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Laura Bonora, Donatella Carboni,
Matteo De Vincenzi



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INTEGRATED COASTAL ZONE MANAGEMENT OF NATURA 2000 AND CULTURAL HERITAGE SITES IN CALABRIAN COASTAL LANDSCAPE (SOUTHERN ITALY)

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Abstract – This study shows the link connecting natural and cultural goods in the coastal landscape of Calabria (Southern Italy), considering seaboard and human impact risk conditions. In fact, Calabria has 58 Natura 2000 sites located on seaboard areas within a length of 300 meters from coast and 63 cultural heritage sites of which 42.9 % coincides with the Natura 2000 network. As a results of this paper, the increasing coastal erosion and a heavy human impact have been highlighted as the main hazards to which the natural and cultural goods are exposed, thus it's necessary a broader approach for the integration of natural and cultural issues into an active Integrated Coastal Zone Management process.

Introduction

Since the beginning of mankind, coasts have always been engaging to people around the world. The reasons of this attractiveness were based on marine food resources, more favourable climate, coastal lowlands to develop agriculture/urbanisation and, also, best opportunities to facilitate the flow of trade [Pinder and Vallega, 2003]. Millennial presence of human coastal settlements left tangible and intangible memories that, nowadays, represents a fundamental part of cultural heritage of coastal populations. In order to restore, preserve and sustain landscape, natural resources and cultural heritage and to promote a social and economic sustainable development, European Union has promoted the Protocol on Integrated Coastal Zone Management in the Mediterranean (ICZM) signed by Mediterranean countries in 2008, which represented the first legal instrument on this issue [Barale and Özhan, 2010+]. The main objective of ICZM protocol is to improve the sustainable development of coastal zones, ensuring that environment and landscapes could be integrated within the economic, social and cultural development of local people for the benefit of current and future generations. By this way, all the contracting countries are invited to realize sound measures to protect, appreciate and promote the cultural heritage of coastal zones conforming to national and international policy. In Italy, the idea of an overall coastal management became a basic question just from 1982 when the issue was addressed by the Italian law n. 979 which established a general planning for sea and coastal defence and providing for purpose the first marine protected areas, defined as marine and coastal environments with a remarkable richness of fauna and flora species, considerable natural and geo-morphologic features, all showing important cultural, social and economic roles [Satta et al., 2016].

Focusing attention between Italian coastal regions, Calabria is a very interesting case study to understand how both natural and cultural heritage of a seaboard landscape could

be managed within an effective and holistic ICZM planning. Calabria extends for about 250 km from north to south in the middle of the Mediterranean Sea. It shows a coastline of 715.7 km, as the 9.7 % of the whole Italian coastal boundary, extending in the middle of the Mediterranean basin. Due to its geographical position surrounded by the Tyrrhenian and Ionian Sea in the western and eastern sides, respectively, and for its higher altitudinal gradient interesting the Apennine chain, Calabria is one of the richest areas in biodiversity across the EU, [Marziliano et al. 2016]. In fact, the Calabrian sites of Natura 2000 network cover a surface area of about 4.2 % of the whole regional territory and are characterized by the presence of 29 faunal species, 8 of vegetal species and 69 habitats of priority interest included in 92/43 Directive. These last sites supplement the Calabrian regional network of protected areas including 3 national parks, 1 marine protected area, 12 public biogenetic reserves, 3 public oriented reserves, 2 regional natural reserves, 4 protected oasis, 1 regional natural park and 5 marine regional parks. At the same time, from both anthropological and historical point of view, Calabria is an interesting region, for the historical presence of Greek colonization and Roman domination. Moreover, the region passed to the Byzantines, the Lombards and the Normans and, with the rest of southern Italy, to the Hohenstaufen, Angevin, Aragonese, and Bourbon [Placanica, 1999]. Finally, it is interesting to note that the Arbëreshe community, of Albanian origins, settled in this region since the 16th century and is currently located in 25 communes in the provinces of Cosenza, Catanzaro and Crotona [Altimari and Savoia, 1994].

