazing livestock) will allow a return to the previous condition. If external forcing is embraced, there is a little that can be done to affect the occurrence of drought. If that is the cause, then the livelihood systems, on which human populations depend, must be made to adapt to that uncertainty.
Second example
A growing body of literature gives evidence of the dominance of the livelihood approach in the debate on rural poverty reduction during the last decade. Whiles many earlier works assume a self accelerating downward spiral between poverty and natural resource depletion, with population growth as a critical factor, this view has been questioned by a number of case studies which point out evidence of poor rural people actively improving their environments using labour-intensive conservation practices. (Cf. the counter paradigm of the MA) On the other hand, links between market prices, labour shortage, insecurity of land tenure, or diversification of incomes could be made with land degradation.
The recognition of the rational and adaptative capacity of indigenous land management practices requires that these practices be incorporated into development and environment schemes to strengthen rather than remedy them. This would imply the adoption of more democratic forms of interaction cooperation between land users on the one-side and, donor agencies and national institutions which set-up large-scale desertification measures on the other. Furthermore, the realization that creation of viable rural livelihoods no longer depends solely on agricultural activities calls for a revision of policies that were exclusively aimed at extending and modernizing peasant production in favour of policies supportive of the rural economy. Policies are needed that facilitate access to a wide range of assets to foster the construction and environmentally sustainable livelihoods.
Ms. Herrmann and Mr. Hutchinson concluded, "*Policies that affect people on the ground may be formulated largely independent of science that is current and thus may serve to degrade rather than enhance the lives of people*".
Those two examples show that scientists are well placed for:
1. Understanding global phenomenon and their impacts on policy options;
2. Conveying messages from people to decision makers.

They also show the importance to develop interdisciplinary teams that address the issue of desertification in its whole complexity and have all necessary knowledge in order to answer to the questions of the decision makers. Those findings concerning complex problems and paradigms are crucial for taking the right decisions and they have to be communicated to the decision makers. Interesting studies do exist and are available on ICSs, however adequate systems were not developed in order to link those messages to the implementation process. It may be difficult for a scientist alone to reach the attention of the global community and national policy makers. ICS could allow defining and communicating those messages.

4.3 Characteristics of the message
Desertification is a complex issue that needs a multidisciplinary and bottom-up approach, anchored into traditional knowledge and using modern technologies. The conclusions drawn above were deriving from a multidisciplinary analysis and assessment. In order to be even more widely accepted and supported they could be peer reviewed. Then, they could be synthesized, targeted, tailored and translated into a language that should be understandable and bearable by the decision makers.
This language should not advocate a particular viewpoint but inform about policy options and the impact of those options. Advocating usually has a negative effect on the credibility of a

scientist's results, because advocacy is equated to being biased in favour of the particular viewpoint. The values that people ascribe to science and the scientific process are important (IUFRO, 2005). How scientific results are disseminated is a key part of influencing policy.

5. The way forward

5.1 Possible options

To keep a strong anchorage into a bottom-up approach as a continuous and constant preoccupation…
To define adequate problematic to be tackled with end-users and policy makers…
To answer to complex questions of the decision makers…
and
To reflect the need of a multidisciplinary approach…
To define a common message, not advocating but reflecting the richness of the thoughts of the scientific community and providing policy options…
In the context of science for good governance for the implementation of the UNCCD…
Two tools may help achieving those challenges: scientific networks and partnerships.

1. Partnerships between NGOs, agencies, governmental bodies, scientists and institutions that would allow to set clear expectations, to identify the communication channels, and to identify the misunderstanding or gap of knowledge of the stakeholders that should be filled, lightened and tackled by the scientists. The National Coordinating Bodies (NCBs) (see figure 1) could play such a role at the national level.
2. Independent scientific networks at each level (national, regional and global) would allow designing the scientific message in itself. The best assessment occurs when scientists from several disciplines work together on an assessment, rather than work independently to produce a set of separate reports (IUFRO, 2005). Then, the networks will allow translating the message adequately (depending on the final users) and disseminating it.

For example, the efficiency of the GoE, that has to answer to those complex problems raised by the decision makers, is hardly hampered by the lack of a coordinated support by institutions agencies and bodies working on desertification.
There is a clear need to implement the article 25 of the text of the Convention that calls for the development of a network of institutions, agencies and bodies to support the implementation of the Convention. The text of the Convention itself precise that the CST should recommend ways and means to facilitate and strengthen the network that should answer to the issues raised in articles 16 to 19. And the COP should recommend operational procedures, a time frame and identify best-suited units of the network.

5.2 Links with the UNCCD process

In the context of the UNCCD those networks could be involved and intervene at different levels: the NCBs, the NAPs, the SRAPs, the RAPs the TPNs, and at the global level. They could provide information (or the message described above) for the support of the reporting process, the review process, the implementation of the different programmes, the submissions on decisions of the CST, the GoE activities and ad hoc working groups of experts. Therefore, scientific information should be able to reach and/or have a real influence on the flow of scientific information defined in *figure 1*. Furthermore, the partnerships defined above, would partly allow the necessary feedbacks mechanisms that are necessary to keep the whole process in a bottom-up approach, keeping in mind the interest of the poorer living in marginalised drylands areas.

6. Conclusion

Several intergovernmental conferences went back on the necessity to develop science for good governance in developing countries:

- The Doha Plan of Action' was approved at the coalition's second South Summit, held in Doha, Qatar on 12-16 June 2005. The document stresses the need for developing countries to build scientific capacity and close the technological gap between them and industrialised nations.
- Arab leaders have agreed to collaborate more closely on research and increase their funding of science and technology. Summit of the 22-member nations of the Arab League, March 2006.
- A ten-year plan to promote science and technology in the Muslim world was endorsed by the senior officials of 57 Islamic states in Mecca in December 2005.
- European Union leaders have agreed to promote science and technology in Africa through networks of universities and centres of excellence, December 2005
- At Africa's second ministerial meeting on science and technology, Senegal's president called on the continent to become an active participant in research, September 2005.

