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CHAPTER V

LAND DEGRADATION AND SOIL CONSERVATION

DESERTIFICATION: CAUSES AND STRATEGIES TO COMPETE

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Introduction

Desertification presently is getting recognised as an important environmental problem of global concern. It affects the sustainable development in many regions, including the Mediterranean, since its effects have world-wide economic and political consequences. Moreover, desertification directly impacts on the public health and the well being of an ever-increasing world population.

As Kofi Annan stated on the occasion of the World Day to combat desertification (17.06.2001), over 1,200,000,000 people in 117 countries around the world, in both temperate and tropical regions, are directly threatened. In the next coming years, 135,000,000 of such people could be compelled to abandon the land.

UNEP (1994) defined desertification as: "*land degradation in arid, semi-arid and dry sub-humid zones arising from various factors, including climatic variation and human impact*".

The process is inter linked with various factors and multiple degradation processes at different time and space scales over different environmental systems that are involved. Land degradation advanced to the state of desertification dates back before present times. It follows particular climatic and human pressure conditions as testified by land protection techniques practised since 2,500 years B.P (Yassoglou, 2000), with different ecosystems recovery degrees.

But in the last decades the land degradation effects have imposed a revision of the responsible events, causes, mechanisms and of the definition of the critical thresholds.

Although some natural processes lead to desertification, it is mainly a human induced problem. Excessive use and over exploitation of natural resources, land, water, vegetation under any eco-system in arid, semi-arid and dry sub-humid domain can initiate or make worse the desertification process. Therefore, the rate more than the present state is relevant and the dynamic nature of desertification has to be underlighted (Stroosnijder, 2000). The problem thus, is a continuous due to increase biotic pressure, but can be subject to control to a great extent by improved management practices.

Desertification with its surrounding problems since long fostered the priority occupation by politicians, decision-makers and an immense involvement of the international organisations, donors, private sector and NGO's. The commitment dates back to the early seventies, with the UNEP promoting two fundamental Conferences, the first one held in

Nairobi in 1977 (*Conference On Desertification,*) and the second one in Rio de Janeiro in 1992 (*Earth Summit on Environment and Development*).

In 1978, the UN started the implementation of an ambitious plan of actions to combat desertification (PACD). Agenda 21 includes (chapter 12) the issue of the management of fragile ecosystems and suggests measures to combat desertification and drought.

The UN Convention to Combat Desertification (in force since December 1996), signed by 175 countries is nowadays the most important international institutional document regarding the actions to fight desertification. According to UNEP (1994) definition, desertification is considered linked to a plurality of "processes" of different nature and origin, natural or anthropic and/or aggravated by human actions, with many and complex causes and dimensions both physical and social-economic. The Annex 4 for the Northern Mediterranean[1] (the others are for Africa, Asia, Latin America and the Caribbean) points out the actions to be undertaken in terms of national, sub-regional, regional intervention as well as the co-operation objectives with the developing countries.

In the long run, directions about the actions to be undertaken were developed from those related to the improvement of knowledge, monitoring, and soil conservation interventions. The more recent actions in terms of new technologies, strategies for both information transfer and integration of degradation measurements were based on the creation of Desertification Focal Points (Lòpez-Bermudez, Barberà, Belmonte-Serrato, 2000), as well as in terms of general principles (participatory approach, local cultural heritage, etc.).

Unfortunately, in spite of the enormous financing budget allocated for implementation, the analysis of the situation after more than 20 years of activities demonstrated that what had been achieved is still far from what was planned and desired and that desertification is in continuous spreading.

In this regard, the following questions are raised up: *what are the main causes leading to such failure in the implementation of the Plan of Action to Combat Desertification (PACD) in full? Why desertification is still continuing and the situation is more aggravated than it was before?*

Analysis of the existing situation

A preliminary analysis of the actions so far undertaken to combat desertification, at the international, Mediterranean, EU, national and local level (E.C., 1999; FAO, 1993; UNEP, 1992a,b,c; WMO/UNEP, 1996), allow considerations pertaining:

