

Local development in Calabria from desertification to sustainability: an Economical Approach

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Abstract: The aspect that characterize the desertification is not only the discomfort related to the depleted of territory's portion, but also the verification that it depends on causes that they are tightly connected of intrusion to the men's levels. Actually many theories put in evidence that the desertification is economically connected to poor areas. Our analysis consider, in fact environmental factors related to the ground, vegetation that they are the basic element of phenomenon's organization. The Medalus Procedure will furnish the impact level of every factor differentiating it for grade of interference and intensity expressing the evaluations for sectors with criterions of gradualness inside the same. At the end of our analysis we can conclude that the Medalus procedure modified considering in particular the men's influence it is an important instrument to individualize and to analyze the phenomenon of the desertification on various levels.

Keywords— desertification, sustainability, ground, water, urbanization

I. DESERTIFICATION: CAUSES AND EFFECTS

DESERTIFICATION is a phenomenon of ground's degradation caused by numerous factors, like climatic variations and human activity. Ground is the superficial stratum of the terrestrial crust that derive from the alteration of a rocky substratum, called mother rock for biological action practiced from all the agents and from the present organisms on it. Ground can include sediments and it is composed from an organic component and from a mineral component. During own evolution, the ground differentiates along it profile a series of horizons. The most common horizons are for example an organic superficial horizon with organic substances and mineral particles that reaches a great percentage (for example 5%-10%), underlying horizon in which the process of the meteoric waters has leaved slimy and sandy component and the underlying horizon where the thin particles are accumulated. The trials that originate a ground are various and it's possible a characterization of the grounds in correlation to the climatic regimes. The desertification often has origin from the intensive exploitation of the population that establishes in the territory to cultivate it or for the pasture.

II. ANALYSIS AND STUDY OF THE PHENOMENON

The underlying horizon where the thin particles are accumulated. The trials that originate a ground are various and it's possible a characterization of the grounds in correlation to the climatic regimes. The desertification

The international community has recognized for a long time the desertification as one of the most greater social and environmental economic problems in various countries of the world. The desertification, in fact, it dramatically reduces ground's fertility and the ability of an ecosystem even if in origin desert or semi-desert to produce services. According the *Convention on the Biological Difference* the ecosystems' services must be considered essential elements for the life of a community both in advanced countries and in developing countries. The services of the ecosystems are generally described in:

- Supply's Services: for example food, water, wood and so on....
- Services of regulation: stabilization of the climate, barrier to the diffusion of the illnesses, disposal of the refusals, quality of the water.
- Cultural services: spiritual values etc
- Services of support: formation of the grade, use of the nourishing ones.

During 1977 the United Nations Conference on Desertification (UNCOD) it adopted the Plan of Action to Combat Desertification (PACD). Despite, the efforts for the realization of this plan a UNEP study during 1991 concluded that the trial of degrade in the arid zones, seed-arid was generally intensified. The specific activities of this plan foresaw among the others the creation of trees' rows like eucaliptus to brake the advance of the desert. The concept of desertification it is therefore, progressively evolved during the years in the attempt to define a trial that even if characterized from local causes is assuming more connotation of a global problem. In the "Summit of Rio" has been decided to found an intergovernmental committee of negotiation to prepare a convection to fight the desertification in the countries that suffer serious drought in particular in Africa. During 17 th

June 1994 in Paris was adopted the UNCCD (United Nations Convention to Combat Desertification in Countries experiencing Serious Drought and/or Desertification, Particularly Africa). This convention defines desertification like a generic degrade of ground in some climatic areas and not necessary an expansion of the desert.

III. CAUSES

The causes that provoke desertification are very complex and are not only the classical activities of elimination of the forests, excessive pasture, bad practices of irrigation and generally non sustainable complexes practices of ground's use but also some mechanisms related to the international trade. We must also consider that UNCCD affirms that also some social and political parameters contribute to the process of desertification like the level of poverty and the political instability. The convention tries to promote local actions with innovative approaches to be effected both to local level and international level.

IV. ZONES INTERESTED BY THE PHENOMENON

The desertification interests particularly bordering zones of the Africa. Other zones to risk of desertification are the western part of the north and south America. Also the Australian desert is in expansion. In Italy the zones interested by this phenomenon are the regions of the Sicily, Sardegna, Calabria and Puglia.