Achieving this will depend in part on increased scientific cooperation between developing countries, including setting up networks of researchers and institutions says the Doha plan. This means also the development of adequate means for transferring the findings of the scientific communities to the decision makers. In the context of research on desertification, tools to achieve this challenge are the development of adequate capacities for the circulation of information such as networks and partnerships at all levels (national, regional and global). Scientific information has been too often not adequately taken into consideration in the process. However, important efforts on ICS have been made in the last few years. It is time to go further and make this information properly circulate.

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Annex 1: Articles of the text of the Convention related to circulation of scientific and technical information and the development of adequate networks

Article 6
Obligations of developed country Parties
(e) promote and facilitate access by affected country Parties, particularly affected developing country Parties, to appropriate technology, knowledge and know-how.

Article 10
National action programmes
They shall […]
e) promote policies and strengthen institutional frameworks which develop cooperation and coordination, in a spirit of partnership, between the donor community, governments at all levels, local populations and community groups, and facilitate access by local populations to appropriate information and technology.

Article 12
International cooperation
Affected country Parties, in collaboration with other Parties and the international community, should cooperate to ensure the promotion of an enabling international environment in the implementation of the Convention. Such cooperation should also cover fields of technology transfer as well as scientific research and development, information collection and dissemination and financial resources.

Article 16
Information collection, analysis and exchange
The Parties agree, according to their respective capabilities, to integrate and coordinate the collection, analysis and exchange of relevant short term and long term data and information to ensure systematic observation of land degradation in affected areas and to understand better and assess the processes and effects of drought and desertification. This would help accomplish, inter alia, early warning and advance planning for periods of adverse climatic variation in a form suited for practical application by users at all levels, including especially local populations. To this end, they shall, as appropriate:
(a) facilitate and strengthen the functioning of the global network of institutions and facilities for the collection, analysis and exchange of information, as well as for systematic observation at all levels, which shall, inter alia:

1. aim to use compatible standards and systems;
2. encompass relevant data and stations, including in remote areas;
3. use and disseminate modern technology for data collection, transmission and assessment on land degradation; and
4. link national, subregional and regional data and information centres more closely with global information sources;

(b) ensure that the collection, analysis and exchange of information address the needs of local communities and those of decision makers, with a view to resolving specific problems, and that local communities are involved in these activities;
(c) support and further develop bilateral and multilateral programmes and projects aimed at defining, conducting, assessing and financing the collection, analysis and exchange of data and information, including, inter alia, integrated sets of physical, biological, social and economic indicators;

(d) make full use of the expertise of competent intergovernmental and non-governmental organizations, particularly to disseminate relevant information and experiences among target groups in different regions;
(e) give full weight to the collection, analysis and exchange of socio-economic data, and their integration with physical and biological data;
(f) exchange and make fully, openly and promptly available information from all publicly available sources relevant to combating desertification and mitigating the effects of drought; and
(g) subject to their respective national legislation and/or policies, exchange information on local and traditional knowledge, ensuring adequate protection for it and providing appropriate return from the benefits derived from it, on an equitable basis and on mutually agreed terms, to the local populations concerned.

Article 18
Transfer, acquisition, adaptation and development of technology
1. The Parties shall, in particular:
(a) fully utilize relevant existing national, subregional, regional and international information systems and clearing-houses for the dissemination of information on available technologies, their sources, their environmental risks and the broad terms under which they may be acquired;
2. The Parties shall, according to their respective capabilities, and subject to their respective national legislation and/or policies, protect, promote and use in particular relevant traditional and local technology, knowledge, know-how and practices and, to that end, they undertake to:
(a) make inventories of such technology, knowledge, know-how and practices and their potential uses with the participation of local populations, and disseminate such information, where appropriate, in cooperation with relevant intergovernmental and non-governmental organizations;
(c) encourage and actively support the improvement and dissemination of such technology, knowledge, know-how and practices or of the development of new technology based on them;

Article 19
Capacity building, education and public awareness
1. They shall promote, as appropriate, capacity- building:
(g) through cooperation, as mutually agreed, to strengthen the capacity of affected developing country Parties to develop and implement programmes in the field of collection, analysis and exchange of information pursuant to article 16;
3. The Parties shall cooperate with each other and through competent intergovernmental organizations, as well as with non-governmental organizations, in undertaking and supporting public awareness and educational programmes in both affected and, where relevant, unaffected country Parties to promote understanding of the causes and effects of desertification and drought and of the importance of meeting the objective of this Convention. To that end, they shall:
(b) promote, on a permanent basis, access by the public to relevant information, and wide public participation in education and awareness activities;
4. The Conference of the Parties shall establish and/or strengthen networks of regional education and training centres to combat desertification and mitigate the effects of drought. These networks shall be coordinated by an institution created or designated for that purpose, in order to train scientific, technical and management personnel and to strengthen existing

institutions responsible for education and training in affected country Parties, where appropriate, with a view to harmonizing programmes and to organizing exchanges of experience among them. These networks shall cooperate closely with relevant intergovernmental and non-governmental organizations to avoid duplication of effort.

Article 25

Networking of institutions, agencies and bodies

1. The Committee on Science and Technology shall, under the supervision of the Conference of the Parties, make provision for the undertaking of a survey and evaluation of the relevant existing networks, institutions, agencies and bodies willing to become units of a network. Such a network shall support the implementation of the Convention.

2. On the basis of the results of the survey and evaluation referred to in paragraph 1, the Committee on Science and Technology shall make recommendations to the Conference of the Parties on ways and means to facilitate and strengthen networking of the units at the local, national and other levels, with a view to ensuring that the thematic needs set out in articles 16 to 19 are addressed.

