COASTLINE GEOGRAPHY AND COASTAL LANDSCAPES: TERRITORIAL DYNAMICS AND INTEGRATED PROTECTION

1. Introducing coastlines and landscapes

Coastal areas are strategically important in the Mediterranean as they perform natural, residential, recreational and commercial functions of particular relevance. Their protection and development must therefore take into account the physical, environmental and cultural characteristics of their territory and of the society that uses and manages them.

From a geographical point of view, coastlines are an evident border while approaching the land from the sea, whether by a conqueror in the past, or by a tourist at present. They mark a transitional zone between inland and outland, revealing the delicate equilibrium between environmental and human needs (Pungetti, 2012). However, often resource consumption along the coast prevails over the need to conserve biodiversity and marine ecosystems. In addition, natural dynamics on coasts, alongside human dynamics, are visible with bradyseism, coastal erosion, soil contamination and desertification.

From a landscape point of view, coastal landscape types vary from natural to seminatural, from recreational to urban. Coastal landscapes have been transformed during times to accommodate human needs, and only a few areas of the world present intact natural features, generally conserved by natural reserves, parks and marine protected areas. Merely coastal landscapes are nowadays seminatural, but a great deal of them have been urbanised and used for tourist, trading and residential purposes, causing several problems to their fragile ecosystems, which require more protection and recognition. Hence the complexity of these issues calls for the involvement of a variety of disciples before tackling the problem properly (Pungetti, 2017).

This is the reason why it has been chosen to expand the Session of the VIII *International Symposium on Mediterranean Coastal Monitoring* to a diversity of topics that go from natural, socio-cultural, economic and legislative aspects of coasts, to their various forms of anthropisation and environmental restoration. Accordingly, a link between geography and landscape has been proposed, allowing the comparison between two disciplines so relevant for both land and sea.

This Session on *Coastline Geography and Coastal Landscapes* includes, therefore, works dedicated to a) the geography of coastal strips, and b) the dynamics of landscapes in the Mediterranean Basin. From the history and description of coastal landscapes, the session expands to its planning and integrated management of coastal areas, aiming to provide an interdisciplinary discussion on the above topics, and to suggest ideas for the conservation and development of coastlines and their landscapes.

2. Between nature and culture

Marine ecosystems are very fragile in the Mediterranean for the continuous human pressure they undergo. As shown in a research by Salaün, Pioch and Dauvin, artificial reefs are important tools to protect and manage these ecosystems. In fact, although they have been originally used for fishery purpose, they have recently been used also in ecological engineering to restore specific habitat functions in the Mediterranean France. For example,

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they have been employed in eco-mooring, and as a substitute for natural reefs for diving activities. In addition, they have been used to sustain artisanal fisheries and to increase fish supply. As a result, the research has proved that artificial reef are also social tools for an integrated approach of an ecosystem-based management of coastal areas.

A sound integrated approach calls, in turn, to Integrated Coastal Zone Management (ICZM). This topic is also tackled by Tagarelli, Cantasano, Caloiero and Pellicone in a study linking Natura 2000 and cultural heritage sites on the Calabrian coast, where natural and cultural heritage are threatened by coastal erosion and human impact. This is evident in the seaboard landscape, meant as the long, thin area of a region that is next to the sea (Cambridge Dictionary, 1995). To overcome this risk, ICZM is urgently needed along these coasts to bridge nature and culture without compromising their heritage.

It is indeed crucial not only to protect, but also to restore natural and cultural heritage of coasts, especially in historic areas like the Mediterranean. To achieve this, strategic vision and design scenery are necessary in planning for sustainability, as accomplished by Pidalà research on the Nebrodi coasts of Sicily. In the division of the coast in three "macro dimensions", i.e. beach, dunes and waterfront, comes forward the complexity of the coastline, where natural and human activities intertwine and develop, shaping land, shores and seas. Because of this complexity, mosaic landscapes are created, and when the impact on the marine environment is strong, criticality and negative effects occur. The answer is a new vision and a new scenario, which have foundations in the sustainability paradigm.