The aim of this study is to pinpoint the risk factors that endanger both natural and cultural heritage located along the Calabrian coastline. At the same time, the authors wish to highlight the actions, within ICZM planning, able to guarantee, simultaneously, protection and use of natural and cultural heritage of Calabrian coastal landscape.

Materials and methods

Special Areas of Conservation (SACs), together with the Special Protection Areas (SPAs), establish a European network of protected natural sites, called Natura 2000. All the protected areas are defined in the European Commission Habitat Directive (92/43/EC) and in the Birds Directive (2009/147/EC) as sites which contribute significantly to the maintenance or to the restoration, at a favourable conservation status, of natural habitats or species, contributing significantly to the maintenance of biological diversity within the biogeographic region to which they belong. In this study, this characterization has been carried out to realize a new kind of landscape pattern able to integrate and improve the environmental, cultural, economic and social issues within the European regulations concerning ICZM process. With this aim, the SACs and the SPAs localized along the Calabrian coastal zone and, especially, the Natura 2000 sites, falling within 300 meters from the high water mark following the “Galasso” Law (1479/89), have been identified. Besides, the cultural sites present along the Calabrian coast, within an area of three hundred meters from coastline have been selected. Finally, the only two islands existing along the regional seaboard have been considered: the islands of Cirella and Dino. This kind of approach belongs to the guidelines of ICZM Protocol and, in particular, to the article 12 which recognizes “special protection to islands, including small islands”. The selected Natura 2000 and cultural heritage sites have been then grouped following these criteria: 1) cultural

heritage sites located within Natura 2000 areas; 2) cultural heritage sites located within a spatial neighbour of 200 meters from the borders of Natura 2000 sites.

In order to take into account the coastal vulnerability, the Coastal Erosion Hazard areas have been considered. This geographical information is drawn by the Extract Plan of Coastal Erosion (PSEC) realized by Calabrian Regional Basin Authority. In the PSEC, the littoral belt, affected by processes of coastline withdrawal, is marked by three different hazard levels from the lowest P1 to the highest P3. This classification results from a multi-temporal analysis of coastline which allowed to characterize the coastal evolution and, especially, the speed of shoreline retreat. A routine in R statistical computing environment [The R Core Team, 2018] has been developed to realize proximity and overlay analysis.

Results

Calabria has 179 SACs and 6 SPAs [MATTM, 2017]. Among these, 55 SACs (30.7 %) and 3 SPAs (50.0 %) have been chosen because they are located totally or partially on seaboard areas within a distance of 300 meters from coastline (Fig. 1).

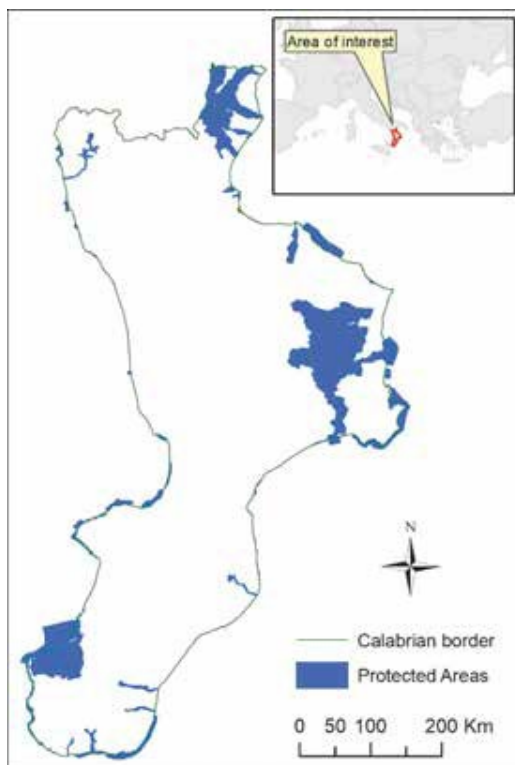


Figure 1 - Localization of the protected coastal areas.

