

Intervention Methodologies to Enhance Sicilian Rural Coastline Landscape Within Climate Change

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Abstract

Nowadays with climatic change, global warming and desertification needing urgent attention and concrete responses, rational use of the planet's resources and safeguarding the global ecosystem are essential presuppositions for sustainable development together with economic prosperity and balanced social quality.

It is well known that these tensions are most exacerbated in strongly anthropic areas like those of the agro-Sicilian coastline. In most of these areas, extensive overbuilding due to urban, industrial and tourism sprawl, and intensive agriculture have above all impoverished the coastline, depleted typical Mediterranean vegetation, eroded the soil, and therefore modified the environment. This work proposes to analyse parts of the Sicilian agricultural landscape, in Ragusa territory, to acquire data on the factors determining the evolution of this degradation and develop intervention methodologies within climate change.

Keywords: rural landscape, climate change

1. Introduction: Climate change, desertification and their impact on the Sicilian coastal landscape.

The Mediterranean basin is already over exposed not only to meteorological extremes (flooding and droughts) but also to natural ones (earthquakes, geological and hydrological instability etc.) due both to the complexity of the environmental, anthropological, social and infrastructural systems as well as to the peculiar characteristics of its ecosystem and its historical, artistic and cultural heritage.

The current and anticipated climatic trends impacting the territory and its landscape are further exacerbated by other factors linked to overexploitation and the unsustainable management of ground resources like crop practices, animal breeding and the management of water resources.

The concept of desertification increasingly relies on environmental and human interaction covering all phenomena of 'soil erosion in arid, semi-arid and sub-humid dry areas, attributable to various causes amongst which climate change and human activity'. This definition, adopted by the United Nations Convention for the Fight Against Drought and Desertification (UN CCD) defines its scope as a function of climatic characteristics and introduces some innovative key concepts: the causes may be both natural and human; erosion is not only the loss of physical and biological characteristics, but also the loss of profitability; the arid, semi-arid and sub-humid dry areas are the most vulnerable in the world requiring urgent intervention.

The environmental and socio-economic peculiarities shared by Sicily and other Mediterranean countries apart from the semi-arid and sub-humid dry climate, seasonal drought, huge rainfall variations and sudden violent downfalls, are the poor soils susceptible to erosion, the heterogeneous landmasses with steep slopes, a crisis in traditional agriculture characterised by the abandonment of the countryside and deterioration in the protection of soil and water, the unsustainable overuse of water resources, and finally the concentration of economic activity along the coasts as well as increasing urbanisation, industrialisation and tourism.

In the Region (Schifani, 2003) and provinces of Ragusa, Siracusa, Agrigento and Catania as confirmed by a CTM (The Mediterranean Remote Sensing Centre) study (1999), desertification is caused by: the abandonment of the countryside, the replacement of traditional farming techniques by modern ones; the irrational management of grazing; the introduction of non-indigenous forest species; the impact of tourism, urban expansion and the transportation infrastructure; poor water management.

According to some data (Salvati et al., 2005), almost the whole of Sicily - 94.4% - is at risk of desertification on the basis of meteorological data for 1971 - 2000 (fig. 1).

2. Aim and method

In the above description, the areas investigated are on the Sicilian coast showing considerable evidence of desertification: the greenhouse area of the Ragusa coast. In particular, the Macconi area (fig. 2) is almost totally covered by greenhouses as far as the final coastal strip which was once of imposing dunes but is now a narrow sandy shore being eroded.

Guide lines for re-designating the landscape have been proposed to promote actions which counteract the current tendency by re-introducing tourism which respects a functional and ecological equilibrium as well as the natural identity of place.

By detailed analysis of the landscape, environmental and anthropic systems, the research

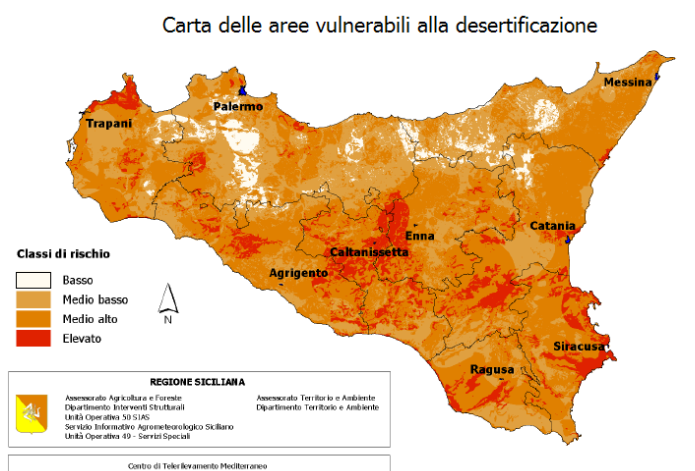


Figure 1. Map of areas vulnerable to desertification in Sicily (Drago, 2003)