V. MEDALUS PROCEDURE MODIFIED

The methodology MEDALUS (1999) allows to define the Sensitive Areas to the Desertification (ESAs: Environmentally Sensorial Areas) considering the so-called *Index of Environmental Sensibility* (ESAI). To realize the UNCCD (United Nations Convention to Combat Desertification, 1996) and the Plan of National Action (P.A.N.), the Regions and the Authorities have to define a specific program of intervention individualizing the most sensitive areas to the risk of desertification. The CIPE Deliberation foresees that the National Committee for the struggle to the Drought and the Desertification, founded with 26.09.97 DPCM (G.U. n. 43 of 21.02.98), with the contribution of institutions and technical-scientific organisms, promotes and it coordinate the adoption of standard and methodologies to the knowledge, to the prevention and to the mitigation of desertification to furnish the necessary support to the organisms responsible of the territory's management (Giordano L. et to the., 2002). The Programs of National Action of the UNCCD's attached IV require indication that can be used for identifying sensitive areas to the desertification. But is it possible to find indications that they can be applied to a whole region? The sensitive areas to the desertification they can be defined in this way to be

comparative among different countries and to different period in the time? One of the methods used is the Medalus II and III (Brandt et. to the., 2002), that foresaw studies in Areas Objective, subsequently recognized sensitive to the desertification. This study conducted to the development of the methodology of the Environmental Sensitive Areas (ESAs: Environmentally Sensorial Areas) considering the so-called *Index of Environmental Sensibility* (ESAI). The objective were: a) to develop the instruments to identify the critical areas for the desertification, b) to establish conditions threshold for the desertification and c) to train the different Objective Areas to be comparative (Imeson A. C., 2004). Environmental sensibility can be defined, in this context as the grade of the ecosystem's reactivity, particularly of the ground, to the solicitations produced by the external agents (Sequi et to the., 1998) both of men origin and of natural origin (biological agents, or climatic agents). The indicators to define the ESAs for the regional desertification can be divided in four categories: Ground, Climate, Vegetation and Management (Low F. et to the., 2000). Through the first three indicators can be obtained a state of the environment conditions while the last indicator expresses an evaluation of the pressure practiced by the agricultural productive activities (Giordano L. et to the., 2002). The realized application has used, therefore, six parameters for the ground, four for the vegetation, three for the climate and two for the quality of the management, considering the available cartographies on the whole regional territory. This situation implicates that the model has a different sensitivity to the parameters used for appraising the four of quality's indexes. The sensitivity to the variation of the ground's parameters will be in fact proportional to the sixth root of the parameter's value, for the vegetation it will be proportional to the fourth root, for the climate it will be proportional to the third root while for the management to the square root. The model's sensitivity to the variations of a parameter becomes, therefore, smaller so more they increase the parameters used to evaluate quality index. This different sensitivity doesn't reflect a real physical phenomenology and this empirical approach it constitutes a first approximation of evaluation. The indicators considered in the MEDALUS project are:

- Mother rock
- Depth of the ground
- Inclination

The index of the ground's quality was given by the relationship:

Index of the Ground's Quality (SQI) = (mother rock * depth of the ground * inclination)^{1/3}. The classification has been made on three levels (high, middle and low) according to the following table:

TABLE I
QUALITY'S CLASSES OF THE GROUND (KOSMAS C. ET AL., 1999)

Classes	Description	Range
1	High quality	<1,13
2	Medium quality	1,13-1,45
3	Low quality	>1,46

The new map of the representative Ground's quality contains a substitutive indicator of the ground's depth that it is the weaving. The indicators considered in examination to represent the quality of the ground have been:

- Mother rock
- Inclination
- Weaving.

The index of the ground's quality has been given by the relationship:

$$\text{Index of Quality of the Ground (SQI)} = (\text{mother rock} * \text{inclination} * \text{weaving})^{1/3}$$

Also in this case the classification is foreseen on three levels (high, medium and low) always according to the table 1. With the substitution of an only indicator it can be noticed as the percentage of distribution of high, medium and low quality is varied. It results, in fact, from the comparison with the preceding map that the zones interested by medium quality, become of low quality. The high quality has been unchanged, exception from the zone of the high Calabria Ionio, where it results decreased. About Climate indicator, the MEDALUS approach proposes three competing indexes to individualize the ESAs:

- Climatic index of Thornthwaite
- Annual average precipitations
- Exposure of the slopes.

