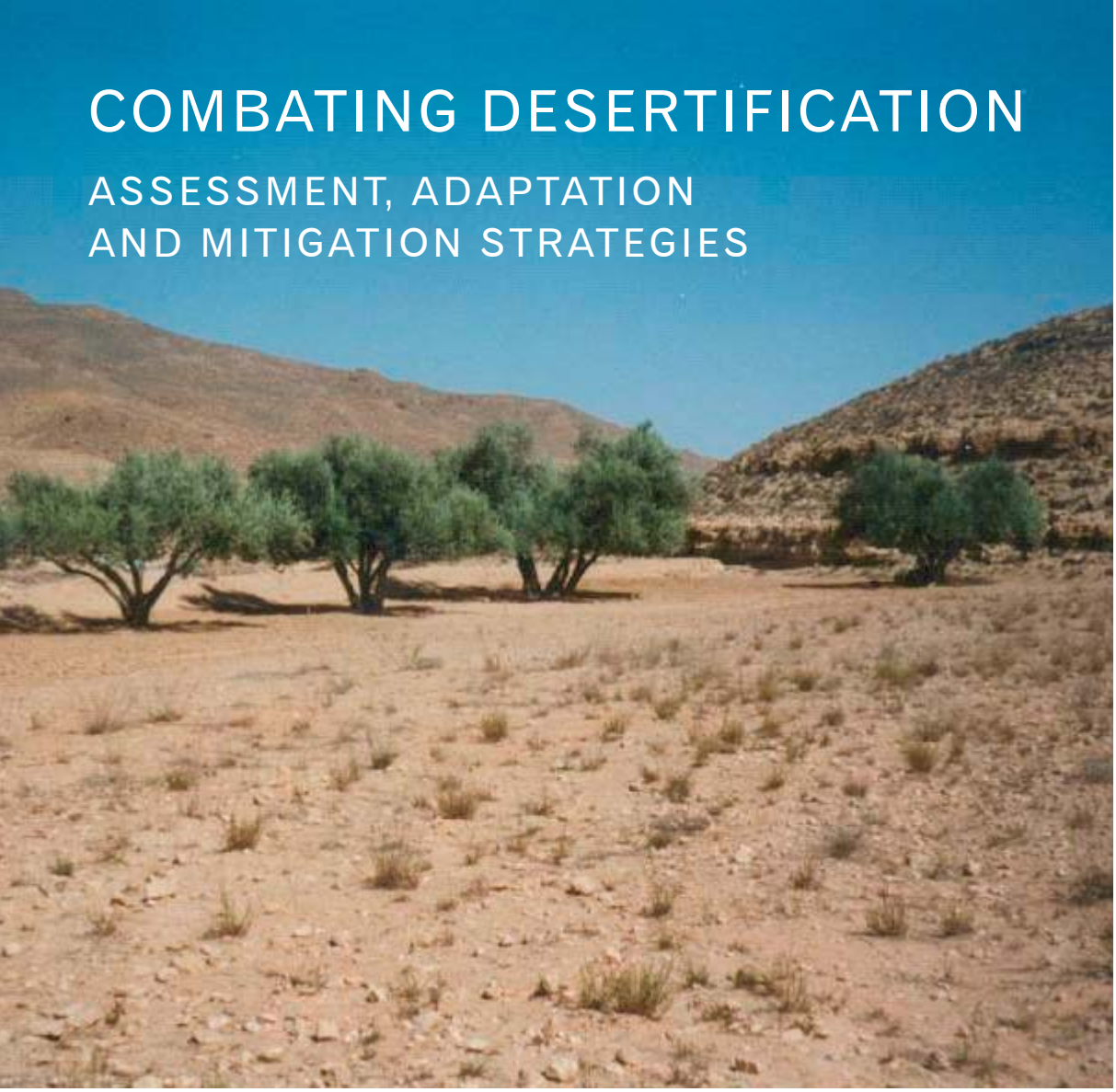
COMBATING DESERTIFICATION

ASSESSMENT, ADAPTATION AND MITIGATION STRATEGIES



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ISBN: 978-90-5989-271-2

Published jointly by UNESCO Chair of Eremology, Ghent University, Belgium, and Belgian Development Cooperation