Amongst the 58 Natura 2000 sites, 313 habitats have been considered, including marine (13 %) and terrestrial (87 %) ones. The overlay between Natura 2000 sites and the coastal erosion risk areas evidenced that 85 % of Natura 2000 sites exposes the 50 % of their surface areas to a high risk of coastal erosion (P3).

Sixty-three cultural heritage sites have been identified: eight castles (12.7 %), five churches (8.0 %), thirty-seven coastal towers (58.7 %), eleven archaeological sites (17.4 %), and two Roman fisheries (3.2 %). The overlay with the coastal erosion risk areas evidenced that 76 % of these cultural goods, scattered along the regional coastline, is characterized by a low erosion risk (P1), at a mean distance of 85 m from coastline. Moreover, 3.2 % of the sites, at a mean distance of 3 m from coastline, fall within a medium erosion risk (P2), while, a high erosion risk (P3) characterise 20.6 % of the sites, at a mean distance of 25 m from coastline. In particular, considering the geographical distribution of the sites, 42.9 % of the ones located in the Tyrrhenian side of the region fall within areas with a low erosion risk, 1.6 % within areas with a medium risk erosion and 11.1% within areas with a high risk erosion, with mean distances from coastlines of 90.5 m, 3.0 m and 12 m, respectively. Conversely, along the Ionian side, 33.3 % of the cultural sites are localized in areas characterized by a low risk erosion, 1.6 % fall in areas with a medium risk erosion and 9.5 % in areas with a high risk erosion. These coastal stretches are located at medium distances from coastline of 83 m, 4 m and 35.5 m, respectively (Fig. 2).

Besides, 49.2 % of the cultural sites existing on Calabrian coast are within the core of 58 Natura 2000 areas or within their buffer zones (200 meters). From the overlapping with the coastal erosion risk areas, 35% of the sites showed a risk P1, at a mean distance of 59 m from coastline, 2 % evidenced a risk P2, at a mean distance of 3 m from coastline and, 13 % presented a high risk (P3), at a mean distance of 12 m from coastline.

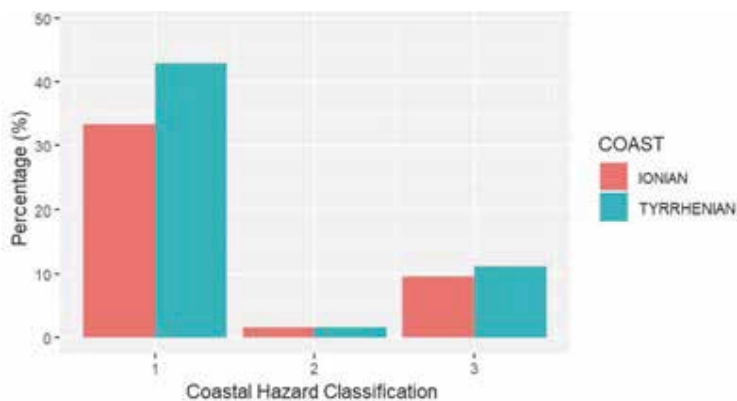


Figure 2 - Percentages of cultural heritage sites within the several classes of coastal hazard.

Discussion

To highlight how cultural heritage sites could be integrated into Natura 2000 ones within the process of an effective Integrated Coastal Zone Management in Calabria, in the

following some interesting case studies along the Calabrian coasts have been discussed. The purpose of such a choice is to highlight that both cultural and natural goods are exposed to the same risk of a partial or total loss.