3. Taking into account these recommendations, the Conference of the Parties shall:

(a) identify those national, subregional, regional and international units that are most appropriate for networking, and recommend operational procedures, and a time frame, for them; and

(b) identify the units best suited to facilitating and strengthening such networking at all levels.

Note: The views expressed in this publication do not necessarily reflect those of the UNCCD Secretariat

SESSION VI

Parallel working group discussion on ICS implementation: needs and requirements

REPORT FROM WORKING GROUP 1: SOCIO-ECONOMIC DATA

Rapporteurs
P. Klintenberg, M. Seely

During the workgroup discussions the following model was developed, illustrating the main components in an Information Circulation System (ICS):

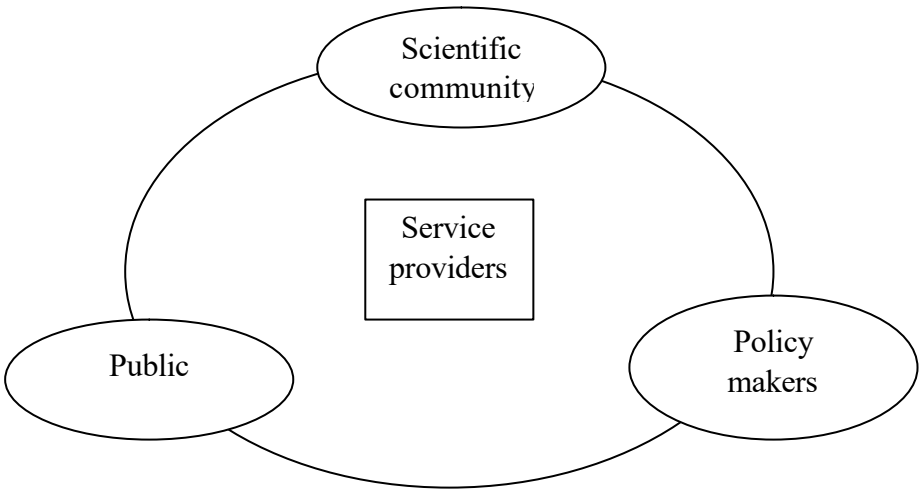

Figure 1: Conceptual model

The conceptual model illustrates information circulation within the three key stakeholder groups and among these groups. Note that there ideally should be information flow to and from all these three groups for the ICS to function. Each of these three groups do have several "internal" information systems, this mega ICS outlined here is focusing on information flow between the different groups. Service providers are central in the model as they are doing much of the translation and dissemination of information between the tree groups.

Scientific community
It was said that scientists within the same field talk and understand each other, however, when scientists from different schools, e.g. biophysical and socio-economic focus, there seem to be problems. These problems mainly arise due to differences in definitions and methods applied by these different groups. For this part of the information circulation system to work better, i.e. results from scientific studies contributing to the combating of desertification, integration between these different groupings is required.

Public
The following information needs towards combating of desertification were identified:
- General information linked to ways of life
- Resource management
- How to combat desertification and general information about processes causing desertification
- Health
- Services
- Demography
- How desertification impacts on local resources
- Migration

- Risk
- Security
- Quality of life

Several of the topics raised above are related. The following overall groups of issues can be defined:

Awareness about causes and effects of desertification

This is one of the fields where science could contribute tremendously as the general view of the public still is of marching deserts, sand dunes expanding from the fringes of the worlds sand seas.

How to combat desertification

This would cover issues as natural resource management and general information of relevance to ways of life. Here is another field where science can and should contribute by making their research findings understood, and be a guidance for development of remedies.

General information about sustainable management of natural resources

Under this heading issues as: health, services, migration, risk, security, demography and quality of life would be covered.

Following groups of the public were identified:

- General public (the people)
- Land owners
- Natural resource users
- Trade authorities

All these groups have different information needs, e.g. general public requires empowerment and connectivity to the other key players in the ICS (scientific community and policy makers). Land owners need information about how to combat desertification and what service are there for them. Natural resource users need information about resource management, disaster management and health. Finally, trade authorities need information about finance opportunities, markets and laws.

Policy makers

It is important that information to the policy makers is clear, understandable and of relevance. Policy makers need information about priorities, not the finer details. Time is an important factor, generally policy makers need information instantly, something that many times clashes with the scientific society.

Services

The key for an ICS to function is efficient translations and distribution of information between and within the three main players identified above. Internally, the scientific community should be able to widen their views out from their own niche to other scientific institutions and faculties. However, present merit systems do not provide any incentives to scientists to translate results to the general public nor the policy makers. For this to happen external service providers are required, e.g. NGOs and other organisations and institutions that have the interest and mandate to translate and implement these findings. There is not one service provider but several, which work on different scales, e.g. with the local community or on the national level, lobbying decision makers etc.

The working group concluded by delivering the following key messages:

- It is important to make sure that socio-economic factors and actors are integrated into the ICS on desertification
- Information packaging is very important for the ICS to functioning

- Information packaging varies depending on who is the creator and receiver of the information
- Everything is not biophysical, there is also the very important human factor.

REPORT FROM WORKING GROUP 2: INTEGRATED COMMUNICATION SYSTEMS AND PHYSICAL INFORMATION

Rapporteurs
J. Henschel , J. L. Rubio

The working group reviewed how ICS relate to physical information on desertification by discussing the general concept and its specific components, by reviewing the relevant information available from all previous presentations, and by developing a framework that places the ICS in context and will be useful for the development of future recommendations.

The components of the ICS can be viewed in terms of a "3+1" model. This comprises three user groups: people (i.e. the general public, especially communities deriving their livelihoods from local natural resources), decision makers and scientists. A Platform of Services connects these users to available data, the sources of data, and its products (Fig. 1). The user groups require information and knowledge to understand difficulties they may experience and to derive guidelines for actions to overcome these difficulties.