Printed in Belgium

TRADITIONAL APPROACH AND REMOTE SENSING TECHNIQUES IN THE DEVELOPMENT AND IMPLEMENTATION OF DESERTIFICATION INDICATORS

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INTRODUCTION

Over the past 50 years humans have changed ecosystems, more rapidly than in past ages, to meet demands for resources. It is increasingly clear that environmental degradation and resource depletion play an important role in creating or exacerbating human insecurities (Dabelko et al., 2002). There is growing understanding that environmental degradation, especially when coupled to inequitable access to critical natural resources, increases the probability of conflict and instability and pose a risk to human security.

A main issue in any strategy aimed at the fight against desertification should be based on the technical and institutional capacity to study environmental degradation processes and natural catastrophes through assessing, quantifying and monitoring phenomena and to implement prevention through adequate intervention.

The present paper focuses on monitoring approaches and methods as a tool to support land degradation and desertification strategies and measures. In fact a leading role is played by the environmental emergencies linked to desertification (MA, 2005) that is a complex process involving the interaction of various components: the socio-economic issues, such as food security, poverty, migratory flows and political stability, and different environmental issues, such as climate change, biodiversity and water supply.

DISCUSSION

ISSUES

Countries involved in the fight against desertification have to establish specific information systems based on quantitative approach, such as the Desertification Monitoring System (DMS). DMS must be able to provide a diagnosis based-monitoring of the state of natural resources and of populations in the affected regions and support the decision-making process, as well as operational support to a wide range of activities. In order to achieve this scope, they should be based on tools like indicators. The international community has understood that it is impossible to define a universal set of indicators, but rather that it is necessary to come up with common methodologies. In this context the Nucleo di Ricerca sulla Desertificazione (NRD-UNISS) of the University of Sassari has done/contributed to several initiatives that have had wide impact particularly from a methodological standpoint (Enne et al., 2003). In the frame of the EU-funded research project DESERTLINKS (Linking science with stakeholders) NRD-UNISS developed a database of indicators that constitutes the heart of the Desertification Indicator System for Mediterranean Europe (DIS4ME). A list of some 220 candidate indicators was compiled, gathering information from different sources. The DESERTWATCH project (Tracking Desertification with Satellite Data), funded by the European Space Agency (ESA), developed an operational remote monitoring systems based on the integration of ground data and remote sensed data.

INTEGRATED SET OF INDICATORS

The need of integrated and multidisciplinary set of desertification indicators for desertification monitoring has been stressed by the research community as well as by the main international organizations involved in the fight against desertification. The DESERTLINKS Project began in 2001 and was completed in 2005. It had 11 partner institutions that previously worked together on other desertification-related EU funded projects, in particular the MEDALUS. The aim of DESERTLINKS was to develop a desertification indicator system for Mediterranean Europe. This would be a contribution to the work of the UNCCD and in particular for the Annex IV sub-region countries of Portugal, Spain, Italy and Greece. The indicator

system (called DIS4ME) is published on the web. DESERTLINKS made a 4-steps approach (Fig.1).

Firstly, from a wide range of sources the main desertification issues were identified. Secondly, again from a wide range of sources, a long list of candidate indicators was compiled. Thirdly, sub-sets of indicators of particular relevance were selected from the long list. Finally the indicator descriptions were written, further refining the definitions and removing indicators from the list which did not meet the necessary selection criteria. After a series of refinement, the following 11 themes emerged as the major ones in Mediterranean desertification, as identified by both national and local stakeholders. In the frame of DESERTLINKS, all the indicators are included in a specific web-based database, consultable on-line, and each of them is described through a specific description sheet, including, among others, information on definitions, scales, objective, method of measurement, benchmarks, bibliography, author of the indicator.

