

The marine and coastal landscape: geological and cultural heritage

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Abstract. The activity carried in the frame of *Alternanza Scuola Lavoro* (ASL) training course, between the Institute of Marine Sciences of the National Research Council (ISMAR-CNR) in Naples, and *Liceo Scientifico Galileo Galilei* in Naples, was focused on issues related to the sea resource. After an accurate bibliographic research, aimed to the deepening of basic concepts on the components and dynamics of the Earth and Sea System Sciences, and practical activities (laboratory and field), carried out in collaboration with the researchers of ISMAR, the student was trained in a critical reading of the territory in terms of landscape forms, with particular attention to the geological definitions of Hazard, Risk and therefore Resilience. Technical sheets were elaborated, comparing the Neapolitan landscape of the marine-coastal environment, as portrayed in the pictorial works of *Vedutismo* ('700 - '800), with the current one, mostly modified by the anthropic pressure on the territory. The aim of the work was to raise awareness of the "consciences" on the protection and safeguarding of the marine territory. The experience conducted with the scholars has shown that the understanding and enhancement of the Neapolitan Landscape in scientific terms, represents a cultural heritage and can have broad and interesting implications in terms of sustainable economic development, as reported by the Convention European Landscape.

Keywords. marine-coastal environment, marine landscape, geological-cultural heritage.

1. Introduction

The present work is the result of a project idea that was born and developed within a training course of *Alternanza Scuola Lavoro* (ASL) between the Institute of Marine Sciences of the National Research Council (ISMAR-CNR) in Naples, and the *Liceo Scientifico Galileo Galilei* of Naples, on issues concerning the sea resource.

During the three years of the training course (200 hours) the student was able to deepen basic concepts of dynamics of the Earth and of the Sea System, in particular through a bibliographic research and interactive exercises with the researchers of ISMAR. The laboratory and field activities were focused on new techniques and methodologies for acquiring geological-geophysical data for the investigation of the marine-coastal environment, both emerged and submerged.

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Field trips and exercises were aimed to encouraging the student to critically read the territory in terms of landscape shapes, with particular attention to the geological definitions of Hazard, Risk and therefore Resilience of the territory.

A final verification and evaluation of what the students acquired during the project was valued through the compilation of summary sheets described the comparison between the Neapolitan landscape, as portrayed in the pictorial works of *Vedutismo* ('700 - '800), with the current one, today largely transformed [1] [2].

The critical reading of the most famous coastal landscapes of the Campanian land, can to raise awareness to new policies of integrated management of the territory, with particular regard to the protection and safeguarding of the sea resource and, to the geo-environmental security of Naples.

The geological landscape is part of the cultural heritage of the Neapolitan territory and can become a source of sustainable development projects with excellent economic and social implications.

2. The Landscape: a Resource

The landscape, in a basic way, can be understood as everything we see around us any land observation point. The elements that make-up the landscape can be grouped into two broad categories: natural elements, everything waxed by nature and, anthropic elements, everything subsequently created by the human action. In the definition given by the European Landscape Convention, and later in the Italian Law 14/2006, the Landscape is "a specific part of the territory, as perceived by the population, whose character comes from the action of natural and/or human factors and their interrelations", specifying how it is "an essential component of the life context of the populations, an expression of the diversity of their common cultural and natural heritage, as well as the base of their identity".

The territory's natural component is primarily the result of a geological becoming. Each Landscape originates its identity from a predominantly geological matrix, from ancient and continuous morphogenetic processes which, in addition to defining its modeling, have significantly influenced and still influence all the other biotic and anthropic processes peculiar to that territory [3].

The geologist who studies the forms, the nature and the genesis of the lands, has a fundamental role in the reading of the landscape and its becoming. Indeed, Geology is the the base for the Landscape reading and contributes to identify its macro and micro-forms, as well as their origin and evolution.

Geological knowledge is essential to recognize and evaluate the diachronic construction of the Landscapes and the "persistence" of their traces, to identify, protect and enhance the natural Heritage (*Geosites*) and, to assess evolution, from a sustainability perspective, of transformed or changing landscapes [4].