To achieve this in a coordinated fashion, there is a need for an integrated system of ICS, or ICS or ICSs. This is required to establish common functions and responsibilities and to develop codes of ethics, such as for data sharing. This approach should benefit institutional funding and resources required to carry out the activities related to the acquisition and provision of physical information. The Desertification ICSs relate to different aspects, namely, the functioning of dryland systems, the driving forces and cause-effect-cause relationships, as well as mitigation of and responses to degradation.

People are one of the three user groups of physical information available through the ICS. The needs of people are a fundamental objective, or target, of the entire ICS. They connect to the ICS through data that they can access locally, through participatory long term monitoring, and through incentives for them to share their own information. People can, for instance, record their observations of agro-forestry productivity and associated biophysical parameters. People are also the ones to translate the information contained in ICSs into action on the ground level. However, because local communities are so diverse and complex, it is difficult to apply common approaches across-board and ICSs need the people themselves to assist with the application of its functions. To overcome this difficulty, it is helpful and most urgent to first identify and focus on vulnerable human systems and to test approaches of translating concepts into action by means of demonstration projects applied at focal sites.

Decision makers, namely politicians, government officials or local leaders require ICS to guide the development of policies, legislation and good governance to address desertification. This user group is an important one to determine what kind of information is required, but they are also an important source of information due to their involvement with different scales of ICS (local, national, regional, global). Decision makers evaluate the usefulness of information in terms of cost-benefit analyses, and require specialist support from statisticians and planners. In turn, decision makers are influential in their ability to provide institutional support and resources required by other groups. Furthermore, they are the ones to coordinate the administrative support required for information management.

The tasks of establishing benchmarks, defining indicators and thresholds, validation and evaluation of data and information, as well as risk analyses and the conceptual development

of appropriate emergency response systems fall onto the third group, scientists. They are concerned with terrestrial, aquatic and atmospheric processes, including human activities and their relationships with and effects on the biogeophyscial environment. Scientific approaches also include developing measures for mitigation. Capabilities change as new and adapted technologies, including modelling and scenario testing, are incorporated as increasingly more powerful research tools. However, scientists are still challenged to incorporate different time and spatial scales and flexible monitoring schemes into common concepts. There is an urgent need for better translation of scientific information for other user groups, as well as consensus on concepts, standardisation of data and interconnection of different kinds of information. Several barriers to the sharing of data and information need to be overcome. The above-mentioned characteristics are traditionally not rewarded in the framework in which many scientists operate. ICS needs to develop appropriate incentives. The ICS of ICSs includes a Platform of Services as the mechanism that provides the enabling environment for the three ICS user groups (Fig. 1). It enables them to enhance their knowledge and understanding and to translate these into action. It is a mechanism to evaluate the information content in different ICSs, thereby enhancing transparency. It also enhances the coordination and dissemination of information, and provides a means of applying up-scaling as well as information feed-back mechanisms. This platform is the means for connecting science to development and vice versa. The mechanism must be flexible so as to respond quickly to changing conditions and frameworks.
It is recommended that platforms of services should be developed that serve different regions of the world and can eventually be interconnected to form a global network.The development of the planned EU-DesertNet is in line with this recommendation.

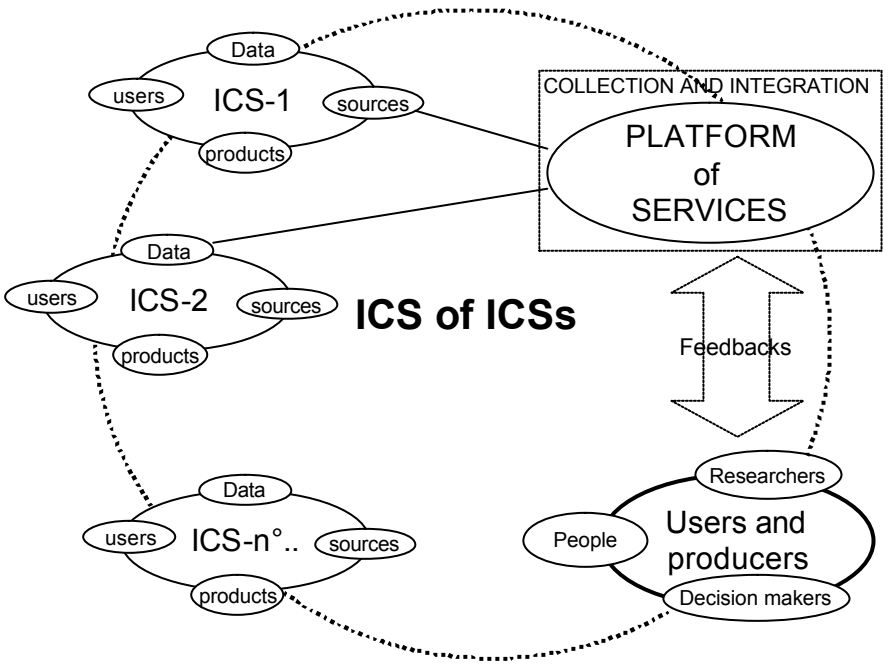

Figure 1: Relationship between different components of a system of ICS of ICSs relating to desertification.

Each ICS comprises data, and its users, sources and products. A platform of services coordinates the collection and integration of all information and optimizes it for different user groups, who in turn also act as sources of information.