The complexity of mosaic landscapes emerges clearly in areas where territorial dynamic is high. One of these is the harbour environment. As Russo points out, past planning influence deeply the present and future coastal landscape and can alter its original feature creating a type of mosaic landscape difficult to manage. The port of Salerno on the Tyrrhenian coast is an example. Created in the Middle Ages, it deteriorated over time due to problems of cover-up, first, and wrong orientation later, with massive landfill phenomena leading to beach erosion. Therefore, a special regulatory plan has been developed, to carry out multiple defence interventions by sheltered cliffs that filled the coast, resulting in a total metamorphosis of the coastal strip. A coastal road has been also built for the new coastal settlements, together with the railway line that has connected the port to the city railway, halting ecological connectivity and dynamics.

Historical landscape developments are recorded in literature, mapping and images (Rackham, 1986; Pungetti, 1996), as well as through oral traditions and stories. A story telling experiment has been attempted by Ghersi in Capo Mele, on the beach of Laigueglia near Savona in Liguria. With a series of research actions from the study of biodiversity to the transformation of the beach, the research has explored material and immaterial resources regarding the place, and has moved to a series of micro-interventions for the public. These have outlined a new way to enjoy the beach, proposing different recreational and cultural activities, which make to reflect on the dynamics of coasts, with their sensitive and eco-sustainable management. Consequently, the initiative has conveyed to the beach the function of an active museum, a unique place for testing and monitoring new mechanisms for the use, protection and narration of landscape values, thus promoting socio-cultural development and biodiversity awareness.

The monitoring of cultural values is a topic which requires further development. An effort has been made by De Marchi, Lalli and Mancini with the online monitoring of environmental perception on the coast of Sicily. The Data Appeal Artificial Intelligence has been employed analysing reviews of texts and scores on Tripadvisor and Google from less than a

hundred public beaches in Sicily, in order to verify the level of cleanliness perceived by the users, and the main factors that determine a positive or negative judgment in the general perception. The findings have resulted in the monitoring of environmental conditions using available data posted online, which has then been processed and analysed by artificial intelligence.

The natural and cultural values of coasts and their landscapes should be not only studied, but also disseminated to young and adults through education and training. A large group of researchers (Altavilla et al.), has been involved in this task, carried forward environmental training for the Italian Coast Guard, an operational organisation for marine environmental protection. On top of standard teaching methods, i.e. face to face teaching, remote classes, use of case studies, simulations and exercises, the group has experimented hands-on training. This learning by doing has guaranteed the effectiveness of teaching, with students' involvement and experiential memory.

3. The other coast

Beyond the sea there is "the other coast", not to be confused by the famous cartoon, but to be spotted in the fresh water of rivers and lakes. In the new link between town and water brought about by climate change, the rivershore shows new features. See level rise, thermal waves and torrential rains will be more common in the Mediterranean, affecting systems of coastal urban areas, for example the drainage system. To overcome this problem, Casu and Zaccagna have suggested to rethink at the role of urban spaces, considering a Sustainable Urban Drainage System for a more efficient management of the water cycle. This has led to a study on the estuary of the Tagus river in Lisbon, redesigning the relationship between water and city, with the purpose to make this urban area more resilient. Three scenarios have been proposed: one related to land use planning, two related to design and infrastructural choices.

Lakes present also interesting coastal environments. The microclimate of Lake Garda, for example, allows the growing of lemon houses along its coast, although located in north Italy. The so called *"limonaie"* are ancient terraced citrus gardens that not only shape the landscape of the lakeshores, but are repository of traditional culture and contemporary society. No longer crucial for the economic sector, they have moved toward natural and recreational functions. In this context, Cazzani and Barontini have offered an interpretation of Lake Garda *limonaie* as anthropogenic, labour intensive, multifunctional landscapes. With their steep calcareous slopes, local flora and fauna, bioclimatic adaptation and distinctive irrigation, this citrus cultivation play a central role in the symbiotic relationships between man and nature. Therefore, to preserve the fragility and peculiarity of the lake landscape, a holistic agro-eco-systemic perspective should be developed, taking into account the cultural heritage of *limonaie*.