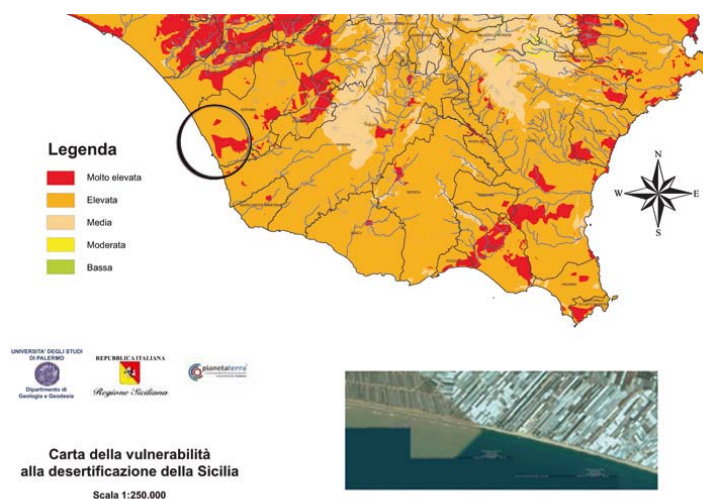


Figure 2. Study zone

aims at providing support for planning and designing the Ragusa coast in light of climate change and the consequent desertification.

Intervention requires good knowledge of the area and its potential as well as any current conflicts. With this aim, a methodology was developed over three different phases (fig. 3):

1. analysis: substantial analysis which summarises territorial characteristics, their interrelations, their historical evolution and the evolutionary, structural and perceptive dynamics of the landscape;
2. processing: based on studying man-environment conflicts, the interferences between anthropic activities and natural processes; on defining territory specific sensitivity/vulnerability indicators; on processing explanatory summaries
3. proposal: guidelines produced by applying a case study which describe the means to safeguard and plan landscape in similar environments.