REPORT FROM WORKING GROUP 3: ICS AND HIGH TECH APPLICATIONS

Rapporteurs
T. Tadesse, A. S. Arya

The use of modern technology is essential to address the challenges of drought and desertification and mitigate the impacts on global environmental. Our Working Group (WG 3) dealt on the high technological applications in the context of the Information Circulation System (ICS) to combat desertification. The working group discussed on the basic definitions and explanation of the "*high tech*" applications. For our easy understanding and reference, we defined "high tech" as advanced technology that enhances the use and dissemination of information that compliment the traditional methods. Therefore, we defined the "high tech" application as automated, fast, efficient, cost effective, repetitive, and complimentary techniques to other traditional resources.

The *high tech* role in the context of the ICS can be divided mainly into two: (a) data collection, processing, and analysis, and (b) information circulation. The data include remote sensing data, geospatial data using the Global Positioning System (GPS), and ground observations using automated stations. These data sets complement the traditional ground observation in addition to using the modern technological advances and state of the art instruments. The information circulation is the main component in using these data sets efficiently. The ICS could use web based user interfaces, web portals, and interoperable systems to exchange data and utilize in research and producing operational products in monitoring drought and desertification.

In order to use the "*high tech*" applications, it may be necessary to assess the existing needs, knowledge, the difficulties associated in using high technology. Our working group considered three categories of users profile for this assessment. These categories are people, scientists, and decision makers. The assessment can be summarized below:

- *People*: The main problem for people especially in the developing countries is lack of infrastructure for introducing modern technological products. The needs of the local people include capacity building on land management and conservation practices, near-real time information on natural disaster and predictions to monitor drought and other natural disasters, etc. Most people are using traditional knowledge and practices to this challenges and needs. The actions to be done recommended by our group are: building community structure for training local experts. Providing not so expensive equipments to facilitate and visualize the high tech products, improve telecommunication, enhance or establish web/TV accesses to the local people, and encourage the integration of the traditional existing knowledge with modern technology. The aim should be to make the high-tech reach the grass-root level, to the end beneficiary i.e. mainly the farmers.
- *Scientists*: It has commonly believed that the knowledge and information provided by scientists are mostly theoretical and generalized. This can be resolved by interacting with people. Feedbacks, on new models and products, from the users provide a sound basis for the research, conducted by scientists. Thus, the needs of the scientists include feedback from the people and administrative bodies, and decision makers to improve the research outputs and efficient use of new products. The interaction with people also helps in identifying the research problems, assessment, and current practices. For this

purpose the working group recommends the establishment of community platform, providing latest equipment for using high tech products, and institutionalization.

- *Decision Makers*: Present day decision makers get uncoordinated information from variety of sources. Some times, it could even be contradictory. That results in confusion and may also lead to inaction. Thus, their coordination and integration of information is essential in using high tech products and information circulation. Building awareness and providing technical background knowledge to the decision makers, enhancing capacity and incentives to use high tech applications (e.g., Decision Support Systems, Geographic Information System, etc), and providing success stories encourage the political willingness and efficient use of the technology.

To attain the objectives of using high technological applications to combat drought and desertification in the context of ICS, the following points must be considered for implementation:

- Resolving WEB access problems and cost issues
- Integration of Modern and traditional ICS
- Visualisation of information through High tech
- Real time collection and access to data sources
- Harmonisation and inter-operability of information
- Sensitizing the decision makers and the grass-root level about the use and benefits of high-tech
- Building capacity and infrastructure for introducing internet in rural areas
- Encouraging the use of internet in arid zones and use of mobile phone networks
- Active and meaningful interaction of different institutions and share technology
- Create technological services to meet user requirement

SESSION VII

General discussion and conclusions

CONCLUSIONS AND ISSUES RAISED

G. ENNE
AIDCCD Coordinator and Director NRD – Desertification Research Group of the University of Sassari, Italy

The AIDCCD Seminar on "Role of the Information Circulation Systems in Scientific and Practical Approaches to Combat Desertification" raised a large number of issues in all its seven sessions that have been thoroughly discussed by all seminar participants.
This documents was elaborated at the end of the seminar and endorsed by all seminar participants who joined the coordinator' efforts to synthesize the many issues raised and the conclusions reached.
This is a comprehensive, although schematic, overview of the main issues raised and grouped under 7 main broad categories, among whom are the existing *open issues* that deserve further attention and discussion, and the identification of *recommendations* and *possible actions,* without neglecting the issues emerged concerning the *nature of ICS, their characterisation and structure.*
All such items are meant to be a support to the creation of a desertification ICS and to the effective and fruitful utilisation of existing ICSs, necessary and instrumental to the fight against desertification.

State of the art

- There is abundance of heterogeneous, dispersed and discontinuous data;
- There exist a great variety of methods as well as different temporal and spatial scales;
- The abundance of data does not translate into information for action;
- Multi-conceptual and multidisciplinary approaches are to be adopted;
- There is not enough information about data and metadata;
- Little efforts are made to get metadata catalogues;
- Results are difficult to be accessed or entirely inaccessible;
- Different types of ICS exist, with different purposes and functions: they could be distinguished/classified in order to issue specific recommendations for actions to support CCD implementation;
- There is poor integration of biophysical and socio-economic indicators;
- An official ICS of the UNCCD still does not exist;
- Syntheses are difficult without harmonisation and compatibility;
- There is no adequate perception of desertification dimension by society;
- There is lack of adequate administrative /institutional coordination.

Statements

Article 17 of the UNCCD states: parties should engage in sharing information

- It is necessary to enhance the potential added value of ICS;
- Knowledge and information dissemination *per se* is not ICS. ICS intrinsically exclude a one-way flow of information;
- ICS must be end-users tailored;
- Drought databases are essential components but they are not enough to define a desertification ICS;
- ICS are based on systematic organisation of information and expertise; in this context, a central role is played by monitoring networks and local observatories (e.g. ROSELT, LTER, NESDA) to provide long term operability, realisation and

sustainability to understand the interaction between Nature and Society in the desertification process;
- Distance learning and training, in terms of exchange of experiences, is a relevant aspect linked to ICS;
- ICS must avoid the bad effect of globalisation but keep the richness of specificities;
- ICS must not be perceived as a product or service but as an output (e.g. empowerment).

