

## **URBANIZATION AND DESERTIFICATION IN EUROPEAN MEDITERRANEAN COASTAL AREAS: A CASE STUDY IN NORTH-WESTERN SARDINIA (ALGHERO, ITALY)**

**Giuseppe Enne, Massimo d'Angelo, Salvatore Madrau and Claudio Zucca**  
*Nucleo Ricerca Desertificazione, University of Sassari, Italy*

**Keywords:** urban growth, soil consumption, Mediterranean, Sardinia, land degradation, tourism, land use, sustainable development.

### **Contents**

1. Introduction
  2. Land degradation and urbanization in Sardinia: A case study of soil consumption in northern Sardinia (Alghero, Italy)
    - 2.1. Brief description of the study area
    - 2.2. The methodological approach for the assessment of soil consumption
    - 2.3. Changes due to urbanization in the Alghero municipality
  3. Conclusions: the need for a local plan of action towards sustainability
- Acknowledgements  
Glossary  
Bibliography  
Biographical Sketches

### **Summary**

The United Nations Convention on Combating Desertification in its Annex IV has recognized a land degradation issue in the northern Mediterranean countries. The peculiar climatic and topographic conditions, associated with severe anthropogenic pressure, have produced widespread degradation phenomena. According to the Convention, the problem of desertification in the northern Mediterranean countries arises from the crisis of traditional agriculture with associated abandonment of marginal areas, the unsustainable exploitation of soil and water resources, and the concentration of economic activity in coastal areas as a result of urban growth, industrial activity, tourism, and irrigated agriculture. Urban growth in agricultural areas represents a kind of land degradation as it causes irreversible direct soil loss, and other related effects.

This paper presents a case study of competition between agricultural and urban land use in the Alghero municipality, where during the last fifty years a rapid expansion of urban areas has caused a loss of land suitable for agricultural use. Direct and indirect effects of urbanization are analyzed and briefly discussed.

### **1. Introduction**

The United Nations Convention on Combating Desertification (UNCCD) defines desertification as “land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities”, where “land

degradation means reduction or loss of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from *land uses* or from a process or combination of processes, including processes arising from *human activities* and *habitation patterns*, such as soil erosion caused by wind and/or water, deterioration of the physical, chemical and biological or economic properties of soil, long-term loss of natural vegetation...” At the global scale, the United Nations (UN) estimates that 30% of the earth’s surface is affected by the degradation of fragile drylands, generally caused by overuse of land, overgrazing, deforestation, poor irrigation methods, and urbanization. The latter, urbanization, is a key aspect of this degradation problem. The rural-urban interface is the place where many land degradation processes and socio-economic conflicts develop. Urbanization and urban development, thus occupy an important position in national and local policies related to sustainable development, such as UNCCD and Agenda 21 implementation. These problems are generally referred to as typical of the megalopolises of developing countries, where the main cities show impressive growth rates and are increasingly surrounded by huge squatter settlements (e.g. the “favelas” of Latin America).

In the Mediterranean coastal areas urbanization is also a major cause of land degradation, though it is driven by different dynamics. Here, an uncontrolled expansion of urban areas can be observed, related to population growth, rural abandonment, and tourism development. The land utilized in this expansion mainly involves areas used for agriculture and often even irrigated land. This way, urban expansion really threatens rural development, which already faces severe problems due to soil erosion and salinization. Furthermore, in a context of under-employment urban migration causes marginalization of the population. This process is particularly worrying on southern and eastern shores of the Mediterranean, where, coupled with strong population growth, it is increasingly threatening food security. A recent scenario by Blue Plan foresees, for the Mediterranean coastal areas, a population increase from 160 to 210 million inhabitants by 2025, with population densities of up to 500 people per square kilometer in Lebanon and Syria, and 300 people/sq. km. in Algeria and Egypt. The trends of urban migration are also strong. In Morocco, for in example, from 1900 to 1994, the urban population increased from 500 000 to 14 000 000, and each year the expansion of urban areas covers 5000 hectare (ha).

It is worth highlighting that desertification represents a major environmental issue also in northern Mediterranean countries, as stated by the specific Regional Annex of the UNCCD (Annex IV). Annex IV recognizes the problems of desertification of this region as arising from:

- the crisis in traditional agriculture with associated land abandonment and deterioration of soil and water conservation structure;
- unsustainable exploitation of water resources leading to serious environmental damage, including chemical pollution, salinization and exhaustion of aquifers, and
- the concentration of economic activity in coastal areas as a result of urban growth, industrial activities, tourism, and irrigated agriculture.

The desertion of internal areas along with the related increase of marginal and unproductive lands, and the concentration of economic activities in coastal areas, seem to be the main forces driving land degradation in wide areas of northern Mediterranean countries. Here, during recent decades, urban growth has often been fast and irrational.