In Calabria, 64 % of the coastline shows a high risk of retreat. As an example, the coastline between Gizzeria (38° 58' 48" N 16° 12' 24" E) and Belvedere Marittimo (39° 38' 11" N 15° 50' 40" E) in the Tyrrhenian side and between Punta Alice (39°24'04" N 17°09'21" E) and Capo Colonna (39° 01' 31" N, 17° 12' 08" E) in the Ionian seaside are mainly exposed to coastal withdrawal. In particular, the second area is an important coastal area with no artificial barrier. In fact, in this area falls the Marine Protected Area of Capo Rizzuto, one of the thirty-one Italian ones, representing a site of a great environmental marine value and Capo Colonna, whose name derives from the presence of a Doric column, the only remained in place of the ancient Greek temple of Hera (III century b. C.). Thus, this area is both an important cultural heritage site and a Special Area of Conservation that overlap in the same landscape pattern. The cultural heritage is characterized by an important archaeological area extending for about 60 ha which includes a set of Greek and Roman buildings remains going back to a period, extending from the eighth century b. C. to the third century a. C. [Mollo 2018] (Fig. 3).

Some of these remains and especially the buildings located in the eastern side of the archaeological site, are very closed to the sea with an average distance of about 7 m in a straight line from coastline, while part of a “domus” is already collapsed in the sea. From a naturalistic point of view, all the promontory is a Special Area of Conservation (IT 9320101) cause for

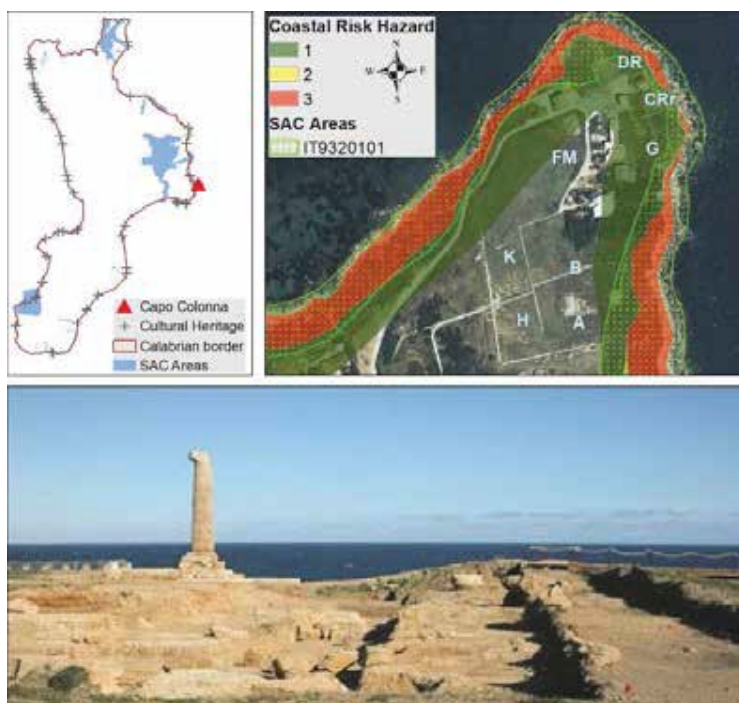


Figure 3 - Geographic position and photo representation of Capo Colonna site.

some coastal habitats: 1210, Annual vegetation of drift lines; 1240, Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp.; 1310, and *Salicornia* and other annuals colonizing mud and sand; 1430 Halo-nitrophilous scrubs (Pegano-Salsoletia). Obviously, the highest risk factor in this seaboard area is due to coastal erosion. Really, all the area is marked by three different risk levels from the lowest P1 to the highest P3. Similarly, to the case study of Capo Colonna, other sites are subjected to the same risk of coastal erosion. One of these is, just for instance, Capo Rizzuto (38°54'25" N 17°01'16" E) with a risk level P3. This sensitive area is another perfect case of landscape overlapping between Natura 2000 site and cultural heritage one.