Open issues

To make ICS on desertification operational and useful, the existing problems and challenges at different levels have to be addressed.

Institutional/political level

- Most of existing ICS, CHM, WEB SITES are based on initiatives connected to trans-national projects instead of strategic funds of each country;
- Although good networking between Countries and researchers exist, ICS have low relevance at the national level policies;
- The role of the National Action Programmes in ICS creation at the different levels should be defined. The possibility of the NAPs in each TPN to be considered as an ICS should be evaluated;
- The projects finish and the ICS, CHM, web sites become obsolete in few months. Measures should be taken to keep valuable ICS functioning;
- Countries should be urged to make non-sensitive information available (or at least referenced through metadatabases);
- Institutions involved into environmental changes are not enough interrelated at the national level;
- International, regional and national actions/projects should be accompanied by an entity composed of political, technical and scientific representatives at the national level;
- Gaps between sectors are big barriers in many Countries.

Thematic/Technical level

- There exist low inter-operability of data: harmonisation, standardisation, compatibility, and integration are needed;
- Sources of data and their update are not directly linked to existing ICS, monitoring networks and local observatories;
- Long term scientific monitoring and experimental sites are needed;
- Low prognostic value for structural analysis;
- Few conjunctural analysis in the Annexes ICS (this is particularly true for Annex IV);
- Each ICS covers a portion of the information chain, which means that a single ICS is not comprehensive;
- ICS contain insufficient information for the general public at large;
- Information is inadequate for policy makers;
- There is low integration between socio-economic data and biophysical data;
- There is low interaction between data and functioning (ecosystem/landscape/society) and data on structure (statistics).

Technological level

- Technology is not a limiting factor, but its application requires a better focusing for operational purposes (see the use of current technology to address the ICS issues, which may be sufficient but should be modified for a better application of operations);
- Take advantages of the potential of new technologies.

Structural level

- Internet usage in the different regions of the world varies greatly (in Africa, only 2.5% of the people have access to internet) and this has a severe impact on the circulation of information;
- Also other communication means and their implementation should be investigated in order to reach all groups of society (see e.g., high levels of illiteracy);
- Proper relays have to be set up through existing organisations;
- Internet is *per se* necessary, but it has to be connected with other services: media, technical services, education, etc.

Functional level

- The transfer of knowledge from the scientific to the end-users level requires the development of intermediate actions and players with short and transparent communication pathways;
- "Packaging" plays a crucial role;
- NGOs play a key role;
- Politicians have to be educated on the scientific process of results.

Cultural level

- Traditional (indigenous) knowledge must be integrated into the scientific knowledge;
- Socio-economic specificities of the different Annexes should be taken into consideration;
- Traditionally marginal groups (e.g. women) should be better integrated into the measures for sustainable development.

Methodological level

- The integration between climate/meteorology, biodiversity, governance and desertification people should be enhanced;
- Interdisciplinary versus multidisciplinary: the first one implies integration of disciplines and should be preferred. Also, the first one needs the second one, as well as specific methodologies;
- A common vision of definitions is required to reach harmonisation;
- Relevant efforts in homogenization, standardization and conceptualisation is needed.

Financial level

- Not only money is needed: "in kind" support is essential. Initiatives could start from small or no cost activities, although this is not enough);
- Incentives for self-help mechanisms should be strengthened.

ICS characterisation

ICS should be:

- open;
- transparent;
- dynamic, enabling immediate actions and reactions;
- flexible;
- designed with short communication pathways;
- independent;
- sustainable;
- voluntary;
- interactive in some of its components;
- include socio-economic factors and traditional knowledge;
- establish a common and holistic message that keeps the richness of the different visions providing different options;
- able to network institutions across levels by thinking locally, building regionally, achieving globally;
- provide a relevant synthesis of data and information for the various catalogues of users (ICS is a tool to provide a synthesis, but it does not provide synthesis itself. Intermediate actions are needed);
- provide alarm/risk management and facilitate prognostic analysis.

ICS structure

To be effective, a framework of a typical communication system should be based on some main components (Fig. 3):

1. collection of data (*possible bottlenecks*: relevance, availability, time efficiency, homogeneity, sustainability);
2. elaboration of data (*possible bottlenecks*. appropriateness to user needs, easily understandable, sustainability);
3. production of information (*possible bottlenecks*: Timeliness, feedback possibilities
4. exchange and dissemination of information.

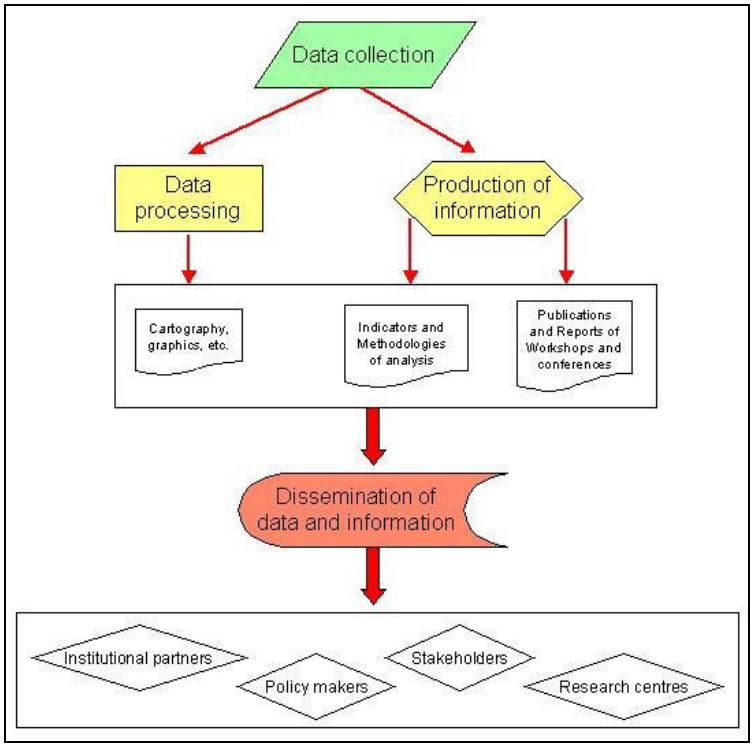

Figure 3: Framework of an Information Circulation System (taken from L. Genesio's contribution in session IV).