[1] In particular in the Annex 4 for the areas of Europe (northern Mediterranean) at risk, the main driving factors were identified in: natural climatic, geological factors (semi-arid conditions, areas with less than 600 mm of rainfall per year, chronic condition of water stress, seasonal drought, very high rainfall variability and high intensity rainfall, prolonged dry periods followed by heavy rainfall, highly erodible soils, uneven relief with steep slopes, great spreading of unconsolidated substrata coming from erosion of uplands, marl and clay bedrocks, wildfires); agricultural practices (intensive mechanical ploughing and increasing exposure of soil without vegetation, intensification of soil use); socio-economic aspects (land abandonment by rural population, deterioration of conservation structures); exploitation of non-agriculture lands (forest losses due to wildfires, overgrazing,); political issues (national and Agrarian Community Policy of subsides, especially in not irrigated areas, leading to marginalisation); etc.

- on one hand, the specific aspects, regarding the understanding and quantification (criteria and tools) of the causing processes in "different" territorial contexts, and,
- on the other hand, the strategy subsequently adopted to control them, regarding aspects of co-ordination and integration of the interventions within the on-going or programmed natural, water and soil, resources management, as well as general environmental policy aspects (relationships between competent stakeholders from the central to local level and to users).

Over the last decades, a strong debate has been carried out about the full meaning of desertification, its localisation and reversibility, as well as the origin and the natural or human induced triggering causes.

In particular, the for the "meaning of desertification", the question goes behind the semantic value, for its effects in terms of perceptions and prevailing opinions that have conditioned the mitigation strategies. Resuming the definitions and the concerned aspects, it is stressed the significance of change or gradual conversion into less favourable or unfavourable situation examined under the point of view of the biological productivity of arid, semi-arid and dry sub-humid ecosystems.

Consequently attention has been given to vegetation and its changes, in terms of type, density, crop extension, intrinsic or economic value, soil and water quality, meteorological parameters, etc., with research activities focused on the following aspects: climate and hydrological conditions, morphodinamics, edaphic - pedological and soil characteristics, vegetation, and anthrophic influence.

On such a topics, defining where and how and why the desertification occurs, process-monitoring approaches have been formalised and applied over different space scales (plot, catchment, regional areas, etc.).

Actions undertaken have basically consisting in identifying vulnerable areas and areas subject to the desertification risk with the set up of indicators, indexes and assessment methodologies. As for the criteria for selection, classification, assessment and application of indicator systems, wide literature and the articulated activity developed at the international level and by different organisations explicitly indicates the multiplicity of analysed aspects and, in general, the specification of the selection processes.

They have been extensively used in the EU founded research projects carried out during these last years. For example in the MEDALUS (Mediterranean Desertification and Land Use) 9-years long Project, the *Environmental Sensitive Areas to Desertification* (ESAs) model was tested (Kosmas *et al.,* 1999), and afterwards applied in several Mediterranean pilot areas.

The ESAs methodology assumes the assessment of the desertification vulnerability of an area through the use of climatic, morpho-dynamic, edaphic, pedological, vegetation and anthropic factors. It takes into account four systems of indicators within which a minimum data set selection has to be assessed: *soil quality indicators* (texture, rock fragments, drainage, parent material, soil depth, slope); *climate quality indicators* (rainfall, aridity aspects); *vegetation quality indicators* (plant cover, fire risk, erosion protection, resistance

to aridity); and *management quality indicators* (intensity of land use in rural zones, pastures, forests, mining and recreational areas, and managerial policies).

Applying specific techniques, four indices are obtained: *SQI Soil Quality Index, CQI Climate Quality Index, VQI Vegetation Quality Index, and MQI Management Quality Index*, and then they are integrated in a synthetic Environmental Sensitive Areas Index.

The ESAI classifies the areas in three main classes of land degradation as "critic", "fragile" and "potentially affected", and further on subdivides them in three subclasses from low to medium and high sensibility to desertification.

The approach is highly flexible, allowing exclusion or inclusion of indicators, crossed analyses and elaboration for both matching the model to the specific environmental conditions or particular aspects.

Oversimplifications and neglects

Complex models of analysis, trying to quantify and forecasts the effects of desertification have been available for some time. Nevertheless, detailed survey systems in pilot areas and the intervention programmes - that have been set up and/or are being continuously implemented, at different levels of significance and applicability - marked “neglects” or “oversimplifications” have prejudiced the fight against desertification.

