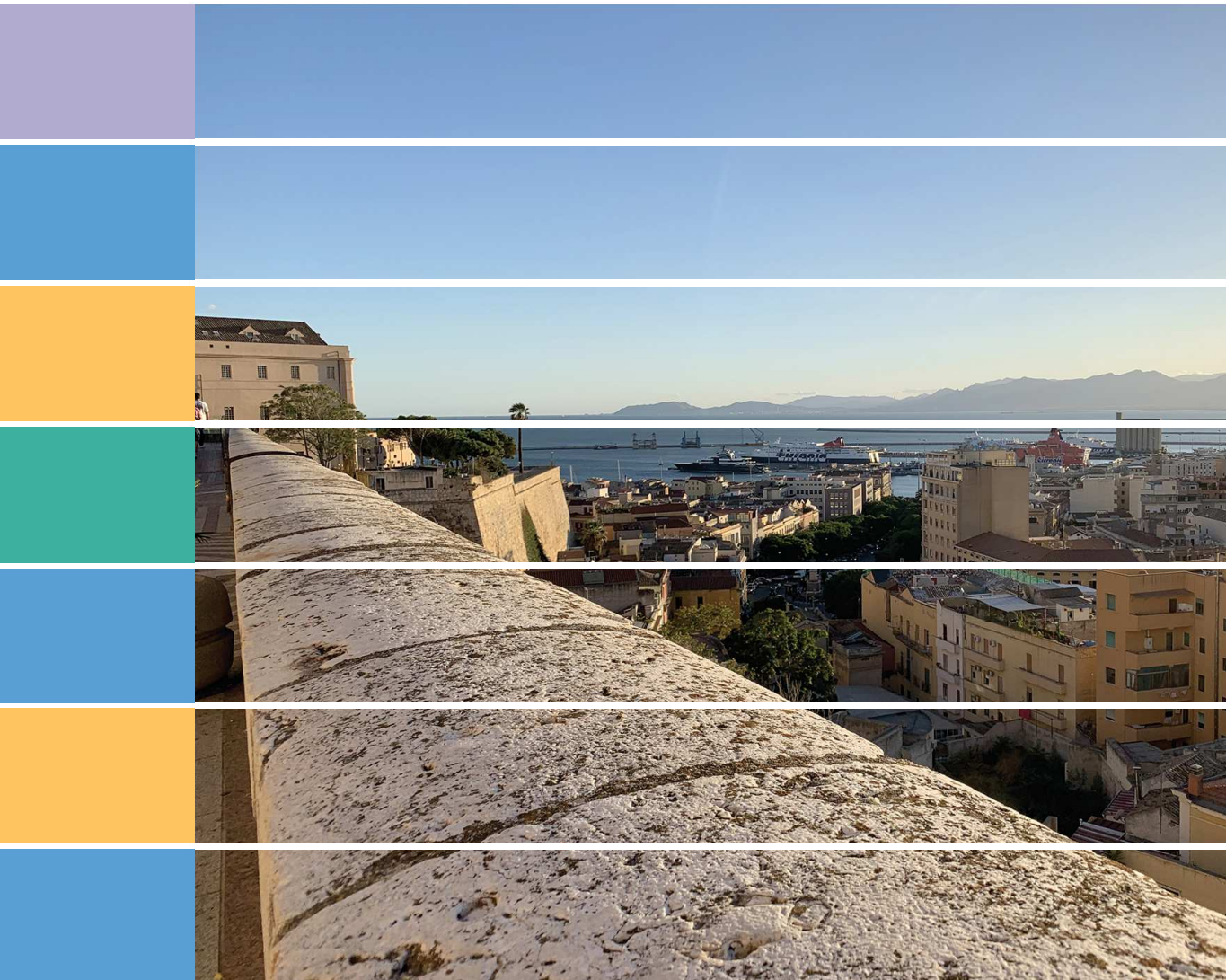


Carmela Gargiulo Corrado Zoppi  
*Editors*

# Planning, Nature and Ecosystem Services



**INPUT** TeMA Lab Dicaa UniNA

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Università degli Studi di Napoli Federico II  
*Scuola Politecnica e delle Scienze di Base*

Smart City, Urban Planning for a Sustainable Future

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Carmela Gargiulo Corrado Zoppi  
*Editors*

## **Planning, Nature and Ecosystem Services**

INPUT aCAdeMy 2019  
*Conference proceedings*

Federico II Open Access University Press



This book collects the papers presented at INPUT aCAdeMy 2019, a special edition of the INPUT Conference hosted by the Department of Civil and Environmental Engineering, and Architecture (DICAAR) of the University of Cagliari.