The same case is for the Vegetation's indicator, for which the MEDALUS proposes the followings four indexes key:

- Risk of fire and ability of recovery
- Protection of the ground from the erosion
- Resistance to the drought
- Vegetable coverage.

The methodology needs for the classification of each indicator and the assignment of a score to each class in relationship to his "weight" on the process of desertification; the score changes among 1 ("weight smaller") and 2 ("weight greater"). The geometric mean of the indicators for the four categories, provides the followings four indexes of quality (QI, Quality Index), which corresponds a classification on three levels (high, medium and low):

- Index of Quality of the Vegetation (VQI)

VQI = (risk of fire and ability of recovery. * protection of the

ground from the erosion.* resistance of the plants to the drought* vegetable coverage)^{1/4}

TABLE II
QUALITY'S CLASSES OF THE VEGETATION (KOSMAS C. ET AL., 1999)

Classes	Description	Range
1	High quality	<1,13
2	Medium quality	1,13-1,38
3	Low quality	>1,38

- Index of Quality of the Climate (CQI)

$$\text{CQI} = (\text{Climatic index of Thornthwaite} * \text{precipitations} * \text{exposure of the slopes})^{1/3}$$

TABLE III
QUALITY'S CLASSES OF THE CLIMATE (KOSMAS C. ET AL., 1999)

Classes	Description	Range
1	High quality	<1,15
2	Medium quality	1,15-1,81
3	Low quality	>1,81

- Index of Quality of the Management and men's pressures (MQI)

MQI = (Intensity of the ground's use* politics of the territory's protection).

TABLE IV
QUALITY'S CLASSES OF THE MANAGEMENT (KOSMAS C. ET AL., 1999)

Classes	Description	Range
1	High quality	<1,15
2	Medium quality	1,15-1,81
3	Low quality	>1,81

The geometric mean of the four indexes of quality furnishes the ESAs index that it classifies the areas in four different categories of sensibility: criticisms, fragile, potential and not subject to desertification (Frega G. et al., 2000):

$$\text{ESAI} = (\text{VQI} * \text{SQI} * \text{CQI} * \text{MQI})^{1/4}$$

The **critical ESAs** are highly degrade areas, cause the bad

use of the ground, representatives a threat for the environment: an example are the areas very corroded. The *fragile ESAs* are areas where any change of the natural activities and/or of the human activities will very probably bring to processes of desertification. The *potential ESAs* are areas for which a particular use of the ground, practiced with not correct criterions, as the use of bad resources and for meaningful climatic variations, they are threatened by the desertification. The *non subject ESAs to desertification* or subject to the low process of degradation they are areas characterized by deep or very deep grounds, well drained and subject to varying climatic conditions, independently of their vegetable coverage, they are not considered areas subject to desertification.

VI. INDEX OF THE VEGETATION'S QUALITY (VQI)

The component of the earths able to oppose the process of desertification is the vegetable coverage. In fact the degrade of an areas it begins with the degradation of the vegetable coverage especially in the case of the Mediterranean vegetation. The indicators of the vegetation's quality that can be considered are:

- Risk of fire and ability of recovery;
- Protection of the ground from the erosion;
- Resistance to the drought;
- Vegetable coverage.

The figure following show the synthesis that is exposed:

Vegetation's Quality

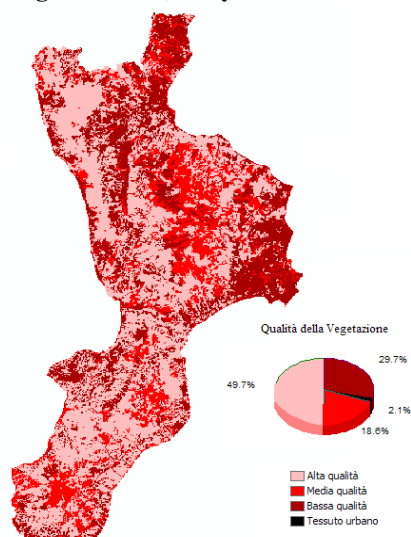


Fig. 1: Vegetation's quality of Calabria.