3. Results and discussion

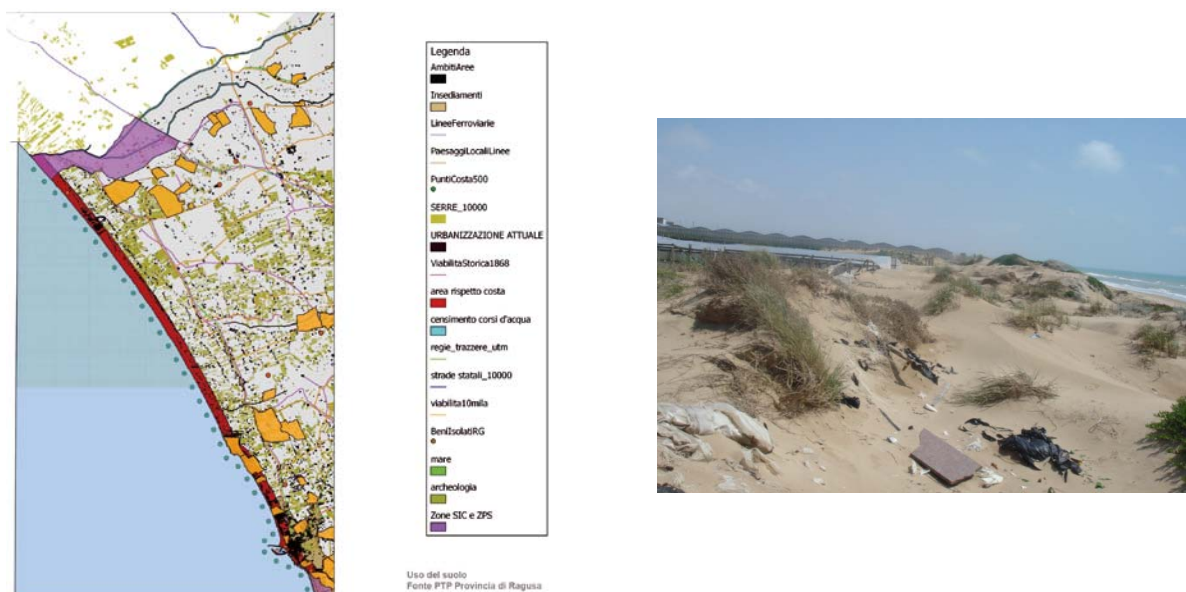
3.1 Knowing the territory

Landscape analysis should be based on a global vision of all the processes involved from natural phenomena to the relationship between man and his environment. The variety and heterogeneity of the information and the numerous themed maps make the overall analysis quite complex so a structured program is needed to understand ongoing developments and the possible evolution of the landscape which should embody the investigations carried out as well as integrate the evaluations.

The analytical process can be broken down into:

- Landscape analysis which forms the knowledge base for design/management.
- Environmental component analysis as it links to climate change which provides a specialised knowledge base on the landscape and its health.

To help with the investigation we analysed historical maps (IGM), Territorial Plan maps and the Territorial Landscape maps of Ragusa Province to fill out the physical, environmental and anthropic characteristics of the territory (fig. 4) and its intended applications while taking into account the provisions of urban planning.



Uso del suolo – Fonte PTP Ragusa

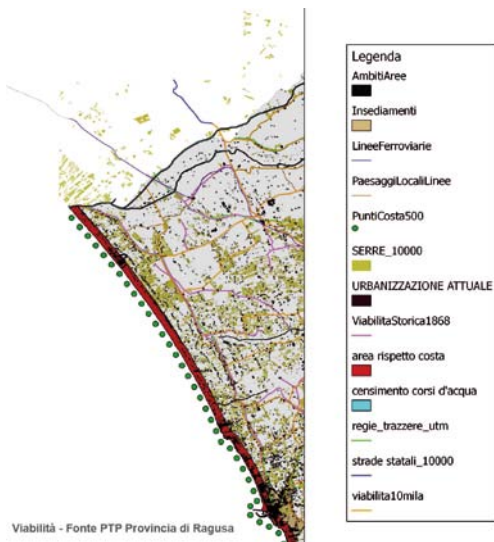
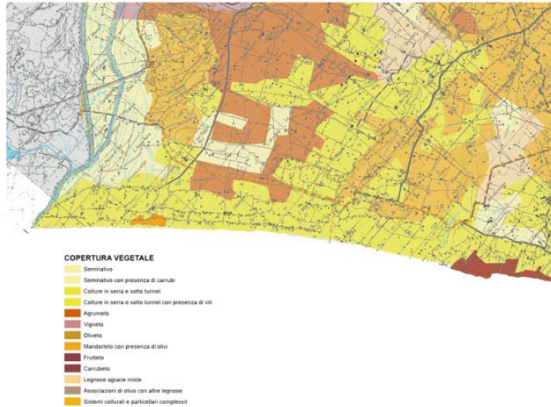


Figure 4. Place analysis and key

Providing the means to better understand the environmental components of a territory and to evaluate more precisely its vulnerability to desertification, given that these are the most important aspects governing the best management or resources, a methodology was created using collected and already validated data to highlight all the issues relating to desertification.

tab. 1. Desertification & loss of landscape potential	Study criteria	Vulnerability criteria	Problem
	Environment /Man conflict Interference between Man and natural processes	Natural causes	
	Anthropic causes		

This led to cataloguing the areas into Sensitive, Vulnerable, At Risk and Already Subject To (tab. 1) in which the combined aspects of climate, vegetation, soil and socio-economics help measure the state of resources and the human pressures at work. In the next phase, specific indicators to monitor the phenomenon were set up as well as appropriate instruments and techniques (guidelines) for managing the territory. The landscape was evaluated to prefigure it to one or two scenarios as defined by policy for the landscape and environment. The scenarios represent a balance between criticality/complexity and landscape potential/opportunity (tab. 2) taking into account future risk in relation to landscape characteristics and highlighting any 'sensitive' areas, any pressure factors and 'vulnerabilities' (Riguccio et al., 2008).

tab. 2. Evaluation	Study criteria	Parameters
	Critical state	Degree of human intervention and/or transformation
		Risk identification
	Potential	Attitudes to conservation & identifying values
Compatible uses		

3.2 Defining parameters/indicators for desertification and applying them to the case study.

Territorial degradation is therefore linked to alterations in soil-water-vegetation factors and only by analysing all the data and information regarding them can they be monitored and quantified.