The plurality of the “processes” either natural or anthropic and/or aggravated by human actions causing desertification, in terms of quantity and quality, explicit through different characteristics and distribution patterns, acting individually or synergically, in reciprocal cause-effect relationships, even with cumulated impacts at different space and time scales. They depend also, over the land, on the “environmental” scale: geographic, geo-morphological, climatic localisation and anthropic development scale. This is particularly significant in the Mediterranean areas, because of its “peculiarity” (environmental, structural and physical diversity), made even more serious by the huge development in the last decades that has often even accelerated and amplified phenomena that are the natural evolution of the land in search of new equilibrium.

Consequently any simplifying interpretation distorts the reality of events (Lòpez-Bermudez, Barberà, Belmonte-Serrato, 2000) and immediately affects the governance of the process itself, in terms of incomplete definitions of the quality-quantity imbalances of the concerned resources and the subsequent simulation of risk scenarios.

Excessive homogenisation and/or mis-estimates are therefore to be linked to the following:

- the data drawn from the regional experiences performed for identifying vulnerable areas, were often derived through indicators and methodologies that took into account partial and particular aspects. In such a context, prevailing or exclusive weights have been attributed only to some components, with the result that assessments were only partially indicative of the real situation. Moreover, this partial information often working at different space and time scale, is generally sparse, disorganised and difficult to be updated, with the obvious consequences in terms of monitoring system changes and dynamics, included those ones produced by mitigation strategies;

- simplifications were made for those territorial contexts where desertification develops, whereas there are complex environmental systems where different and active responsible processes can be interconnected. Consequently, homologation criteria for the geographic, environmental, geo-morphological, climatic and anthropic differences on the land were adopted, whereas these differences, indeed, play a determinant role. In spite of the existing network of experimental fields in Mediterranean areas, their extension is reduced and cannot be representative of the ecosystems;
- the assessments performed, generally referred to the application of models for which inputs derived from measurable/measured data not necessarily available and/or shared were used, often caused heterogeneity with respect to the output;
- the use of excessively simplified quantification models (some of them widely used for global area assessments) has hampered the release of a significant output.

A significant example for its impact on the undertaken actions, regards *soil erosion*, considered among the prevalent processes triggering desertification. In Mediterranean region, theoretical and experimental assessments were performed for identifying areas at actual or potential risk of soil erosion, through both qualitative and quantitative approaches.

Field measurements and modelling have been generally related on water erosion processes at the scales of plot and large catchments (sediment yield in reservoirs). Soil losses and the evolution of the erosion process measured at the plot scale are very different than that of a catchment (Poesen *et al.,* 1994) and cannot be representative of the global process on the catchment, because of the impact of other instability processes such as flooding, mass movements, gullies, linear erosion, and particular dynamical behaviour, such as that of ephemeral channels, heavily influencing the sediment yield. This shows the scale dependent nature of the runoff generation, position and connectivity and the soil erosion, occurring over a range of time and space scales with different effects on site and off-site (Poesen *et al.,* 1996; Trisorio Liuzzi, 1997).

Consequently predictions based on models only accounting for interrill and rill erosion (starting from the Universal Soil Loss Equation), used for the set up of mitigation strategies in larger areas, gave rise to a general abuse of pertinent rules in the set up of the mitigation strategies. Thornes (2000), reviewing (Burke and Thornes, 1998) the mitigation actions taken in Mediterranean region affirms that: *"the over-emphasis on soil erosion as the main diagnostic feature coupled, as it is, to loss of agricultural production, has led to a mitigation agenda that concentrates on re-affirming the choice of (re-)afforestation as the panacea to desertification".* On this subject has to be highlighted that the chapter 12 of Agenda XXI stresses the soil conservation measures through afforestation.

Moreover Thornes (2000) points out the question of the overestimation and misestimating of erosion rates during the last 2 millennia and the subsequent remark concerning the thresholds governing the need of soil conservation measures. The question regards the reasonable quantification, in climates different from the temperate humid ones, of a soil loss tolerance level (T-factor), defined on on-site and off-site effects considerations, that is to be compared to the erosion rates (ton/ha/year).