We can notice that the territory of Calabria is divided in areas of high quality (49,9%), average quality (18,4%) and low quality (31,7%). The best conditions of vegetation are for Reggio Calabria (Figura.1). In this area, in fact, dominates the green zones and the perennial agricultural crops that they protect the territory from the degrade. The areas of Catanzaro,

Cosenza and Vibo Valentia are more predisposed to the degrade (Figure 1).

VII. INDEX OF QUALITY OF THE CLIMATE (CQI)

The irregular annual distribution of the precipitations are the principal climatic factors that contribute to the degradation of the earths in the semi-arid and arid zones; according to recent studies (Kosmas C. et to the., 1999) the global climatic changes will interest the vulnerabilities areas of the Mediterranean. In the years the erosion factors can bring to a possible process of desertification. In this context the indicators that can be considered to represent the quality of the climate and therefore to individualize the ESAs are:

- Climatic index of Thornthwaite;
- Precipitations annual averages;
- Exposure of the slopes.

The figure following show the synthesis that is exposed:

Climate's Quality

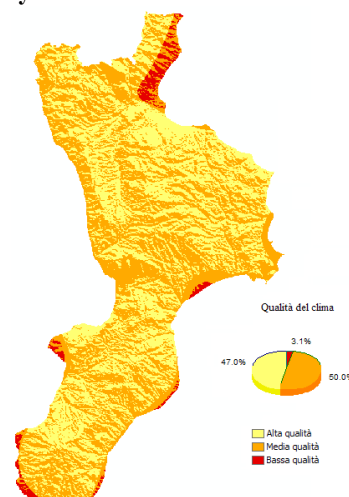


Fig. 2: Climate's quality of Calabria.

VIII. INDEX OF QUALITY OF THE GROUND

The ground, the water and the climate are component fundamental of the terrestrial ecosystem. According to the OCSE the principals processes of environmental degradation are usually referable to the erosion of the ground, to the loss of organic substance, to the deterioration of the structure, to the desertification, to the accumulation of toxic substances, to the loss of nourishing elements, etc. The protection of the environment, therefore, starts from the protection of the ground, operated through an agriculture, a forestry and a politics urbanism and sustainable structures (ARSSA, 2003).

The ground has many fundamental functions for the environmental equilibriums and with strong economic and social implications. Particularly:

- **Productive function.** The production of biomass, essential for the human survival, it depends on the ground that it represents the water reservoir and the

reserve of nourishing essential to the growth of the vegetables;

- **Protective function.** The ground acts as a barrier against the pollution, limiting the risks of degrade.
- **Naturalistic function.** The ground is the natural habitat of an enormous quantity of organisms and it assures essential ecological functions in the protection of the biodiversity (ARSSA, 2003). The representative indicators of the quality of the ground can be connected to the water content of the ground and the resistance to the erosion. This qualities can be evaluated using simple characteristics of the ground, like:
 - Mother rock
 - Depth of the ground
 - Inclination
 - Weaving
 - Rocky fragments
 - Water reserve
 - Drain
 - Salinity.

IX. QUALITIES OF THE MANAGEMENT AND MEN'S PRESSURES (MQI)

The index of Quality of the Management considers the stress induced by the human factor. The used indicators are the intensity ground's use and the politics of the territory's protection, considered notable incidence on the state and the evolution of the natural resources (ground, water, vegetation, etc.) of the same place. The intervention of the man has a remarkable role in the politics of protection of the territory that determine the intensity of use of the ground. In this optics it is to observe the Urbanistic Law of the region Calabria with the objective: to promote an orderly development of the territory of the urban fabrics and of the productive system; to assure that the processes of transformation preserve from irreversible alterations the essential characteristics of the territory and maintain the cultural characteristics conferred by the natural and historical stories of it; to improve the quality of the life; to mitigate the impact of the installations on the natural and environmental systems; to promote the exploitation and the improvement of the environmental, architectural, cultural and social qualities of the urban territory, to foresee the use of territory only when consequential alternatives don't subsist (Art. 3, law Urbanism, 2002). The changes in action in the economic and social structures of some rural zones have in many cases subsequently consequences on the environment exasperating the phenomenon of erosion and increasing the superficial outflows. In the definition of the ESAs to the desertification, to represent the quality of the management and the men's pressures we can consider two indicators:

- Intensity use of the ground;
- Politics of protection of the territory.

