

NATURE PROTECTION AND LOCAL DEVELOPMENT: A STUDY CONCERNING A NATURAL PARK LOCATED IN SARDINIA (ITALY)

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Abstract – As per Italian National law on natural protected areas (Law no. 394/1991), Regional natural parks can include inner land areas, rivers, lakes, and coastal areas having high natural and environmental values. Within a park, such areas define a homogeneous system based on natural characteristics and aspects of sites and on high-value views and landscapes, having also regards to cultural traditions of local communities.

Defining appropriate spatial planning tools for these areas is therefore of outmost importance. On the one hand, plans must guarantee protection and preservation of local natural values and of the ecological balance; on the other hand, plans should also promote social and economic development, by implementing planning processes aimed at valorizing the local identity. This problematic dichotomy deserves serious consideration because protected areas can border, or even include, agricultural plains, urban settlements, as well as tourism hotspots, subject to high anthropic pressures.

The eastern part of the Tepilora Regional Park, located in Sardinia (Italy), represent a relevant case study as a paragon of the question at stake.

It develops near the attractive village of Posada and includes the Rio Posada's (Posada River) environmental system, the River's estuary and the adjacent beach, an extended, flourishing and characteristic agricultural plain.

This study implements a knowledge-based planning methodology that starting from an in-depth study of the context, identifies a territorial system, consistent with the governance tools in force, characterized by sub-areas of a significant degree of internal homogeneity and, therefore, from a specific level of protection, which constitute the spatial reference for the definition of the constraints, of the permitted uses, of the intended public or private use, by virtue of the needs of protection and conservation of the resources present, in the Park.

The aim of the proposed methodology is to being effective in recognizing both expressed and unexpressed potentials of the Park spatial context, and it makes it possible to protect and enhance the Park's attitudes and identity through the definition of place-based planning strategies.

Introduction

The growing awareness about the importance of protecting the environment to ensure the ecological balance for present and future generations has led to a progressive expansion of the system of protected areas, on a national and international scale [3], which nowadays consists of heterogeneous landscapes, from those characterized by a high degree of naturalness to those most marked by anthropic action. This complexity is at the core of several

multidisciplinary studies oriented to define integrated approaches to landscape planning and management, capable of combining nature conservation and local development needs [5,11].

According to the Italian Constitution and international agreements, Law no. 394/1991 (National law on natural protected areas) defines and classifies the protected natural areas. The Law represents the first comprehensive legislation which introduces a special protection and management regime for territories worthy of protection by virtue of their significant naturalistic and environmental values [4].

According to the VI update of the Official List of Protected Areas (2010), there are over 870 Protected Natural Areas in Italy [6]. More precisely, the terrestrial ones cover a surface of over 3 million hectares, that is about 10.5 % of the national territory [7].

The amount of recorded protected areas represents a significant result in ethical and moral point of view [2] and reveals a shared understanding of the environmental protection as a prerequisite to prevent loss of the soil resource and the ecosystem stability/balance, especially when involved in more effective green infrastructure projects [10], thus safeguarding primary values such as health, life, and biodiversity. At the same time, the data testifies an important economic and social goal as conservation policies, in the broader sense of protection and enhancement of natural and anthropic capital, actively contribute to increasing the country's levels of wealth and economic well-being [9]. In this regard, protected areas may represent an essential condition to promote endogenous model of sustainable development of the territories, also from the point of view of tourism, in line with the growing demand for slow tourism [1].

Regional natural parks constitute an important component of the nation's natural heritage, in qualitative and quantitative terms. Among the 871 Protected Natural Areas recorded in the Official List, 134 Protected Natural Areas fall into the category of Regional Natural Parks. The law establishes three main cognitive, planning, regulatory and management tools through which to ensure the protection of their natural and environmental values: the regulation, which governs the activities permitted within the protected area; the planning scheme, which divides and regulates the territory according to the different degree of protection; the multi-year economic and social plan which promotes the sustainable development of local populations through compatible initiatives and activities.

In the Sardinia Region (Italy), Regional Law no. 31/1989 introduces the principles for the establishment and management of the protected areas, including natural parks. The four parks established to date differ in terms of geographical location, environmental and landscape characteristics, degrees of naturalness and anthropization, total surface, number of municipalities involved, presence of protected areas, including those of international level [8]. Nowadays, none of the four parks has yet adopted the main planning tool, i.e. the plan of the park, and, as a consequence, the regulation and the multiannual program of economic and social development, determining a general condition of delay in the definition of a regulatory framework for the natural heritage protection and in the proposal of development strategies aimed at ensuring the protection of natural and anthropic values and of their long-standing interrelations, according to the principles of integrated conservation.