This kind of urbanization dynamic in northern Mediterranean countries can be viewed as a cause of desertification when its direct and indirect effects are considered:

- irreversible loss of soil, particularly productive soils suitable for agricultural crops, due to direct *soil sealing* by structures, quarrying, waste disposal, pollution, etc;
- irreversible loss of vegetation cover and natural sites and their fragile ecosystems;
- alteration of hydrological regime and increased frequency of flooding;
- progressive quantitative and qualitative impoverishment of water resources due to over-exploitation (increasing demand), salinization and pollution;
- increasing competition between rural and urban water needs, accentuating the crisis of rural areas, and
- landscape degradation, microclimate change, etc.

Turkey constitutes a good example that illuminates where urbanization patterns can be considered one of the major variables controlling land degradation and quality of life. At present, 64.6% of the population (40 million) live in towns with more than 10 000 people, and the trend is strongly positive. During the last forty years the urban migration rate was about 6% per year, exceeding the population increases. The biggest cities show a particularly rapid expansion and 45% of the population is concentrated in cities with more than 100 000 inhabitants. The urban population will likely reach 75% of Turkey's total population by 2010. Furthermore, about 40% of the urban population (in 1997), lives in squatter, informal, and illegal settlements, which are in violation of the cities' land use plans. The urban population concentrated in these settlements in 1960 was only 16.4%. Today, about 60% of Istanbul's population and 50% of Izmir's population live in this condition. According to available estimates, between 1975 and 1995 these settlements occupied 150 000 ha of the most fertile soils.

Land of high agricultural quality is also being increasingly occupied by industry and this is causing problems in the rational use of limited resources. Around the city of Ankara, 16% of the irrigated soils were lost to urban areas. The situation is particularly worrying in coastal areas, where a number of small industrial and tourist settlements are appearing, occupying the coastline for tens of kilometers.

These environmental problems, which are widespread in the northern Mediterranean countries, are more severe in those areas where, during recent decades, development policies have favored mass tourism. Tourism in the Mediterranean is characterized by movements of people, mainly concentrated in the summer period, towards areas of interest; more than 30% of world tourism is attracted by the Mediterranean region, with 80% alone coming from the European countries (Spain, Italy, southern France, and Greece). The Blue Plan foresees for 2025 an average of 200/250 millions visitors per year. Due to the presence of tourists, an economic sector arises that satisfies all their

needs. They introduce new urbanization patterns, characterized by high per capita land consumption (extended residential and service areas) and a higher demand for quality living standards (especially in terms of water consumption). The pressure exerted by these seasonal mass movements impacts the environment, economy, and cultural and natural heritage. In some cases this favors development, but in many others it alters fragile equilibria.

The case of the Province of Alicante in Spain is emblematic. Due to uncontrolled urbanization along the coastline, a “wall of cement” is the result of a development policy based on mass tourism. It has had a severe impact on the environment and is now recognized as the cause of loss of fragile coastal ecosystems (humid areas) and of accelerated coastal erosion. Similar situations can be observed in the Greek Islands, where rapid degradation of water resources and increasing costs of waste disposal constitute additional issues.

With regard to Italy, it is one of the most populated counties in Europe. It has an average population density of 189 people/sq. km., but with a density of 500 people/sq. km. in the plains and along the coast, where 18 million people live. This population increased by 30% between 1951 and 1991. The presence of tourists in coastal areas, furthermore, exceeds 30 million per year. Tourist settlements created “linear cities” with a total volume of 3 150 000 m<sup>3</sup> of buildings, of which 850 000 m<sup>3</sup> are used only during summer. The last decades have been characterized by lack of integrated planning of urban and rural development. Illegal settlements, furthermore, even if not important in quantitative terms, as in other countries, have had a significant environmental impact.

-  
-  
-

TO ACCESS ALL THE 19 PAGES OF THIS CHAPTER,  
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

### **Bibliography**

Ben Ali, D., Di Giulio, A., Lasram, M. and Lavergne, M. (Eds.) (1996). *Urbanization et Agriculture en Mediterranee: Conflits et Complementarites (Urbanization and Agriculture in the Mediterranean: Conflicts and Complementarities)*, 584 pp. Paris: Editions l'Harmattan. [This book deals with the problem of anthropogenic pressure, due to urbanization, on Mediterranean coastal areas in general, and with particular reference to southern and eastern Mediterranean countries. Case studies are presented and discussed].

Brandt, J. and Thornes, J. (Eds.) (1998). *Mediterranean Desertification and Land Use*. Chichester, New York: John Wiley and Sons. [This book is a collection of contributions on various aspects of desertification in the northern Mediterranean. It summarizes the results of the first phase of the MEDALUS (Mediterranean Desertification and Land Use) research project financed by the European Commission under its Environment and Climate Program].

Camarda D. and Grassini, L. (Eds.) (2000). *Interdependency between Agriculture and Urbanization: Conflicts on Sustainable Use of Soil and Water*, 374 pp. Bari: International Center for Advanced Mediterranean Agronomic Studies. [The book presents selected contributions from the first meeting of the Concerted Action on Agriculture and Urbanization in the Mediterranean Region financed by the European Commission under its INCO-DC (International Cooperation with Developing Countries) Program].