Biodiversity and anthropisation are also the characteristics of three coastal lakes of Campi Flegrei near Naples. The deep link between nature and culture in this environment has been illustrated in a recent research by Giudici, Jannuzzi, Patrizio and Pisani Massamormile. Examining ancient literature, archaeological remains and previous studies, deep changes of this territory have emerged during the times. Geography, ecology geology, volcanology and hydrology are the basis for studies of this type, which anyway need to move forward to provide sound tools for integrated protection; this being a goal of this Symposium Session too. In this spirit, after analysing problems of careless, lack of planning and engagement tools, the need of restoring natural ecosystems and cultural landscapes has been highlighted by the research, integrating territorial needs such as nature and culture conservation, quality of life,

tourism and economy. Moreover, to succeed, stakeholders must be involved in actions for waterflow recovery, nature conservation and landscape restoration.

4. Scenario for development and planning

Scenarios are the foundations for coastal development and planning. Hydrological scenarios, for example, have been elaborated by Venudo, Rodani and Devescovi to explore potential design strategies for the Low Friulian Plain. Aiming at investigating the complex territorial transformation, the morphological history of a landscape unit has been described as a blend of biological deserts and wrecks of endangered landscapes. On the basis that hydrological risk represents an intrinsic and retroactive vulnerability of the area which could be adapted and mitigated, there is a need to recover, restore and monitor the water margin continuity through flooding strategies able to prevent future fluctuations. The foreseen scenario can therefore form the base for an overall masterplan for the Friulian "deserts", aiming at its renaturalisation by means of preserving biodiversity and reducing fragmentation. A new landscape, finally, can take shape, reconstructing the environmental continuity and configuring the watershape within an ecological network for the Friulian deserts.

Development between infrastructures and innovation has always been a challenge in coastal areas. An attempt to create scenarios of the port area of Trieste, seen as an incubator of innovations, has been made by Bisiani and Savron with the objective to define a new landscape able to enhance activities that can provide quality of life and employment opportunities. In particular, a new landscape can be designed with modern technology, where infrastructure and storage space, both physical and digital, minimize the presence of man, configuring the logics of a new artificial living.

Scenarios for planning, moreover, are crucial in regional and local governance. The theoretical scenario implemented by the municipal plans of the Romagna coast has been recently analysed and discussed by Zullo, Fiorini, Marucci and Romano with the aim to highlight how their forecasts can change the future settlement structure, especially in highly urbanized coastal strip next to extremely fragile environments. New tools necessary for future developments are indicated in a technological platform linked with the environmental assessment procedures of plans for the optimised location of new settlements. Such optimisation would provide afterwards a balance between tourist economy and ecosystem preservation along the shores, with a strategically driven vision capable of directing territorial policies, environmental regeneration and sustainable transformation in the long run.

Extreme littoralisation, furthermore, is a common trend of contemporary seashores. The RE.CO.RD. project - Recycling strategies for the coastal sustainable waste management towards E&D innovation - of the EC Interreg Programme, aims to develop new strategies to arrest the environmental impact of economic activities linked to tourism in coastal areas. As outlined by Epifania and Pollice, networking and governance play key roles in the sustainability of coastline, and accordingly coastal developers have and active role for environmental qualification, and at the same time for the sustainable development of coastal tourism. Hence a multifunctional approach must be applied to coastal management of touristic areas.

It is not unusual to note indiscriminate soil and resources exploitation in favour of land use, threatening very fertile coastlines. The paradox, as Mazzeo points out, consists not of the lack of legislative or planning instruments for the regeneration of natural and agricultural sites, but of the poor results they produce, the uncontrolled urban expansion, and a management

completely indifferent to territorial risks. Despite this, possible intervention policies have been proposed in the Domitian coast in north Campania to redevelop this territory.