Quality of the management

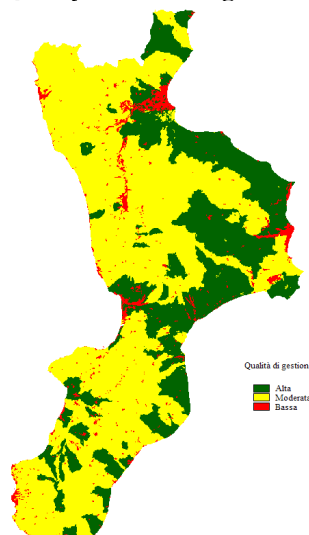


Fig. 11: Quality of the management in the Calabria area

Intensities of ground's use

Regarding the intensive use of ground we can consider, many areas, that offered pasture to flocks and herds for hundreds of years, after the increase of the population (around the years 20) these areas were destined to the intensive cultivation becoming more vulnerabilities (high rates of erosion, superficial layers poor of nourishing); so these areas were abandoned. The abandonment of these areas can be followed by a phase of deterioration or improvement of the ground, in base to the particular climatic characteristics and of the same ground. For instance, the hilly areas that can support an enough vegetable coverage through the accumulation of organic materials, the improvement of the structure of the ground, can improve in the time (Kosmas C. et to the., 1999). Contrarily in the cases of scarce vegetable coverage, the erosive process can be very active and the degradation of the ground becomes irreversible. Finally, in the cases in which the surface of the ground is partially covered by annual or perennial vegetation the portion without vegetation creates favourable conditions to the superficial outflow and the degradation. Other process of degradation can be produced by the high density of livestock that reduces the porous space among the particles of the ground, with consequent partial or integral loss of it absorptive capacities. When the phenomenon reaches the deep layers of the ground it is irreversible (Communication errand UE; 2002). "To quantify" the intensity of use of the ground, it's used the classification of the utilize of the ground (Kosmas C. et to the., 1999):

- Areas used for the agriculture (crops, pastures, etc.);
- Natural areas (forests, areas with bushes, etc.);
- Areas used for the recreation (parks, development of the tourism, tourist zones, etc.);

- Infrastructures (roads, banks, etc.).

Politics of protection of the territory

The politics of protection of the ground involve the monitoring of the same ground and the elaboration of tools (cartographies, banks given) to direct the technical choices toward the sustainable use of the natural resources (ARSSA, 2003). The regional and national legislation furnishes the rules for the management of the territory and for the use of the natural resources, particularly ground and water. These rules are often in conflict with the local affairs and they are perceived as a limit to the local development. For this reason their only existence is often insufficient to the protection of the environment.

X.CONCLUSION

The analysis allows to evaluate the risk relative to the phenomenon of desertification in particular in Calabria. The multifunction role of the ground becomes central in the environment and in the risk management. The environmental politics allows to resolve many problems, particularly the problems about the organic material of the ground, biodiversity and waterproofing. The politics on the use of the ground can for example, have an important role to protect the resources of the ground, limiting the practice of the waterproofing. It is fundamental, therefore, to treat the problem of the desertification considering the environmental and territorial elements and the types of installations of that places. The quality of the ground must be linked to the quality of management, to the men pressures because areas with high vulnerability but with scarce demographic pressure will become less subject to the desertification in comparison to areas few vulnerabilities but subject to greater men pressure. The Medalus Procedure results a formidable and efficient instrument for the zones of emergency. Applying the problem of the desertification to the Calabrian territory underlines the necessity of water resources in many zones of the Calabrian areas for the alarm of desertification in many zones. For the vulnerability of the Calabrian territory, the Medalus procedure results effective and necessary to define the criterions, to limit and to direct a sustainable use of the resources.

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