The connection between desertification and ecosystems productivity has given rise to a short cut between climate and plant production (Falkenman, 2001), which in turn has the omission of the water question as a key of the problem (*water blindness*). The advancing water scarcity, environmental not-negotiable precondition - in terms of hydroclimate and soil - is the new dimension in the set up of a strategy for combating desertification, strictly linked to the issue of food and environment security. The perspective in the Mediterranean area is doomed by the fundamental questions of the increasing population growth, water demand and the spreading pollution.

The solution is then shifted towards the improvement and implementation of an *integrated land/water/ecosystem management*, not focused on a specific environmental problem (sectorial view) and properly including both the land use, because "*a land use decision is also a water decision*" (Falkenman, 2001) and the ecosystems for their water dependence and the services provided.

The planning approach as a tool

The PACD implementation has been generally carried out through programmes focused on measures mitigating specific processes.

Short-term remedial programmes for dealing with problems such as, for example, soil erosion and salinisation are designed to alleviate their immediate appearance. Being both starters to desertification, undoubtedly any successful strategy to combat desertification should consider their control.

In regard to the control measures, accordingly with the possible purposes (forecasting and preventing the activation of new processes and/or further aggravation of those on-going; rehabilitation of endangered situations; conservation of acceptable or previously remediated situations/ maintenance), the range of modalities and characteristics is wide and opportunities of choice vary depending on the causative factors involved and the environmental realities (*structural*: mechanical and/or biological, agronomic actions, etc.; *non structural*: prescription type, restrictions, bans, behaviours, etc.; *sectorial*: thematic plans; priority studies, detailed studies, etc.; *localised* / *punctual*: specific programmes of intervention, monitoring actions, etc.).

From the technical point of view, knowledge is well systematised and exhaustive and the modes of intervention for the control of each single causative factor have greatly developed. Design solutions, technological innovations, ranges of techniques tested for different environments, consolidated practices, are exhaustively reported in the vast scientific and technical literature produced on this subject in the last decades.

Any measure designed to mitigate and prevent dry land degradation i.e. desertification must be short and long-term. The first requisite for any successful amelioration project is an accurate diagnosis of the problem, followed by careful identification of the physical and human causes of degradation.

In our opinion we cannot separate between soil erosion, salinisation, desertification and integrated land/water/ecosystem management. Therefore, not focusing on a specific

process and enlarging the scenario (Figure 1), as announced in terms both of an *integrated land/water/ecosystem management* and of time, space scales and interconnections with the global environmental components involved, a plan of control actions has:

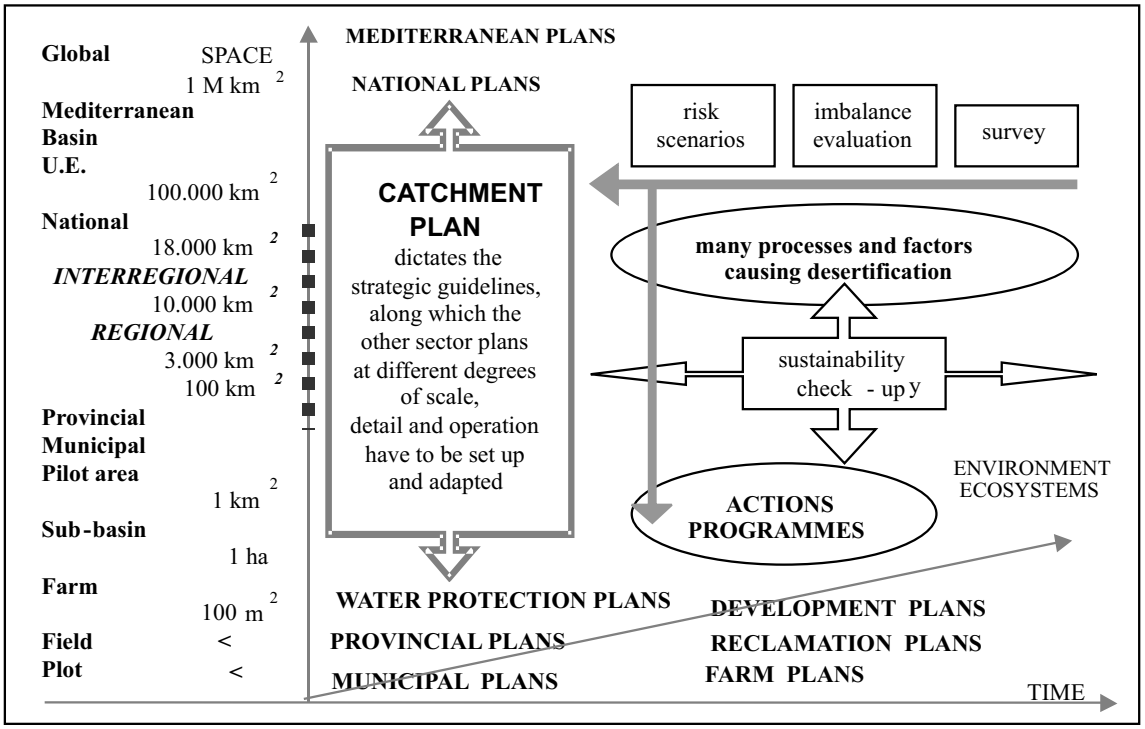

Figure 1. Planning outlines of a land/water/ecosystem management

- to be proposed, if possible, in several alternatives, considering that it is appropriate to make a possible "choice", depending on priorities decided upon not necessarily in the technical-scientific domain only, but also in the political, economic and social one, and that often have to reconcile different needs (hydraulic, economic, social, etc.) often conflicting with each other;
- to be assessed (in all the alternatives) as a function of the environmental impacts it mitigates and in its turn may produce new levels of risk it allows to reach;
- to be integrated with the on-going or programmed measures related to resource management and, in general, to be co-ordinated with the local environmental policies.

This means to go beyond the cognitive aspects of the system, in addition to the logic of the punctual intervention, to the sectorial approaches privileging single points of view, to the integration of "complex" actions (different specialisation, experiences, data, processing, etc.), but rather aiming at the global defence of the system, i.e. comprehensive land/water/ecosystem management.

Referring to the integrated resource management in general, and desertification in particular, the following aspects can nullify the actions for sustainable development:

- homologation of the characters of local realities, not only in terms of different orientations of environmental policy (local and sub-local), but also in terms of environmental diversity of ecosystems;
- the lack of co-ordination of environmental policies can lead to implement and use financial investments with diversified and conflicting or non-optimised environmental objectives (the environmental theme, and desertification as one of its domains, involves in fact different sectors of financial investment).

This goes well beyond the consideration that the range of partners and stakeholders has enlarged from the traditional ones to all the collective actors of local environmental development (through the tools of concentration and co-operation made available by regulations) and even to the national, regional and local governments.

Since international, Mediterranean, EU, member state policies are oriented to sectorial and territorial strategies of sustainable development, "sustainability" controls have continuously to be made (considering also the environmental assessment, ex ante, intermediate and ex post, of plans and programmes) within an integration system:

- both between involved stakeholders at different levels, from the central one to the local territorial one; and
- between different "sectors of action and investment" of financial resources.

The operational scenario is the complex integrated process of preparation, processing, monitoring of plans and programmes, developed through central Environmental Authorities and local and sectorial Authorities.

This process is thus developed at different territorial scales ranging from the global, (scale 1:5,000,000) to the EU scale (scale 1:1,000,000), to the national scale (scale 1:250,000) to the local levels (scale 1:50,000 - 1:25,000 up to the scale 1:5,000 or less). The solution is then to be found in the integration of plans and programmes at different levels of the territorial "vertical" and "horizontal" scales.

The crucial question is the identification and the implementation of a proper "master" planning level, considered from the point of view of the risk of desertification and the preservation and defence of natural resources, that may effectively be the domain within which both the system of actions to combat desertification has to be developed in operational terms and the governance ability (policy and institutions) can solve possible conflicts and constraints.

This is to be identified in a "catchment" level, depending on the river network and related environmental characteristics and conditions of the specific space domain (Trisorio-Liuzzi and Hamdy, 2001).