A different planning experience is described for the Tuscan coast by Saragosa and Chiti. With the objective of outlining the flows of energy in relation to the territorial structure, a cross scale survey methodology has been applied to analyse which settlement configurations can support quality of life. Future research development is however required to explore how the designed solutions support resilience. Hence it would be useful to evaluate the degree of adaptation and survival of species, and to find ways to manage through spatial configurations the ecological flows within the morphogenetic processes of settlements.

Territorial planning is often implemented at two levels: strategic with guidelines, and operational with plans. In harbour regions, the Strategic System Planning Document belongs to the first, and the Port Regulatory Plan to the second. A methodology to identify the port areas which influence the city has been proposed by Palano, Del Corona, Montioni, Pichi and Scamporrino, measuring the degree of such interaction through indicators. The study has formed the basis for the perimeter of the new port-city interaction areas within a Strategic System Planning Document for the North Tyrrhenian Sea.

5. Tools for monitoring and management

Before embracing any territorial management process, monitoring is essential to gather the necessary information on the state of the art of the territory involved. In turn, monitoring and management require tools to carry out the process. Among these are data bases, the foundation of any investigation. On this line, Esposito and Bosi have proposed a database to support sustainable coastal zone management, namely the LaCoast Atlas. This lays in the context of the LaCoast Project on land cover changes in coastal zones, i.e. a geo-referenced database that constitutes a tool for integrated spatial analysis of policies. The LaCoast Atlas database, built from Corine Land Cover database, Landsat images and desk teamwork, has investigated coastline changes, meant to provide indicators for European coastal zones management in order to support land use decision-making.

Mediterranean coasts, as well known, are under increasing human pressure, which has degraded ecosystems and landscapes. A particular challenge is the control of marine litter, which is causing increasing plastic pollution in our seas. Accordingly, a study aimed to analyse and to quantify the abundance, weight and compositions of marine litter has been carried out by a large research group (Corbau et al.) along two beaches of the Asinara Island in Sardinia. Analysing the marine litter, it has emerged that plastic fragments, lolly sticks and string are the most frequent type of debris.

The management of degraded material is doubtless a priority in the Mediterranean Basis. Lolli, for example, has clearly highlighted how our seabed is full of debris. Their removal from the seabed is imperative to maintain downflow conditions and land reclamation, to guarantee coastal protection, and to ensure navigability and port accessibility. Nevertheless, the fragile marine ecosystems are under threat by unsustainable dredging and management operations. Dredged material, in fact, should not be considered just waste, but in some cases it could be considered a resource. Further research and work, however, should be put forward to develop this resilient concept.

The above validates the importance of a vision for the future management of Mediterranean coastal settlements and landscapes. A synthesis among database, analysis,

tools and outlook has been attempted by Scamporrino in a study aimed to overcome a rigid zone planning, which has proved inadequate to manage Italian harbour transformation, in favour of a quali-quantitative approach supported by the View Management method consolidated in North Europe. Visual impact measuring instruments, accordingly, have been used to measure the visual and scenic impact known as "View Management". This method can provide useful tools for the analysis, design and planning of urban and landscape transformations at visual and scenic level, especially in the mosaic landscapes of coasts with historical permanence. Their protection and valorisation are in fact significant to raise awareness on local identity, cultural heritage and image of coastal settlements and landscapes.

6. Conclusions

The Session Coastline Geography and Coastal Landscapes of the VIII International Symposium on Mediterranean Coastal Monitoring has demonstrated the key role that coastal areas play in the Mediterranean Basin, not only for their natural and recreational role, but also for their residential and economic purpose.

Mediterranean coastal landscapes, whether facing sea, river or lake, retain both natural and cultural values which are often threatened by human activities. It is hence necessary to protect these values, and to provide sound tools for ICZM, like up-to-date databases, monitoring processes, participatory design and planning.

Research, however, has outlined that, despite serval legislative and planning measures are in place, there is still the need to implement a broad vision, interdisciplinary research, strategic planning and integrated management in order to protect, as well as to develop, Mediterranean coasts and their landscapes.

7. Acknowledgements

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