By referring to the main anthropic activities in the territory, the study has revealed several indicators which highlight conflicts with the environment and interference between human and natural processes. This interference can provoke physical, chemical and biological alterations.

The indicators have been subdivided into **activity sectors** (Agriculture, Tourism, Urbanisation, Infrastructure). To standardise the information with the data obtained from the landscape analysis these indicators have been subdivided according to vulnerability into: **structural, functional and perceived** (Russo e Riguccio, 2009).

The indicators' estimate

The indicators provide information which is combined with qualitative evaluations of the specific territorial context. They help in evaluating the potential/criticality of the territory and in identifying strategies for sustainable development. Each indicator (Riguccio et al., 2009) is able to carry out a 'prompt evaluation' of territorial vulnerability by attributing a specific value and verifying the actual trend (Tab. 3) (DiSGAM, ARPA, 2003).

So, by way of a subjective evaluation, values were attributed to those indicators

on the basis of statistical data and territorial interpretation. The results were further catalogued according to a value (Vulnerability Index VL), calculated by a method developed in the

Value	Very low	Low	Moderate	High	Very high
Brief evaluation					
Variable V ⁿ	1	2	3	4	5
Actual tendency					
trend	^ improvement	= stable	v worsening		

previous phase which sets the ‘risk category’ which in descending order identifies territorial intervention priorities (tab. 5) (Riguccio et Alt., 2009). The risk value was quickly chosen from table 4 (DiSGAM, ARPA, 2003).

<u>Risk</u>	<i>Very low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Very high</i>
<u>Variable R</u>	≤ 5	$5 \leq R < 10$	$10 \leq R < 15$	$15 \leq R < 20$	≥ 20

4. Adaptation and intervention strategies: setting up guidelines and identifying compatible utilisation.

The intervention strategies put forward by the IPCC (Intergovernmental Panel on Climate Change) can be condensed into two key terms: mitigating *global climate change* and adaptation. Adequate intervention as expressed by the IPCC might lead to significant results; intervention strategies should not be backward looking but anticipate the expected changes over the next 30 – 40 years.

Mitigation means human intervention to reduce greenhouse gas sources or increase removal processes whereas adaptation means adjusting natural or human systems to environmental change either for damage limitation or to exploit opportunities.

Adaptation to the impact of climate change is a complex process implying adjustments in time and space in response to expected or ongoing climatic variations. Adaptation involves both natural and socio-economic systems both of which can be ‘autonomous’ (ie. spontaneous responses to change mostly by ecosystems in natural systems and by the private sector in socio-economic ones) or ‘planned’.

The National Action Programme (PAN) in the Fight Against Drought and Desertification passed by CIPE no. 229 (21/12/1999), provides for a complementary set of interventions in the following priority sectors: protecting the land, sustainable management of water resources, reducing the impact of manufacturing, re-establishing territorial equilibrium (eg. recouping degraded soils, land reclamation and re-naturalisation etc.).

On the basis of these indicators for reducing the impact of climate change it is necessary to rediscover closer ties to nature with a high capacity for adaptation and re-establishing the equilibrium in both urban and rural areas.

In light of the coastal area analysis by activity sector (Agriculture, Tourism, Urbanisation, Infrastructure), a ‘good practice’ outline has been drafted setting out strategies to set in motion the regeneration of the coastal landscape (fig. 5). Fine-tuning the guidelines was helped by territorial planning and programming apparatus which identify specific fundamental objectives: accessing the sea, safeguarding dunes, cycle/walk paths, landscape mitigation and improvement, mitigating impact on land and water, diversifying sector economics (greenhouse crops), farm multi-functionality and increasing facilities and services for tourism.