The above areas have highlighted that the main hazard for both the natural and cultural heritage is related to coastal erosion. From an ICZM Protocol point of view, it is necessary a long-term planning to preserve and use both natural and cultural heritage in a global vision perspective. So, a new kind of integrated approach and “ad hoc” actions that should provide for a wider view in coastal management are needed. In particular, as regards coastal erosion, the need for an effective coastal defence system must become the main appointment for the regional authorities through a comprehensive coastal planning in order to avoid single emerging actions. With this aim, in some coastal stretches more damaged by erosional trends, it could be useful to realize operations of beach nourishment never realized along the Calabria coasts in the last decades [MATTM, 2017]. This recovering action must be realized through the selection of suitable sands drawn from seafloor beds close to continental shelf, using the same grain size of the native shore to be nourished. The beach nourishment, together with the demolition of the works of hard engineering, replaced by other operations of soft ones, are the recovering actions suggested by regional policy [Bertollini, 2010]. Particularly, the use of semi-submerged mattress in geo-textile materials filled with sands could guarantee a better protection of the underwater archaeological goods. Really, the use of these tools does not cause drastic measures for their placing on the seabed and are easily placeable and removable also upon archaeological remains without causing any damage [Aminti and Cappuccini, 2012]. Another kind of coastal restoration could be the transplantation of *Posidonia oceanica* (Linnaeus) Delile shoots [Piazzi and Cinelli, 1995; Medina et al., 2001], as well as the use of its seedlings [Pereda-Briones et al. 2018] through restoration projects feasible in some coastal areas more subjected to human pressure or close to dead “matte” of *Posidonia oceanica* meadows. Really, from data analysis and from a careful examination of the frequency distribution of marine habitats, the most widespread one, in Calabrian coastal waters, is *Posidonia* beds that represent a priority habitat of the Habitat Directive (code 1120*). In fact, *Posidonia* meadows is the typical marine ecosystem in the infra-littoral bottom of the Mediterranean Sea on mobile substrates, from the surface to a depth of approximately 35 ÷ 40 meters, being the “climax” stage of a successional process [Ghirardelli, 1981]. Finally, a further defence system against coastal erosion is represented by the protection and the restoration of coastal dunes. Really, from our results, coastal dunes appear residual and very fragmented along the Calabrian coasts, being present in the 39.6 % of Natura 2000 sites. The protection of these sensitive habitats must be realized through nature-based solutions (e.g. braidings, and geo-textile nets) and through the plantation of some autochthonous vegetal species, as for instance *Erucastrum virgatum* C. Presl and/or *Calicotome infesta* (C. Presl) Guss, that could provide important protective mechanisms along the regional coastline.

For many other coastal areas that represent an overlapping between Natura 2000 sites and cultural heritage ones, a great risk factor is the human impact connected to an

incorrect enjoyment of coastal goods. For example, the rock of St. Irene, named also Galea, is about one hundred meters from the Tyrrhenian coastline and it extends in South-West direction of 120 meters in length with a maximum width of 40 meters (38° 43' 31" N, 15° 59' 58" E). It is a typical example of ichthyic plant made by rock excavation (Fig. 4).