In this context, undoubtedly the Neapolitan territory, with its beautiful landscapes, is the result of a rich and complex geological history in which volcanism is the main protagonist. The effusive activity of *Vesuvius* and the *Phlegrean Fields*, in different shapes and ways, has always fascinated the sightseer who, from the beginning of the 1700s started to represent these beautiful landscapes in pictorial representations, sometimes rich in imaginary and charm with also the addition of ancient remains.

The Neapolitan Landscape, as portrayed in the *Grand Tour* [5], and more generally by the *Vedutismo* with the Posillipo School, must be read in a dynamic

relationship with the current one and not as a simple background for the figures shown in the foreground. The geomorphological and paleo-environmental elements that appear are precious testimony that permit not only to evaluate the evolution of the Geological Landscape over the centuries, but also to "contribute" to a more precise location of it, also in terms of evaluation of the Geo-environmental Risk.

A critical reading of the Landscape, based on a clear and accurate identification of the geological context and taking into account its evolution over time, in terms of anthropization, through the analysis of the artistic-cultural documentation, can give a better evaluation and awareness of Risk and therefore of the consequent actions in terms of Resilience of the territory. From the contents of a UNESCO report (1972) [6], acknowledged by the Exchanges Plans for the Hydrogeological Dissolution of Regional and National Basin Authorities, the Risk is defined as the product of three factors: Hazard, Damage on exposed value and Vulnerability.

The first consists in the probability that a damaging event occurs again for different times in a given time interval, and is inherent to the natural geological component of the site; the second is identified with the value of what is exposed to the effects of that hazard, that is the anthropic part; the third corresponds to which and how much of the exposed Value can be lost.

The strong anthropization of the last century, with a not well planned urbanization in terms of services and sub-services, also with high-impact industrial settlements, which is implanted in a geological context with a Very High volcano-seismic Hazard, as the Neapolitan one, can only create an increase in risk at alert levels, such as to impose sustainable territorial management policies designed to favor technical interventions to encourage greater resilience.

It is possible to resume the definition of "Active Landscape" reported in the European Landscape Code: any place that, related to others and with urban and rural spaces, "creates" with them complex interrelations giving shape to "Exceptional landscapes" or to "Deteriorated landscapes of daily life" [7].

3. The Training Project

The *Alternanza Scuola Lavoro* (ASL) courses (MIUR project made obligatory by the reform of *Buona Scuola* brought from the Italian Law 107/2015), provide, to the young students of the secondary schools of second degree, the opportunity to gain work experience before graduation. It is an educational methodology based on the development of learning processes, which promote the culture of work and give priority to the dimension of the experience, guiding the didactic field of the Plan of the Educational Offering of schools. Alternance hours are an integralessential part of the curricular activity and are distributed over the whole school year, so as to ensure that the student involved has a significant presence, in terms of time, in the context of work reality.

A sufficiently long stay encourages and enhances the role of the partner institution and gives the student the opportunity to understand the language of the organisation, using it to acquire knowledge and skills not only professional, but also social and relational. Learning by doing responds positively to the training needs of each individual student. The model of ASL aims not only to overcome the idea of disconnection between training and operating, but also has the most incisive objective of increasing motivation to study and guiding young students in the discovery of

personal vocations, interests and styles of individual learning, enriching school education with the acquisition of skills acquired in the field. This condition guarantees a competitive advantage over those who limit their training to the theoretical context alone, offering new incentives for learning and added value to personal training.

The ASL training course conducted by the CNR with the Liceo Scientifico Galileo Galilei in Naples, lasting a total of three years (200 hours), can be considered in the context of the enhancement of the education to cultural artistic and landscape heritage, as well as the protection of the Neapolitan territory and its Sea [8].