ICS must be user-tailored; in this context, three main target groups can be identified (see also the Working Groups conclusions):

- *Scientists*, involving universities, research centres and scientific networks, for the refinement of knowledge;
  - *Intermediate actors, or operational level,* also involving the private sector, NGOs at all levels and international organisations (E.G. FAO, IFAD and many more), having a more technical approach also focusing on projects execution;
- *Decision makers, policy makers and services* (platform of services for accessing, interpreting and supporting applications of research results), for public and administrative bodies
- *People/individuals*, involving individuals (e.g. local leaders), communities, media and communication experts, and having a dissemination, educational and training target (in Europe, among the others: municipalities, enterprises, professional associations, cooperatives, chambers of commerce, etc.). This group therefore requires translation into different and simple languages and different temporal and spatial scales for action.

Recommendation

- To sustain/support and keep operational the existing monitoring networks and observatories within the sub-regional ICS networks, with concrete and continuous actions;
- To enhance internet access in developing countries;
- To exploit all relevant communication tools;
- To link ICS and desertification EWS;
- Scientists must be involved in the ICS process. They should emphasise the outcomes of applied research and show success stories and best practices;

- To implement the didactic use of ICS (e.g., distance learning);
- To plan intermediate actions to facilitate science to the end-users (grass root level)
- To link desertification ICS information to related problems: poverty, migrations, security issues, water scarcity, etc.;
- To favour ICS outputs to reach desertification actors;
- To improve interaction with Policy Makers and administrative officers having any influence on the decision making process;
- The Regional Coordination Units of the UNCCD should promote the follow up activities of TPNs in the framework of ICS in all UNCCD Annexes;
- To activate within FAO the "Global Operational" network of Drought and Desertification ICSs
- To promote Desertification info through ICS, to be linked to global environmental initiatives.
- To request the UNCCD Secretariat and the CST Bureau to support in every Annex region, a regional network of networks and to support the creation of a Global Scientific Network of Regional ICS and desertification to favour scientific networking for sustainable development and implementing article 25:

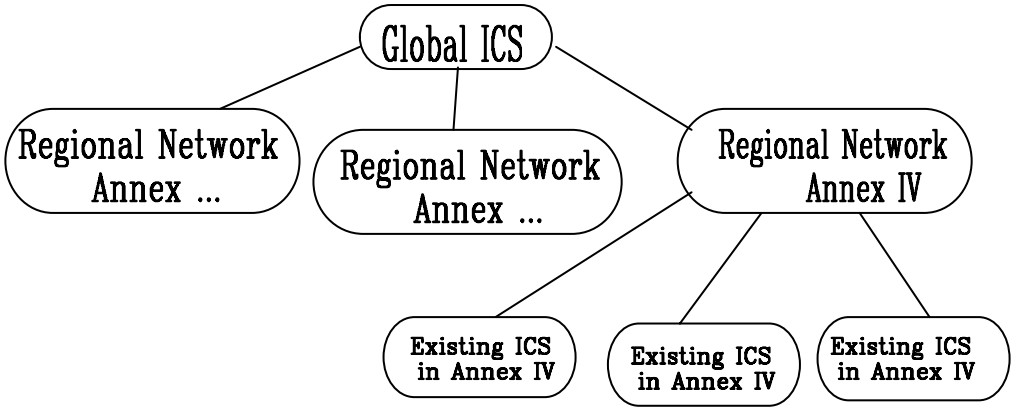

Figure 4: Possible Global ICS composition and functioning, with specific example for Annex IV

Possible actions

- To support the Global Drought Preparedness Network;
- To make a census of existing ICS with their characteristics (level, quality, type of data, etc.) as soon as possible;
- To create a network of desertification ICS in which European scientists are involved, and within the European Desertnet (see declaration of the seminar participants);
- To support the creation of one sub-regional ICS network per sub region to support the link between the existing sub-regional ICS networks;
- To promote the desertification ICS in all UNCCD annexes;
- To enhance the ICS on traditional knowledge available on Google and similar, and collected by scientists, observatories, etc;
- To develop a training project targeted to trainers for the realisation/utilisation of ICS at all levels;
- To enhance the GOEs THEMANET proposal;
- To enhance participation to UNCCD CRIC 5;

- Review existing "Networks of Networks" and draw lessons from success and failures;
- To urge the needed institutional effort for sustainability in providing financial, technological and human resources.