Within this framework, the Tepilora Natural Park, located in north-eastern Sardinia, represents a relevant paragon to deal with the issue at stake [13].

The present study proposes a knowledge-based planning methodology that supports plan-making processes concerning natural parks for an effective conservation of the specific territorial reference units (homogeneous areas). The latter identify areas characterized by

different degrees of naturalness, to which to assign different degrees of conservation. In this sense, the planning scheme of the Tepilora natural park is the result of the complex cognitive framework matured through specialized studies, field investigations and critical interpretations of the territory.

After a first introduction on the state of planning of natural parks in the Sardinian Region (paragraph 1), the paper analyzes the case study (paragraph 2) and proposes a planning methodology that supports plan-making processes concerning natural parks (paragraph 3). Finally, the authors discuss the expected results of the ongoing planning experience.

Area of study

The Tepilora Regional Natural Park, located in north-eastern Sardinia, can be considered a relevant case study for the definition of planning approaches and methods aimed at ensuring the protection of a territorial system characterized by different degrees of naturalness and heterogeneous values. These unique features, together with the geographical context, have also been stressed by the recent establishment of the Tepilora, Rio Posada and Montalbo Biosphere Reserve by UNESCO (June 2017), as part of the "Man and Biosphere (MAB)" program. The Biosphere Reserve brings together 17 municipalities of north-eastern Sardinia around the Tepilora park, which appears as its beating heart (Core zone MaB).

The Park covers an area of about 7877 ha, from the granite plateau of the Municipality of Bitti, to about 500 m above sea level, passing through the hilly area of the Municipality of Lodé, up to the plain of the Municipality of Torpé and the Coastal Municipality of Posada. For this reason, during the elaboration of the plan and according to the context analysis, three macro-areas have been recognized within the Park, which are characterized by a landscape and management homogeneity fully recognizable in relation to the territorial planning scheme drawn up (Fig. 1), which see in the Rio Posada (Posada River) the precious element of connection between sea and mountains.

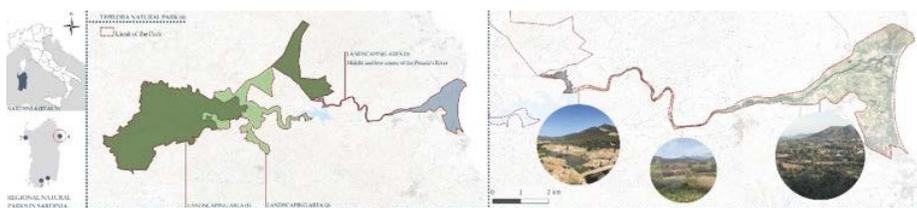


Figure 1 – The Tepilora regional natural Park and its landscaping areas. Author: Mara Ladu.

The first macro-area is identified with the mountain-forest landscape, where the character of the forest landscape prevails characterized by a high degree of naturalness, consisting of the state forests of Crastazza - Tepilora and Sos Littos - Sas Tumbas in the territory of Bitti and the state forest of Usinavà in Torpè.

The second macro-area is identified with the landscape of two enclaves located in the territory of Bitti and the hilly-forest landscape of the territory of Lodè.

The third macro-area takes the name of Medio e Basso Corso del Rio Posada (Middle and Lower Course of the Posada River) and is identified with the fluvial-agricultural and coastal landscape of the wetlands and the beach. The context is that of the alluvial agricultural plains of Torpè and Posada, served by a capillary irrigation network infrastructure that has allowed until now the development of intensive agricultural activity, where the artificial reservoir of Torpè represents an element of discontinuity between mountain areas and intermediate areas of the plains. It includes, in Torpè, the middle course of the Rio Posada and, in Posada, where it develops around the fortress of the ancient village, the flourishing agricultural plain, the beach, its dune system, where a mainly seasonal type of tourism has been consolidated, and finally the Ramsar area Foce del Rio Posada (Mouth of Posada River), recently established. This is an area of great landscape and naturalistic value, and represents the place where the Rio ends its path by rejoining the sea.