On the basis of the acquired experience, studies and interventions related to indicators should be finalised to respond to the criteria and methodologies proposed by the UNCCD. For example, it is necessary to promote a better integration of the frameworks in order to facilitate the exchange of data and experiences and to contribute to the necessary harmonisation of the efforts towards this direction.

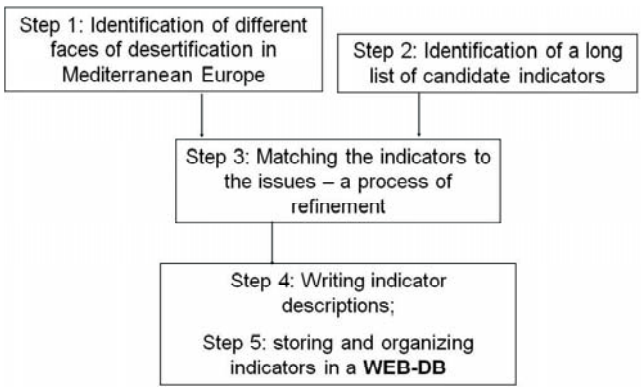

Figure 1. DESERTLINKS methodological approach and structure

From the technical point of view, among the main open issues are: (1) the organisation of structured sets of Benchmarks and Indicators (B&I) able to represent the land degradation systems; (2) the integration of different disciplines and different spatial and temporal scales involved in the phenomena; (3) the evaluation and quantification of effectiveness and benefits of mitigation interventions, including the socio economic ones.

From the institutional point of view, the main difficulties at the national and local levels are linked to inter-sectoral coordination, whereas at the supranational level methodological harmonisation is urgently needed.

OPERATIONAL REMOTE MONITORING SYSTEMS

Remote sensing plays an important role in the most recent research experiences on desertification monitoring. In fact, remote sensing produces images that can be used to create thematic maps for the analysis and estimation of desertification status or to abstract indicators of land changes from different images in order to realize a dynamic monitoring. One of the main issues in monitoring and managing desertification processes through indicators is due to the subjectivity of the methodologies that can be carried out and applied. The development and the implementation of operational monitoring systems constitute an essential step to limit such subjectivity and to make desertification monitoring reliable and repeatable. Thus, the use of this kind of system can provide the potential users with a tool based on standard framework and methodology that shall serve as common infrastructure.

The DESERTWATCH Project is focused on land degradation and desertification monitoring under the framework of UNCCD on the north Mediterranean region. It is not a research project, but a development activity to create a user-tailored operational system to assess and monitor desertification and its trend over time on the base of Earth Observation (EO) technology. The project intends to valorise the outcomes of ten years of European research, by integrating the more consolidated procedures and algorithms into an operational highly automatized system. DESERTWATCH aims at supporting national and regional authorities of Annex IV countries by giving an operational responses to the needs and requirements of

the user community. It is based on the integration of data of different nature (ground data and remote sensing data). The logic of the system is shown in Fig 2.

On the left there is data input, including DEM (Digital Elevation Model), Socio-economic data, Meteorological data, Soil quality and Management Quality from the users, and the most important one is the Remote Sensing data (Landsat and Meris images). After pre-processing, all these data are input into a sequence of elaboration procedures, including different Modules such as SMA, LDI, Auto Classification and Scenario Modelling (Blue color boxes). The products are listed on the right. The project shall be implemented in Portugal, Italy, Greece and Turkey and foresees a close involvement of the institutional Users (National Committees to Combat Desertification). The outputs will be transferred to the specific users through a process based on direct demonstration and operation from the consortium. The goal is to bridge the gap between the scientific