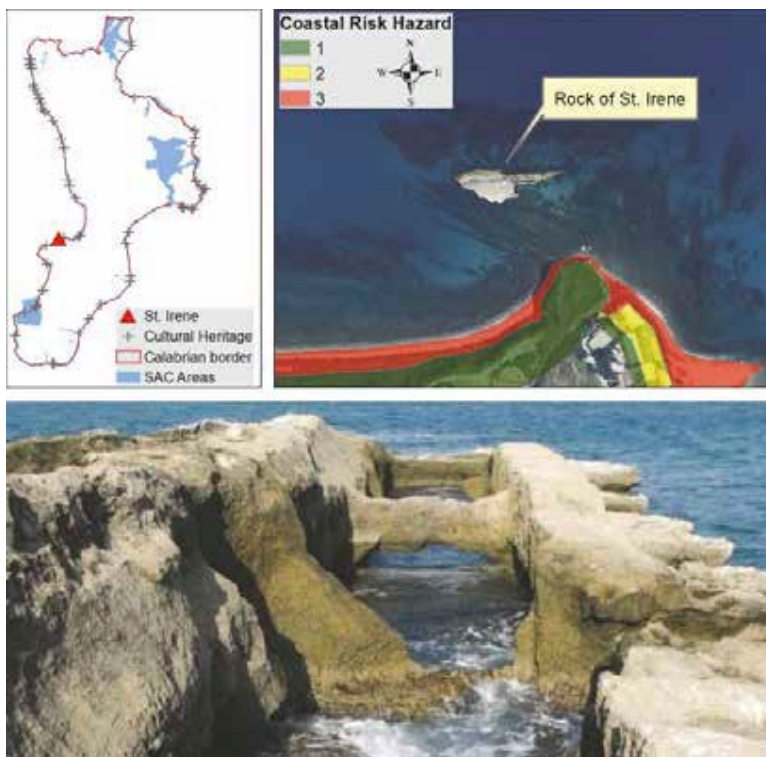


Figure 4 - Geographic position and photo representation of St. Irene site.

The fish pond, by middle dimensions, is made by a complex of four pools showing the remains of flowing grooves and of the moving sluice gates, named “cataractae”, used to close the channels and to prevent the escape of fishes. The pools are perpendicularly crossed by two channels connecting them with the open sea and with an inner harbour, so to assent the water exchange. The harbour was used for the trade of salt fish and the production of “garum”. In fact, on the beach, just in front of the plant, it was located another complex of pools, named “cetariae”, for the fish salting [Iannelli and Mariottini, 2009]. The area, surrounding the rock of St. Irene, including the coastal stretch in its outskirts, is a Special Area of Conservation (IT 9340094) for the presence of following Habitats: 1110 Sandbanks which are slightly covered by sea water all the time; 1170 Reefs; and 1120* Posidonia beds (priority habitat).

Last interesting case is represented by the isle of Cirella, located along the Calabrian Tyrrhenian coast at a distance from shoreline of about 600 meters (Fig. 5).

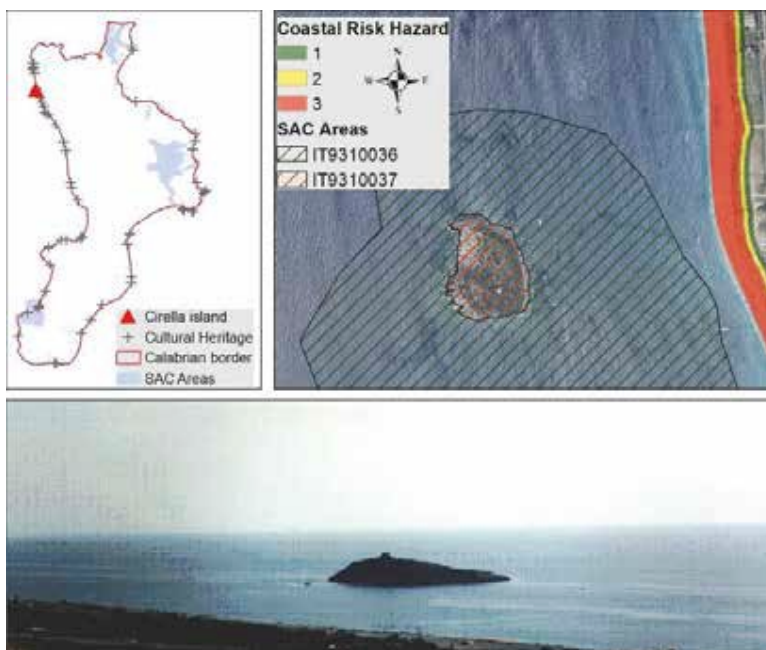


Figure 5 - Geographic position and photo representation of the Cirella island.