The diversity of landscapes of the park translates into a rich ecosystem variety (in terms of habitat and species), geomorphological, microclimatic and vegetational, also determined by historical and cultural factors. The downstream part of the park is characterized by an evident process of anthropization characterized by an important coexistence between natural habitats and agricultural areas and is also equipped with a recent and punctual planning tool, the Municipal Urban Plan (MUP). As will be illustrated in the next paragraph, the latter is the area of study assumed for the development and application of the proposed territorial planning methodology that is based on the reading and interpretation of the environmental context of the territory, in coherence, when possible, with the transformation processes in progress, and aimed at protecting and enhancing the complexity, identity and peculiarities of the territory.

Materials and Methods

The plan of the Tepilora Park consists in the conception of a territorial system divided into three macro-areas, each of which is divided into similar areas, characterized by the same degree of naturalness and protection, and further divided into Spatial reference units (SRU) that introduce further specific requirements. The methodological approach, developed and applied in the Middle and Lower Course of the Rio Posada is based on five main phases.

The first phase consists of the analysis of the territory and the identification of the structural components of the landscape. This phase is divided into: visits on site, diachronic reading of orthophotos, elaboration of environmental analysis, study of cartography and specialized plan reports. The last three define the Cognitive Framework (CF) of the Plan.

Visits on site are fundamental to investigate, from a qualitative point of view, the dynamics of the context, to build a visual idea of the study area and the consequences that design choices can have on it, on a human scale. The diachronic study of orthophotos shows the evolution of the study area, at a landscape scale. The structure of the CF was defined during the setting up of the Strategic Environmental Assessment (SEA). The SEA, in the case of the Tepilora Plan, plays a key role: it is integrated into the planning process [14] in the elaboration of the CF and of the Interpretative and Strategic Design Framework (IF-SD). In the definition of the latter, integration takes place by objectives and actions that are deduced in the drafting of the Environmental Report (ER). While with regard to the CF, the environmental analysis of the ER constitutes the complete cognitive basis of the state of the

environment that allows to highlight the potential strengths, weaknesses, opportunities and risks that, summarized and collected in the SWOT analysis, represent the reference point of a sustainable planning rooted in the context to which it refers in strategic and spatial terms¹.

The analysis phase allows to identify the Rio Posada and the mouth system, the agricultural alluvial plain, the beach and the relief of Orville, as structural components of the landscape. For each of these, a degree of anthropogenic transformation (low, medium and high) was assigned and at the same time, spatial correlation with the landscape systems highlighted by the specialized analyzes (phase I) was evaluated. The correlation assessment was then carried out, in terms of zoning and regulations, with the planning tools in force on the area of study: the MUP of Torpé and Posada (phase II) (table 1).

Table 1 – Excerpt referring the assessment of correlation between the structural components, the landscape systems, the level of anthropic transformation undergone by them and the planning tools in force on the study area.

Structural components of landscape	Landscape systems	Level of anthropogenic transformation	MUP of Posada	Correlation assessment
Rio Posada and mouth system of Rio Posada	- Artificial basins and rivers of the Thermo-Meso-Mediterraneo Secco - Holocene lake sediments of the Dry Mediterranean Thermo-Meso	Low	H: safeguard zones	Yes
Agricultural Alluvial Plain (Posada)	- Thermo-Meso-Mediterranean Dry Alluvial Deposits - Intrusive and metamorphic substrates of the Dry Thermo-Meso-Mediterranean	High	- E: agricultural area - F: tourist-receptive area - G: areas for public services - S: services of general interest	Yes

The next step is to assign, for each type of urban area identified by the UP, a preliminary degree of protection (phase III), in line with the provisions of Law 394/1991: zone A, integral reserve; zone B, general reserve; zone C, protection areas; zone D, areas of economic and social promotion. The process of awarding the preliminary degree of protection took place following an assessment of consistency between the objectives, the intended uses, the prevailing categories of intervention identified by the MUP, and the level of protection provided by the protection zones referred to in the legislation on parks. Zones

¹ For further information, please refer to the SEA of the Tepilora Plan. The integration of the SEA into the planning process is also specifically the subject of Marras M.'s doctoral research, under the supervision of Prof. Zoppi C. and the co-supervision of Proff. Colavitti A.M. and Lai S.