Table 5. SUMMARY OF GUIDELINES FOR THE 'MACCONI' COASTLINE & INTERVENTION PRIORITY BY RISK INDEX			
VL	I	R	GUIDE LINE
1		≤ 5	
2	AF ¹ ,AF ² ,TF ⁶ , US ⁵ ,US ³ .	$5 \leq R \leq 10$	Diversification of tourism; tourism flow management.
3	AS ¹ ,AS ² AS ³ AS ⁸ AS ⁹ AF ⁵ AP ¹ AP ² AP ³ TS ¹ TS ² TS ³ TS ⁴ TS ⁶ TF ¹ TF ² TF ⁷ TP ¹ TP ² TP ⁴ US ¹ US ² US ⁴ UF ² UF ³ UF ⁶ UP ¹ UP ² UP ³ UP ⁴ IP ¹ IS ¹ IS ² IS ³ IF ¹ IF ² IF ³ IF ⁴	$10 \leq R \leq 15$	Recovery and re-use of organic fractions as fertiliser; de-seasonalising demand; creation of green spaces and parks to re-grade the environment and improve micro-climates; restore residential and agricultural buildings; re-vitalise waterfronts; functional re-grading of public spaces; improving public transport to disincentivise private transport; reconfiguration and reorganisation of access systems; creation and promotion of an alternative road network; tourist flow management; up-grading rainwater drainage; improving the roadside view of the countryside.
4	AS ⁵ AS ⁶ AS ⁷ AF ³ AF ⁶ AP ⁴ AP ⁵ TS ⁵ TS ⁷ TF ⁵ TF ⁸ UF ¹ UF ⁵ IF ⁵ IP ²	$15 \leq R \leq 20$	Re-naturalisation of water courses; multi-functionality of rural spaces (holiday farms, agricultural parks, educational farms, agricultural museums etc.); creation of ecological networks; promoting quality brands; sustainable use of water resources; use of low saline water and adopting techniques for mixing water of varying salinity; incentivising traditional agriculture; promoting cultural tourism; diversifying demand; incentivising rural tourism; improving the efficiency of the water network and using renewable energy sources; sustainable management of solid urban waste; incentivising slow mobility.
5	AF ⁴ TF ³ TF ⁴ TP ³ UF ⁴ IP ³	≥ 20	Recovery of marginal areas; recovery of the dune coastal strip; re-naturalisation of abandoned agricultural land; reduction in the consumption of natural soils and the adoption of agricultural good practices; protection and amelioration of cultural and landscape features; reduction in rainproofed areas; research into alternative sources for water provision; improvement in collection, cleaning and disposal of urban waste; optimisation of the existing road network; incentives for public transport.

A: Agro-silvo-pastorale; T: turismo; U: urbanizzazione; I: infrastrutturizzazione; S: vulnerabilità strutturale; F: vulnerabilità funzionale; P: vulnerabilità percettiva (fonti: URI, Assessorato Agricoltura, APAT, ARPA, Osservatorio nazionale rifiuti, piani paesistici, piani territoriali, PRG). L'apice corrisponde all'indicatore specifico riportato in Riguccio et Alt., 2009.

Table 5 – Table 5. Guideline summary for the 'Macconi' coast and intervention priority by risk index.

5. Conclusions

The results of the study lead to drawing some conclusions. Today's Macconi system, and in general the Ragusa coast, is undergoing huge pressure from agriculture and urbanisation as highlighted by the VL values and which represent medium high risk factors. Therefore, short-term intervention is required through re-grading and by creating new scenarios which introduce techniques of adaptation to current climate change. These interventions, described in the guidelines, should be capable of augmenting landscape/environment quality as well as the identity of place and also capable of initiating territorial development processes which, for Sicily, would be linked to the tourism and agriculture sectors.







	Landscape Strategies	Description	Examples & suggestions
AGRICULTURAL SYSTEM	Agricultural park.. Museum agriculture. Educational Farms. Rivitalising rural space.	Open-air museum path circuit tracing the evolution of agricultural practices Re-acquisition of abandoned agricultural land and greenhouses put out of business by tourism or other means.	 
ANTHROPIC SYSTEM	Public space. Accessibility. Slow mobility. Waterfronts.	System of places and inter-connections which by exploiting historical thoroughfares, emarginated and abandoned areas and the existing micro-network creates: access to the sea and viceversa, a cycle-path network which connects the coast with its hinterland, ways of crossing the dunes, tourism facilities.	 
ENVIRONMENTAL SYSTEM	Restoring ecology-environment equilibrium. Re-grading water courses.	Re-establishing the environmental conditions of the Dirillo estuary, starting up environmental tourism, reintroduction of traditional cultivation, creation of a 'green ecological biway' within the landscape.	 

Figure 5. Strategies and intervention suggestions

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