The activity of the first year was focused on the deepening of some basic concepts related to the components and dynamics of the of the Earth and the Sea System Sciences, in particular through a bibliographical research and interactive exercises with specialized researchers. The laboratory and field activities enclosed the new techniques and methodologies of investigation of the geological-geophysical and geochemical data in marine-coastal environment. Specifically, the investigation of the geological “datum”, aimed to the scientific study of the marine-coastal environment, was developed, through field activities in the area of the City of Naples.

Starting from the second year, the ASL activity was directed towards the definition of the Hazard and geological Risk: $(R=HxDxV)$

$$Risk = Hazard \times Damage \text{ on the exposed value} \times Vulnerability \text{ of the exposed value}$$

Several types of geological risk (seismic, volcanic, hydrogeological, and environmental), techniques and methodologies of investigation up to those of graphic representation of data have been addressed [9] [10] [11] [12].

During the third year, with the application of the concepts acquired through a critical reading of the landscape, the students acquired the concept of resilience and therefore of possible land Neapolitan recovery, in environmental and socio-cultural terms.

In the last step of verification and control of learning the student was invited to read a painting work (vista), depicting a landscape foreshortening of Campania Felix.

The interaction between man and landscape is continuous over time basing itself on multiple aspects related to four fundamental concepts: knowledge, perception interpretation, and intervention.

The art of painting, from time to time, stressed one or more of these aspects. In medieval painting for example the landscape was mostly the background of a sacred subject while in the expressionism the landscape becomes rather inner representation. But it is between the end of '600 and the beginning of '700 that the landscape results in a real topographic representation, with a strong degree of adherence to the truth. During this period the artists who try themselves in the painting of sight were few and focused their attention on the city that, by vocation, presented urban glimpses of great suggestion. From this period onwards the analysis of the pictures reperesented an excellent tool for studying the landscape of the era and a base for comparison with the current one to understand how much the man was impacted on it.

The comparison, between the current landscape and the historical portrait in the picture, makes it possible to identify analogies and differences in the spatial dynamics, or to highlight the variation of the anthropic conditions on the territory characterized by a geo-morphological context with an intrinsic hazard. From the analysis of the landscape modifications by anthropization, it is possible to define the degree of

geological risk to which the area portrayed is subject and therefore also succeed in proposing actions of prevention and mitigation of risk (Resilience).

For each landscape view a technical sheet was elaborated, summarizing the critical reading in terms of risk and resilience and aims to raise awareness about the protection and protection of the territory. The connection to the *Grand Tour* increases the artistic value of the Geological Landscape also in a highly anthropized territory, such as the urban one of Naples, but at the same time can be a resource in terms of sustainable economic development.

4. The Resilience

Cities are truly complex urban systems, non-linear, capable of self-organization, which are constantly conditional by the action of uncontrollable factors, which are the result of internal system processes or exogenous factors. Understanding individual factors is the key to identify the capabilities that a given system needs to possess in order to be resilient, or able to cope with external or internal pressures by preserving its characteristics and structure, or by adapting or modifying to changing conditions. The concept of resilience is used, with not always homogeneous meanings, in many disciplines: engineering, natural sciences, ecology, psychology and sociology.

In recent years, this concept associated with strategies for the development of urban and territorial systems (Resilience and Resilient City) - had a very wide diffusion and become a fundamental reference point for guiding innovation in the field of policies and strategies for sustainable development of the territory. Social institutions and organisations involved in the protection, management and maintenance of the environment and willing to promote regeneration and territorial and urban development projects, however, are faced with a complex concept with still not fully clear implications [13]. In the most innovative research and experience aimed at mitigating territorial risks, the concept of resilience was therefore assumed a fundamental role in the construction of strategies that integrate the objectives of risk reduction and dangerousness with those related to the territorial quality. In recent texts, the study of resilience, while referring to the issue of territorial risks, includes more general objectives: a system that is more resilient to territorial risks is, and should be, in general, a territorial urban system of higher overall quality (environmental and social).

Then, analyse an urban landscape in its geological/geomorphological elements, identifying the potential natural risks in relation to the strong anthropic presence is the starting point for building a path in terms of environmental resilience.