A, B, C, D were then further divided into SRU (phase IV). The articulation in SRU represents a further degree of deepening, developed through the analysis of specialized studies, context and, in particular, carrying out a critical overlay mapping between cartography related to landscape systems, land cover, geology, vegetation and fauna. The perimeters of the areas identified in advance have therefore been subject to verification and, in some cases, redefinition of their degree of protection. In this way, although the zoning of MUP finds significant correspondence with the classification reported by the study on land cover, and highlights the invariants, the zoning of the Park Plan often does not coincide with that defined by the current MUP, as it implements a project that recognizes and reinforces the continuous and unitary character of systems that currently appear fragmented (Fig. 2).

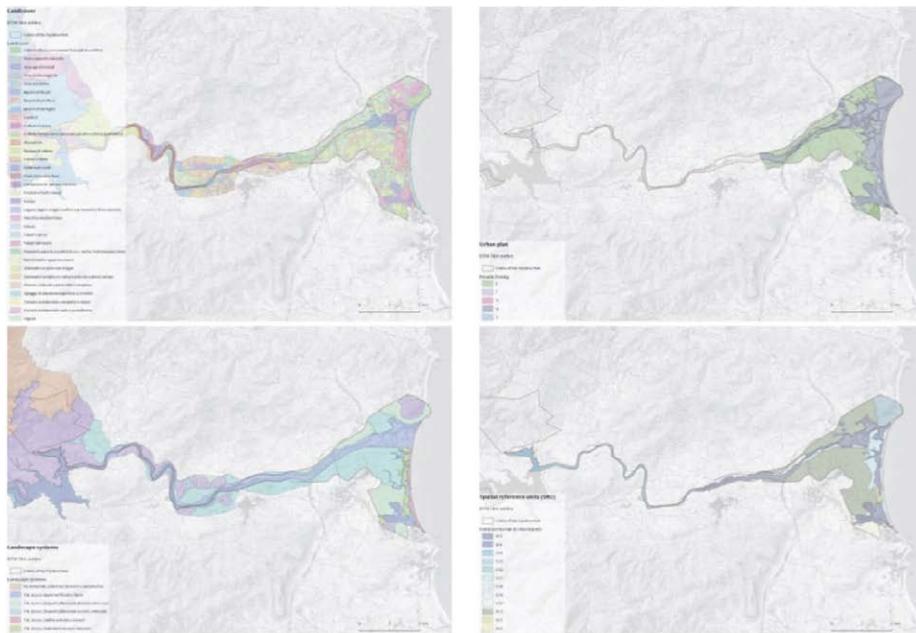


Figure 2 – Representation of the maps related to land use, the zoning of the urban planning tools in force in the area of study, the landscape systems, the SRU system introduced by the Tepilora Park Plan. Author: Martina Marras, based on the cartography drafted by the Planning Office.

The spatial taxonomy is accompanied by regulatory requirements defined in the Implementing Technical Standards (ITS). In the ITS, a more detailed definition of the general requirements relating to zones A, B, C, D is reported integrated for each SRU by further specifications that take into account the protection needs of species, animals and plants, and of the habitats present.

Phase V relates the system of actions that address the strategic framework of the plan objectives identified during the elaboration of the SEA, with the spatial system of the SRU highlighting the integration between the strategic plan and the regulatory device (Table 2).

Table 2 – Excerpt referring to some SRU about the correlation between the zoning introduced by the territorial planning of the Park of Tepilora, its strategic framework and the urban planning tool in force in the study area.

MUP zoning of Posada	Level of protection	SRU	Action of the plan
H - Water system and wetlands H - Habitat 43	B. General reserves	B15 Water system and wetlands of the Rio Posada	Interventions to improve the use of the environmental context of the Rio Posada Integrated conservation of the landscapes of coastal wetlands, river mouths and agricultural alluvial plains aimed at ensuring the balance between environmental protection needs and settlement development requirements Restoration and maintenance of riverbeds and sediment management (...)
...			
H - Beaches and dunes H - Area of tourist-environmental redevelopment	C. Conservation areas	C28-Beaches and dunes	Interventions to contain massive seaside tourism and to promote itinerant tourism in the various areas of the Park Actions to prevent the degradation and fragmentation of dune habitats Interventions aimed at the sustainable management of the coasts (...)
...			
E1 - Posada Gardens E1 - Area with sclerophyll vegetation, meadows and pasture E2 - Agricultural land E5 - Wooded areas and deciduous forests S2 - Services G - Services	D. Areas of economic and social promotion	UTR-D12-Posada Gardens	Launch of projects for the economic exploitation of products and services, direct and indirect, of agricultural and forestry systems Definition of measures for the reintroduction of traditional agricultural production on the territory Interventions in support of extensive and organic agriculture, favoring traditional cultivation methods and techniques Interventions to adapt and strengthen the irrigation network in the agricultural plain of the municipalities of Torpè and Posada (...)
...			