With these general lines it is mandatory the adoption of a planning assessment approach based on 3 phases continuously integrated with each other: *survey* (acquiring available information and completing knowledge on the different quality and quantity aspects of the concerned resources); *identification (*definition of the quality-quantity imbalances and the subsequent simulation of risk scenarios); *proposals* (definition of the actions to be adopted for re-equilibrating the system, assessment of new sets up and implementation of resource management systems).

The formulation of the three steps is to be made by taking into account the specific theme analysed and the purposes of the application: as for the spatial scale, with point or localised analysis, or extended to concerned tracts and areas, to pilot areas, to whole basins, etc.; as for the time scale, recording and forecasting the time of occurrence and the evolution of the phenomena observed; as for the environmental scale, classifying and zoning the concerned land by homogeneous and characterising domains. Certainly different levels can be represented by sets of systems of indicators and indexes, selected on the basis of the scales and having adequate characteristics.

The above-said aspect of the subdivision of different "scales" (space-time-homogeneous territorial domains) is considered to be particularly important since it is in this context that some of the obstacles - that so far have led to failures of targeted actions - have been overcome.

In this framework is to be set the research carried out (IAM-B/CHIEAM and Dept. of Engineering and Management of the Agricultural and Forest Systems, Bari University) about the identification of areas at risk of desertification finalised to the setting up of the control measures and related effectiveness.

The first results regard the testing of the modified ESAs methodology (Ladisa, 2001; Ladisa and Trisorio Liuzzi, 2001; Ladisa *et al.,* 2002a,b) for the Province of Bari (Southern Italy). In the area (5,117.7 km^2) the original model ESAs yielded misleading results because of the particular geographic, environmental, geomorphological, climatic and anthropic variables triggering desertification.

Analysing such conditions as well as the data availability at municipality and provincial scale, the approach sets up a whole set of new indicators regarding each of four main quality indices as it is illustrated in Figure 2.

In particular two supplementary indicators refer to rainfall erosivity, several statistical indicators concern rural, pasture and forest land use intensity, an integrated Land Use and Management Quality Index consider different land uses and management policies and a new Human Pressure Index regards population density, rural employment and tourism pressure.

The input data were derived from various statistical databases and from the results of some other projects realised at provincial and regional scales. The soil characteristics were found on the results of the ACLA 2 project (Steduto and Todorovic, 2001), while the land use database mainly on the CORINE land use and land cover database (CORINE, 1995). The data were geo-referenced and assembled in a GIS in several layers, each representing an indicator of the quality of the area.

The results (one of the maps obtained is shown in Figure 3), compared with those obtained with the original approach, are satisfactory, giving a finer territorial subdivision of sensitivity classes and highlighting additional considerations about the causes of land degradation and related control strategies. Further improvement of the proposed approach is going on for the assessment of the human-induced causes of land degradation and better planning and implementation of anti-desertification strategies.