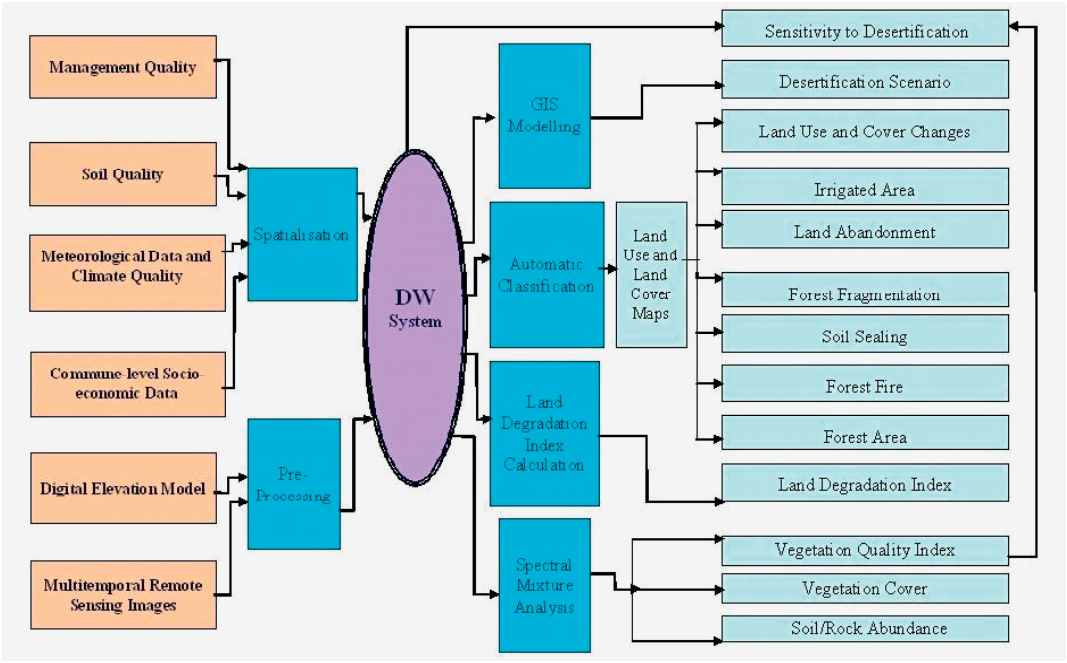

Figure 2.The logic and the structure of the DesertWatch System

usage of Earth Observation (EO) data and the set-up and operation of reliable services tailored to specific users needs and validated by the user. In fact, the users shall be provided with a system, which can be routinely used by non-experts, for generating the required indicators about desertification. The system will enable an objective comparison of data generated over different areas.

CONCLUSIONS

Land degradation and desertification monitoring and assessment should be based on systems, such as DMS, able to monitor/predict phenomena and to quantify impacts of desertification and benefits of mitigation. These systems can be effective if they use quantitative approaches based on desertification indicators. In this context desertification indicators constitute an essential tool for they can provide the required and necessary reliability and objectivity to make DMS operational. Thus, the development of projects focused on methodological issues related to indicators is an important step to design reliable and improved systems in order to safeguard environmental (and social and economical) security. As a further consideration, we can observe that, although there is a large number of experiences and technological capabilities about monitoring, they often remain largely under-utilised and inadequately shared. Hence, dissemination is poor and restricted and information cannot be directly used by decision-makers, at both the national and international levels.

The contributions developed by DESERTWATCH, through the implementation of an operational and user-tailored information system, gave input to the improvement of fight against desertification in terms of limiting subjectivity related to the collection and the elaboration of data. Concerning DESERTLINKS, the developed approach was based on the work with local stakeholders to find out how they perceive and are affected by desertification provides valuable insight for the research and institutional communities and engages the stakeholders in efforts to combat it. Finally, the process of reviewing the practicality of indicators leads to confidence and trust in the wider of these indicators, within and outside Mediterranean Europe. In fact DIS4ME proved to be a transversal and ductile tool able to host indicators coming from different experiences linked to desertification and other environmental issues (e.g. integrated coastal management).

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