Comune di Alghero. (2002). Alghero: Ambiente e Turismo per uno Sviluppo Sostenibile – SLOT A21. (Sviluppo Locale e Turismo Agenda 21- Agenda 21: Local Development and Tourism; Alghero: Environment and Tourism towards a Sustainability [www.alghero.it](http://www.alghero.it)). [This publication presents a summary of the executive project financed by the Italian Ministry of Environment for the elaboration of a Local Action Plan under the Local Agenda 21 framework].

Enne, G., d'Angelo, M. and Zanolla, C. (Eds.) (1999). *Indicators for Assessing Desertification in the Mediterranean*. Rome: Agenzia Nazionale per la Protezione dell'Ambiente (Italian Agency for Environmental Protection). [This book reviews the methodologies used for assessing desertification in the Mediterranean region coming from research and institutional activities].

European Commission—DG Directorate-General Environment. (1999). *Sustainable Tourism and Natura 2000: Guidelines, Initiatives, and Good Practices in Europe*. Luxembourg: Office for Official Publications of the European Communities. [This document was produced for all the stakeholders concerned with the development of sustainable tourism within a Natura 2000 site and more in general in protected areas. The document presents selected case studies of good practice].

Madrau, S. and d'Angelo, M. (1999). Lo Studio dei Suoli e della Copertura delle Terre: un Contributo alla Gestione del Territorio. *Protezione dell'ambiente e gestione delle Risorse Naturali* (The Knowledge of Soil and Land Cover: a Contribution to Land Management). *Environmental Protection and Natural Resources Management* (ed. M. Gutierrez), 137-165. Padova: CEDAM (Casa Editrice Dottor Antonio Milani). [This contribution introduces the main components of the environment of the Alghero municipality with focus on soils, land cover, and land capability].

Mairota, P., Thornes, J., and Geeson, N. (Eds.) (1998). *Atlas of Mediterranean Environments in Europe: the Desertification Context*, 205 pp. Chichester, New York: John Wiley & Sons. [The Atlas brings to a wide audience the problems of desertification affecting the European Mediterranean countries, with a focus on background and management issues].

Perez, Trejo F. (1992). *Desertification and Land Degradation in the European Mediterranean*, 63 pp. Brussels: European Commission. [This booklet represents the first attempt to characterize the peculiarity of desertification in the European Mediterranean].

United Nations Environmental Program. (1994). *United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa*. Geneva: UNEP. [Since its entry into force in December 1996, the Convention represents the institutional framework for all actions that mitigate desertification].

### **Biographical Sketches**

**Giuseppe Enne** graduated in agricultural science. He is a full Professor of Animal Science and Director of the NRD (Nucleo Ricerca Desertificazione – Desertification Research Group) of the University of Sassari (Italy). He has more than 30 years experience in livestock and rangeland management in the Mediterranean environment and is a member of the Roster of experts of the United Nations Convention to Combat Desertification (UNCCD). He also is the co-ordinator of several national and international research projects, the author of more than 200 publications and editor of several books, and a member of several scientific societies.

**Massimo d'Angelo** graduated in Forestry, and is an adjunct Professor of Forest Biometry, and researcher of the NRD (Nucleo Ricerca Desertificazione – Desertification Research Group) of the University of Sassari (Italy). Currently he is also an Officer at the Ente Foreste della Sardegna (Regional Forestry Agency of Sardinia). He has 15 years of experience in remote sensing applications for land evaluation and management, and is the author of more than 50 publications.

**Salvatore Madrau** received his degree in agricultural science. He is an Associate Professor of Geopedology, and researcher of the NRD (Nucleo Ricerca Desertificazione – Desertification Research Group) of the University of Sassari (Italy). He is an expert in soil genesis and cartography with particular reference to the soil/landscape relationship. His recent studies are mainly related to land suitability and capability evaluation. Dr. Salvatore is also a member of the Italian National Society of Soil Science, the Italian National Society of Pedology, and the International Union of Soil Science. He is the author of more than 50 publications.

**Claudio Zucca** received a degree in environmental sciences and a PhD in pedology. He has been a researcher of the NRD (Nucleo Ricerca Desertificazione – Desertification Research Group) of the University of Sassari (Italy) since 1996. Zucca is also involved in several EU and national research projects on desertification and land degradation in the Mediterranean basin. He is the project manager of a SMAP (Short and Medium term priority environmental Action Program) cooperation project on rangeland rehabilitation in Morocco and Tunisia and is an expert in GIS (Geographic Information System) applications for the evaluation and management of soil and land resources with particular reference to soil degradation processes. Along with being a member of the Italian National Society of Soil Science, the Italian National Society of Pedology, and International Union of Soil Science, he is also an expert on soil degradation indicators and the author of more than 25 publications.