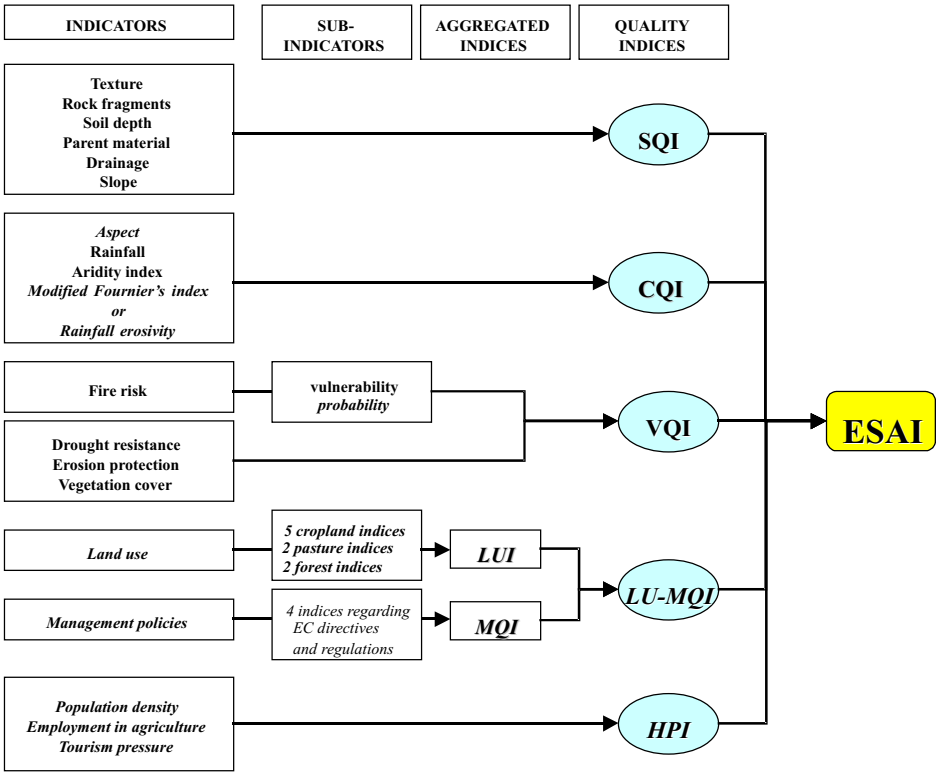

Figure 2. Desertification Indicators and Quality Indices used in the modified ESAs approach. In italic are written new and/or modified indicators and quality indices (Ladisa, 2001; Ladisa, Todorovic, Trisorio Liuzzi, 2002a,b)

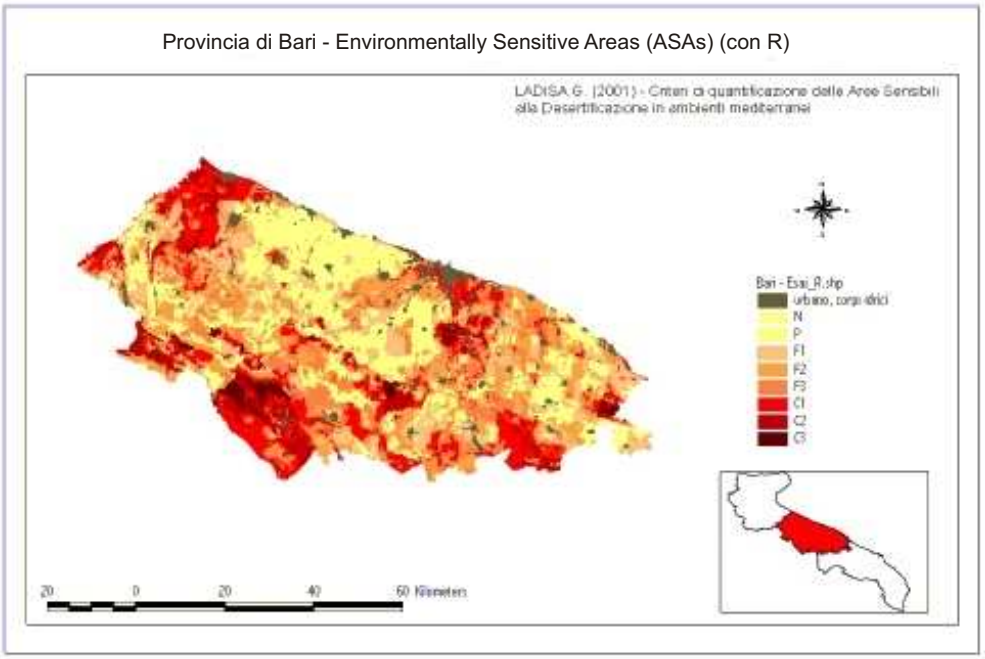

Figure 3. Characterisation of the areas sensitive to desertification in the Province of Bari by using the modified ESAs approach. R is the Rainfall Erosivity Index, settled through the factor *R* of the USLE, calculated according to the proposal of D'Asaro and Santoro (1983) knowing the elevation [m] of meteorological stations, the average annual precipitation [mm] and the average number of rainy days during the year. Legend: C-critic, F-fragile, P-potential, N-non-affected, U-urban (Ladisa, 2001; Ladisa, Todorovic, Trisorio Liuzzi, 2002a,b).