Active exchange of experience on indicators and development of perspectives in the context of UNCCD

Nucleo di Ricerca sulla Desertificatione Università degli Studi di Sassari

The Desert Research Foundation of Namibia

European Union Research Directorate General

International Seminar on

Role of Information Circulation Systems in scientific and practical approaches to combat desertification

Windhoek and Ondangwa (Namibia), 2-7 April 2006

2ND APRIL

18.00	In Mokuti Lodge, chairmen and rapporteurs meeting to discuss about how to carry out facilitated discussions and reach the seminar objectives.
19.00	Dinner

3RD APRIL

Opening session: Information Circulation Systems – a theoretical background

Co-Chairman:M. Seely and G. Enne *Rapporteur: C. Zanolla*

18.00	Opening and welcome, *by G. Enne, Nucleo Ricerca Desertificazione, Università di Sassari, Italy*.
18.15	Key note address, *by M. Seely, Desert Research Foundation of Namibia*
18.55	Introduction to the discussion format, *by P. Klintenberg, Desert Research Foundation of Namibia*
19.05	Discussion
20.00	Dinner

4TH APRIL

Session 1: Experiences and lessons learnt implementing ICS: scientific views

Chairman: M. Seely *Rapporteur: C. Zucca*

09.00	Reflection on topic by expert , *by T. Tadesse, National Drought Mitigation Center, University of Nebraska, USA*
09.30	National and regional scientific networking for supporting the implementation process of the UNCCD – the examples of Desert*Net Germany and the European Desertnet, *by M. Akhtar Schuster, University of Hamburg, Germany*
09.50	*Coffee Break*
10.10	Discussion
12.30	*Lunch*

Session 2: Experiences and lessons learnt implementing ICS: ICS and long term environmental monitoring

Chairman: G. Begni *Rapporteur: N. Ben Khattra*

14.30	Reflection on topic by expert *by J. Henschel, Gobabeb Training and Research Center, Namibia*
15.00	ELTOSA experience, *by J. Pauw, chair of Eltosa and J.Henschel, Gobabeb Training and Research Center, Namibia*
15.20	An ICS for desertification monitoring in Africa Circum-Saharian zone : focus on one of its components : the SIEL-ROSELT, *by M. Loireau, Centre IRD – Montpellier, France*
15.40	*Coffee break*
16.00	Discussion
18.00	End of session 2

5TH APRIL

Session 3: Experiences and lessons learnt implementing ICS in UNCCD Annexes I and II

Chairman: J. Henschel *Rapporteur: V. Louro*

09.00	Overview and reflections on ICS in Annex 1**,** *by B. Masumbuko, Network for Environment and Sustainable Development in Africa, Côte d'Ivoire*
09.30	Overview of and reflection on ICS in Annex 2, *by Y. Youlin and A. De Vanssay, UNCCD Secretariat*
10.00	Desertification Information Systems – Information Systems and Environmental Monitoring on Internet: commentary and outlooks, *by N. Ben Khattra, Observatoire du Sahara et du Sahel*
10.20	Information Circulation System for combating desertification and societal development in India using satellite based programmes: a holistic approach, *by Dr A. Arya, Space Applications Centre, India*
10.40	Efforts for combating land degradation and information sharing at national and provincial levels in Western China dryland ecosystems, *by S. Siheng, National Desertification Monitoring Center, China*
11.00	*Coffee Break*
11.20	Discussion
13.00	*Lunch*

Session 4: Experiences and lessons learnt implementing ICS in UNCCD Annexes III and IV

Chairman: S. Siheng *Rapporteur: M. Akhtar-Schuster*

14.00	Overview of and reflection on ICS in Annex 3, *by L. Torres, IADIZA, Argentina and A. Saez*
14.30	Overview of and reflection on ICS in Annex 4, *by L. Genesio, Institute of Biometeorology, National Research Council, Italy*
15.00	The information on Desertification in the Euro-Mediterranean context: weakness, difficulties and the way forward, *by L. Rubio, Desertification Research Centre -CIDE, Spain*
15.20	Information Circulation Systems to combat desertification in Portugal, *by V. Louro, CCD Focal Point for Portugal*

15.40	*Coffee Break*
16.00	Discussion
18.00	End of Session 3

6TH APRIL

Session 5: Experiences and lessons learnt implementing ICS: views from Multi-lateral initiatives

Chairman: A. Saez *Rapporteur: J. Rubio*

08.30	Reflection on topic by expert, *by F. Perez-Trejo WEICENT, Food and Agriculture Organisation*
09.00	Science for good governance: scientific information and communication systems in the context of the United Nations Convention to Combat Desertification, *by A. de Vanssay, UNCCD Secretariat*
09.20	*Coffee Break*

Session 6: Parallel working groups discussions on ICS implementation: needs and requirements

09.40	Working Group 1: ICS on Socio-economic data Working Group 2: ICS and physical data Working Group 3: ICS and high tech applications
11.00	*Coffee Break*
11.20	Working Groups contuinue
13.00	*Lunch*

Session 7: General discussion and conclusions

Chairman: A. Arya *Rapporteur: P. Klintenberg*

14.00	Presentation of Working Group results and facilitated discussion
17.00	Conclusions, *by M. Seely, Desert Research Foundation of Namibia*
17.30	End of seminar, *by G. Enne, Nucleo Ricerca Desertificazione, Università di Sassari, Italy*

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This volume contains the proceedings of the International Seminar on *Role of Information Circulation System in scientific and practical approaches to combat desertification* held in Windhoek and Ondangwa, Namibia, in April 2006.
Aim of the seminar was to identify the main key issues and needs to propose possible common approaches and solutions related to Information Circulation System in the UNCCD Annexes, while offering a significant opportunity of meeting and exchanging data, information and ideas.

The seminar was organised in the framework of the AIDCCD project (Active Exchange of Experiences on Indicators and Development of Perspective in the Context of UNCCD), aiming at developing and co-ordinating exchange of experience across the world among institutions involved in the implementation of the UNCCD regional Annexes.

AIDCCD is a project funded by the European Commission, Research Directorate-General under the Fifth Framework Programme (Natural Resources Management and Services).

The excellent support of Prof. Mary Seely and Dr. Patrik Klintenberg in the organisation and realisation of the seminar is gratefully acknowledged. The scientific and technical support of Dr. Chiara Zanolla, Dr. Claudio Zucca and Dr. Valeria Petrucci is also gratefully acknowledged.

These documents are also available on the project web site: www.nrd.uniss.it/sections/aid-ccd/