Results

The Plan of the Tepilora Park, in the macro-area of the Middle and Lower Course of the Rio Posada, which extends for about 955 hectares, that is 12 % of the entire Park, provides for the establishment of: n. 2 UTR of general oriented reserve (B), for an area of 217 hectares approx.; n. 7 UTR of protection areas, for an area of about 271 hectares; n. 4 UTR of economic and social promotion (D), for an area of 467 hectares approx. 48.9 % of the macro-area under study is represented by areas of economic and social promotion characterized by a considerable level of anthropogenic transformation deriving from agro-silvo-pastoral activity. The oriented reserve and conservation areas occupy an area equal to about 30 % of the entire extension of the macro-area and no integral reserve areas (A) are identified. The Plan assigns a high level of protection to the wet element of the Rio Posada water system, including it in zone B of general oriented reserve. Here the scientific and educational uses related to the dissemination of knowledge of the Park are allowed, as well as the activities of tourist, recreational and cultural fruition. These are allowed in compliance with the species and habitats present and with specific limitations relating to the means of use. The construction of new buildings and infrastructures is not allowed, with the exception of small buildings for the introduction of naturalistic observation activities. Protection zones (C) define a buffer zone between the wet element (B) and the agricultural plain (D). In the latter, the Plan identifies the area of economic and social promotion as the small urbanized portions present and the alluvial agricultural plain, recognizing a value that is also identity to the agricultural plot of cultivated fields and rural roads typical of the context. In these territories, the Plan allows sustainable anthropic activity aimed at enhancing pre-existing economic activities, also through the construction of new buildings related to the activities of running the fund and tourist-accommodation. At the same time, it introduces specific protection provisions for the most sensitive elements present in widespread form, including small streams and woodland formations.

Discussion and conclusions

The present study proposed a knowledge-based planning methodology which, starting from an identification of three similar macro-areas in the Park, allowed to define a further division of the territorial system into Spatial reference units (SRU) and to introduce different levels of protection according to the specific degree of naturalness recognized.

The study highlights how important it is for the planning process to develop in successive levels of plan design and in stages. The stages involve knowledge, interpretation and choices of plan. It is important to emphasize that the process of defining the Plan contains a subjective component, through which the planner projects into the plan his technical skills, his experience [12], but also his vision of the world. As explained in the previous paragraphs, the draft plan is developed starting from a general context, following a progressive degree of detail in the definition of a spatial articulation, in UTR, which is compared from a zoning and regulatory point of view with the pre-existing planning tools at an urban scale, in a gradual transition of scale that takes shape both in terms of planning and analysis. In the transition of scale, the study of the dynamics of the context is confirmed as fundamental, but also a subsequent skimming aimed at identifying the aspects considered fundamental so that the

plan choices can be targeted and consistent with the objectives. In this macro-area, four main aspects have been identified, among the more than ten present: landscape systems, land cover, urban planning tools in force, flora and fauna. These have been chosen according to the area of study, that is a protected area, and according to the type of plan. In this way the planning process aimed at maintaining those natural elements which are specific to the landscape, protecting the species present, and their habitats, and evaluating the transformations already regulated by the local planning tools in force. The results also describe how the strategic vision, and the regulatory system can effectively contribute to the implementation of a virtuous local development, inside or outside the limit of the Park, identifying specific actions in favor of the integrated conservation of the coastal environment and, more in general, of the agricultural-fluvial landscape typical of the macro-area here examined.

In conclusion, the plan of the park becomes the planning tool capable of defining a regulatory framework based on the recognition of the place identity and its values, as well as of the expressed and unexpressed potential of the territorial context of the Park within a comprehensive conservation and enhancement strategy. Finally, the methodology is readily exportable to other spatial contexts, at different spatial scales, where conservation and development pressures should be adequately balanced as regards areas characterized by relevant values of nature and natural resources.

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