5. Analysed indicators and technical sheet

Considering that the landscape can be defined as a part of the territory whose character is given by the interaction between natural actions and the human footprint (anthropic activity), in agreement with the European Landscape Convention and consequent Italian Law 14/2006, it is obvious that the indicator elements for a critical reading of the landscape focused on the definition of Risk and therefore of Resilience towards any catastrophic events to which the territory is subject, are to be identified in at least two main ones: *geomorphology* and *anthropization*.

- *Geomorphology*

The geomorphology [from the Greek γη (ge), in Italian "Earth" and μορφή (morphé), "Shape" and λογος (logos), "Speech, Treatise"] is the science that studies the morphology of the earth's surface, that is the forms that constitute the relief of the territory, investigating its origin and evolution. In particular, geomorphology studies the correlations between land morphology, its lithological features and the processes that have modified it.

For the Neapolitan territory, the typical geomorphology of the volcanic areas is characterized by conical shapes with steep slopes that can be found both in the Vesuvian area and in the Phlegraean area, passing through the Ischia island, associated with the lithology of outcroppings capable to favor the presence of pyroclastic effusive deposits.

- *Anthropization*

The presence of man, as a result of his action on the natural component of the territory, is identified with anthropization. In geography and ecology, anthropization (from the Greek ἀνθρώπος man) is the conversion of open spaces, landscapes, and natural environments by human action, which results in the historical-cultural value of the territory, that is the value exposed to natural hazard, necessary in the estimation of geological risk and in the development of preventative measures for resilience assesment.

The critical reading of the landscape, inspired by the comparison between yesterday's and present, that is between the current landscape and the pictorial work (Figure 1), is aimed at identifying the Hazard (intrinsic in the geological nature of the area), Risk (as the result of the Hazard in relation to anthropization or of historical-cultural value and of its own vulnerability) and Resilience (ability of the territory to resist the natural event, in particular to catastrophic ones).



Figure 1. Comparison between the view of Naples from the sea at the present state (left) and as portrayed in the painting work (right) reported the Departure of Charles of Bourbon for Spain view from the sea (1759) by Antonio Joli (National Museum of Capodimonte, Naples).

The reading of the landscape is summarized through a technical sheet (Figure 2) which shows, in addition to the identification of the pictorial work and the author, and the contextualization in the territory (main components), also the indicators: geomorphology, with associated danger, and the history of the territory (human activity or anthropization). The comparison between yesterday and today is analyzed as a possible anthropic impact that has the effect of increasing the exposed value and its vulnerability, determining a greater geological risk to which the territory is subject and which should therefore stimulate a better management policy in terms of of resilience [14].

Landscape	Current view
Pictorial work	Painting
Painting description	Title: Place: Year: Size: Exposure:
Author	
Reason for the choice	
Description of the main components	Country location: Region: Province: Exstension: Housing density: Climate:
Hystory of the territory	
Geomorphological and hazard data	
Risk	
Comparison between yesterday and today	
Resilience	
Bibliography and web sites	

Figure 2. Example of technical sheet used for the landscape analysis.

6. Conclusion

The project experience carried out during the *Alternanza Scuola Lavoro* Project with the students of *Liceo Scientifico Galileo Galilei* of Naples, highlighted that the understanding and enhancement of the Neapolitan Landscape in scientific-cultural terms, may have wide and interesting implications, in line with what reported by the Convention European Landscape.

The Neapolitan Landscape, more than any other at national level, represents a geological-cultural heritage of significant importance, and of international appeal, and therefore must develop integrated management policies based on environmental and landscape quality indicators, aimed at boosting jobs. In this respect, besides the safeguarding of the geological landscapes, that can be identified as Geosites, protected areas such as the *Vesuvius* and the *Phlegrean Fields*, all the urban landscapes must be protected, particularly those where the sea is still the protagonist.

The Cultural Wealth of the Neapolitan territory is strongly represented by a geological-landscape component that, appropriately developed and encouraged in terms of Geo-tourism, particularly in the field activities with the use of digital information through mobile applications, could represent an excellent form of sustainable economic development for the territory.

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