Conclusions

Desertification has to be analysed in the framework of the revision of what and how should be integrated in a land/water/ecosystem management context. On this subject the further following remarks highlight such existing serious situation with particular regard to the developing Countries:

- The PACD is dealing with a problem that cannot be solved once and for all. It is rather dealing with a process that will generate new problems to be tackled after the more urgent ones have been dealt with.
- Success and/or failure in the implementation of any programme is mainly subject of the pre-steps that should be taken for strengthening the capabilities of the countries affected and, particularly, the developing ones through guidance and assistance in developing appropriate policies, pricing, legislation, institution buildings, improved natural resource management, the capacity to use environmental impact assessment and environmental cost benefit analysis technologies, improved environmental data base and environmental education and training. Those are crucial elements to be fully considered to assure a successful programme implementation. As a matter of fact, developing countries affected by desertification were unable to cope with the problem due to the weak functional Institutions and drastic shortage in the well-trained human resources capable for carrying the job.
- It is well recognised that desertification has become one of the most serious environmental and socio-economic problems of the world; therefore it should be conceived as integrated part of programmes for socio-economic development and thereby the anti-desertification campaign should be managed as an integral part of socio-economic development of the territories and societies subjected to desertification. The opposite was the case for PACD implementation, where most actions were not fully in such programmes and were considered as measures to amend environmental damage only.
- Participation, consultation, co-ordination, partnership, subsidiary, decentralisation are essential tools and major driving forces for the implementation processes. However, we have to recognise that none of these exhortations it's easy, given that they involve major changes in whom holds power and who has the right to make important decisions. An understanding of political economy and power was lacking in the implementation of the PACD, and it is essential for clarifying how far these various abstractions can be pursued in terms of development practice. In any case, one of the drawbacks, which negatively affected the implementation of the programmes in most countries, is the ignoring of affected populations being not fully involved either in the planning or in the implementation processes. The bottom up approach was not at all present.
- Combating desertification requires the involvement of different ministries, scientific and local institutions of variable disciplines beside the private sector and many other local organisations. Co-ordination between those various parties is a central component and crucial element in fighting desertification. However, putting the different involved parties working together in harmony, according to a well-defined duty to be realised in time and to the programme-working plan, it was very difficult to achieve as there are

strong forces acting against such an apparently logical approach. In our opinion, such very weak co-ordination during the implementation of the PACD is a major cause for not being able to combat and stop the increasingly spreading desertification.

These are the lessons and experiences learned from the past, the question is: *what are our policies and strategies for the future?*

Any measure designed to mitigate and prevent dry land degradation *i.e.* desertification must be short and long-term. The first requisite for any successful amelioration project is an accurate diagnosis of the problem, followed by careful identification of the physical and human causes of degradation.

Long-term strategies are of greater ultimate value as they aim to attack the root causes underlying land degradation. Such long-term strategies must be principally based on fulfilling the following:

- Any community action must be suited to the ability of the people directly affected by the degradation to finance and carry out appropriate conservation and restoration programmes, which often presupposes the use of relatively inexpensive, simple and appropriate local technologies. Technology usually provides the best starting point for more sustainable land management, particularly in developing countries.
- Research and policy design should accept that the main land use planner and decision-maker is the herder or farmer who depends on the resources concerned. We have to learn from our mistakes and not to repeat them. For too long, governmental agencies, NGOs and donor projects have considered themselves to be the best placed to decide what should be done. This is one of the major errors on which we embarked our strategies in the past, hence this assumption of responsibility has often been inappropriate and has not been matched by effective actions.
- The establishment of a concrete linkage between the researchers and decision-makers. The challenges faced by the researchers and policy-makers is thus to find a way of supporting a "virtuous" circle of intensification to tighter definition of rights and increased investments in improving the land and access to a range of technical options which farmers can adapt to their circumstances.
- The nature of degradation processes must be thoroughly understood, clearly diagnosed and careful initial assessment made of the most suitable options for prevention and rehabilitation. It is no solution to resolve one degradation problem by creating new problem. Greater urgency should be given to the adoption of uniform criteria and methodologies to assess and delineate land degradation.
- Actions based on economic efficiency must take into account the need for maintaining ecosystem diversity and complexity.

Based on a thorough review of what have been achieved and the new challenges we are at the moment facing, implies that the development of a comprehensive strategy to confront these challenges is of crucial importance to safeguard environment and respond to changes which may adversely affect our economic health and welfare.

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