For its characteristic geographical position (39° 69' 88" N, 15° 80' 16" E), for the suggestive appearance of a coastal tower and, also, for the presence of a typical Mediterranean vegetation, the island represents one of the most beautiful landscape of the Calabrian coast. All the island is a Special Area of Conservation for the presence of many habitat types: 1240 Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp.; 5330 Thermo-Mediterranean and pre-desert scrub; 8210 Calcareous rocky slopes with chasmophytic vegetation; 9320 *Olea* and *Ceratonia* forests and, at last, for the priority habitat 6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodieta. Finally, there is close to the island, in its inland coastal waters, a large meadow of *Posidonia oceanica*, whose broad size allowed to raise this marine site as a Special Area of Conservation (Habitat 1120* priority habitat) contiguous to the terrestrial one located at the top of the island. From a cultural point of view, there is on the top of the island a log-pyramidal tower on a square basis. This tower, nowadays partially in ruins, was built in sixteenth century and it was a part of the military system for coastal defence against the Saracen invasions [Carafa and Calderazzi, 1999]. Besides, in the marine areas between the islet and the coastline it has been discovered some clay materials dated back to third century a. C. [Mollo, 2018]. In this important coastal region, the highest risk is related to the heavy human impact on such sensitive area. The large tourist demand, during the summer months from June to September, represents a real hazard for *Posidonia oceanica* meadows due to mechanical damages for anchor grooving by boating moorings. At the same time, also the Saracen tower and the insular habitats, suffering in summer months by a constant tourist impact, are not protected

by specific measures. Indeed, there is not a correct tourist boarding to inform all the visitors about the natural and cultural heritages still living on the island, just to improve its protection through a more acquainted tourist enjoyment.

As like as Cirella islet, also the island of Dino shows a clear overlapping between natural and cultural goods. All the island, located along the Tyrrhenian coast (39° 50' 18" N, 15° 46' 22" E), is a Special Area of Conservation (IT 9310034). It holds the following habitats: 1240 Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp.; 5330 Thermo-Mediterranean and pre-desert scrub; 6220 Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea (Priority Habitat); 8210 Calcareous rocky slopes with chasmophytic vegetation; 9320 Olea and Ceratonia forests; 9340 *Quercus ilex* Linnaeus and *Quercus rotundifolia* Lamarck forests. Finally, on the sea bottoms close to the island there are three different areas colonized by *Posidonia oceanica* meadows, whose presence allowed to raise this marine site as Special Area of Conservation (IT 9310035). As well, on the island, at its southern end, it is located a tower by a log-pyramidal section, on a square basis. This tower was built in sixteenth century a. C. and it was characterized by five dropouts and by a typical drawbridge connecting the outside staircase with the feasible floor [Carafa and Calderazzi, 1999].

The above described cases showed that both cultural and natural goods are exposed to the risk of partial or total loss, evidencing that cultural heritage sites and Natura 2000 sites should be integrated into the process of an effective Integrated Coastal Zone Management. The risk of a deterioration of the natural and cultural heritage could be reduced through detailed actions of spreading and awakening of the public opinion, both public and private. In particular, three different levels of public involvement in ICZM policy must be considered. First of all, to actuate a suitable and complete information (passive role) for population and tourists. Then, to realize information systems, pathways and walking routs in the areas more exposed to human impacts, but also to stop the movement and the parking of land vehicles and marine vessels in fragile natural or cultural areas, including beaches and dunes. Finally, to realize a pro-active role in ICZM implementation by the main actors involved in ICZM process, as for instance national, regional and local authorities (active role).

Conclusions

In the coastal landscape, sea and land interact in the same territorial unit integrating coastal ecosystem and its cultural heritage in a whole system, according to the concept of a "landscape continuum". The loss in biodiversity level and the decay of cultural heritage, actually on going, could produce a different landscape feeling and a collective poor memory for the next generations. So, to reverse this negative trend, it could be envisaged a new kind of coastal tourism along the Calabrian coasts able to appreciate the natural and cultural heritages on the seaward and landward sides of the region for an effective Integrated Coastal Zone Management. So, the Calabrian coastal landscape become an ideal pattern where the natural and cultural features of coastal ecosystems could interact for the social and economic growth of local people. Finally, Calabria could provide an innovative landscape model introducing a broader approach for the integration of natural and cultural issues into an active ICZM process.

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