INPUT aCAdeMy Conference will focus on contemporary planning issues with particular attention to ecosystem services, green and blue infrastructure and governance and management of Natura 2000 sites and coastal marine areas.

INPUT aCAdeMy 2019 is organized within the GIREPAM Project (Integrated Management of Ecological Networks through Parks and Marine Areas), co-funded by the European Regional Development Fund (ERDF) in relation to the 2014-2020 Interreg Italy – France (Maritime) Programme.

INPUT aCAdeMy 2019 is supported by Società Italiana degli Urbanisti (SIU, the Italian Society of Spatial Planners), Istituto Nazionale di Urbanistica (INU, the Italian National Institute of Urban Planning), UrbIng Ricerca Scientifica (the Association of Spatial Planning Scholars of the Italian Schools of Engineering) and Ordine degli Ingegneri di Cagliari (OIC, Professional Association of Engineers of Cagliari).

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This book is the most recent scientific contribution of the "Smart City, Urban Planning for a Sustainable Future" Book Series, dedicated to the collection of research e-books, published by FedOAPress - Federico II Open Access University Press. The volume contains the scientific contributions presented at the INPUT aCademy 2019 Conference. In detail, this publication, including 92 papers grouped in 11 sessions, for a total of 1056 pages, has been edited by some members of the Editorial Staff of "TeMA Journal", here listed in alphabetical order:

- Rosaria Battarra;
- Gerardo Carpentieri;
- Federica Gaglione;
- Carmen Guida;
- Rosa Morosini;
- Floriana Zucaro.

The most heartfelt thanks go to these young and more experienced colleagues for the hard work done in these months. A final word of thanks goes to Professor Roberto Delle Donne, Director of the CAB - Center for Libraries "Roberto Pettorino" of the University of Naples Federico II, for his active availability and the constant support also shown in this last publication.

*Rocco Papa*

Editor of the Smart City, Urban Planning for a Sustainable Future" Book Series  
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## INTRODUCTION

This e-book contains the Proceedings of the INPUT aAcademy 2019 Conference held at the University of Cagliari on 24-26 June 2019, titled "Planning, nature and ecosystem services." Input aAcademy follows the tenth INPUT Conference, held in September 2018 at Tuscia University, in Viterbo and, in some way, it breaks the biennial tradition of the INPUT Conferences. The reason for the frequency increase of the INPUT Conferences is that the Department of Civil and Environmental Engineering and Architecture of the University of Cagliari is involved in a project funded by the Programme INTERREG Marittimo–Italia France–Maritime 2014–2020, Axis 2.

In the context of the project, entitled "GIREPAM–Integrated Management of Ecological Networks through Parks and Marine Areas", the Department and the Office for Nature Protection and forest policies of the Regional Autonomous Administration of Sardinia are studying and defining an experimental methodology to integrate conservation measures concerning Natura 2000 Sites into marine protected areas regulations. The methodology is implemented to build the new regulations of two marine protected areas of Sardinia, namely the Island of Asinara and of the Island of Tavolara and Cape Coda Cavallo.

Since GIREPAM allocates a considerable amount of funds to the organization of an international conference on protection of nature and natural resources, ecosystem services and their relationship with spatial planning processes and practices, green infrastructure, and integrated management of protected areas and Natura 2000 Sites, and these funds must be spent by December 2019, the research group at the Department proposed to the INPUT Community, during the 2018 Viterbo Conference, a 2019 INPUT Conference focussing on these themes. The INPUT Community responded enthusiastically and, that being so, the research group has made every effort to make the event come true.

The Conference develops through plenary sessions and parallel tracks. The scope of the plenary sessions is to propose distinguished points of view concerning research and implied planning ideas and policies on important and significant issues which feature the ongoing scientific and technical debate on nature and natural resources.

The questions proposed and discussed in the Conference are three central topics which are characterized by several studies available in contemporary literature, and by vibrant debates as well, both from the theoretical and technical points of view. These questions are presented and discussed in the three plenary sessions which are the starting points of the three days of the Conference. Each plenary session is organized as follows: first, a speaker, a distinguished scholar, proposes the findings of his theoretical and/or applied research work and derived implications for spatial policy; secondly, a discussant, a distinguished



scholar as well, critically analyzes the positions expressed in the first place and identifies open or unresolved questions and outstanding issues; thirdly, the public enters the discussion, through questions, observations, critical positions. Finally, the speaker replies to the discussant's and to the public's statements.

The first plenary session is on "Valuing ecosystem services in money: A necessary evil for protecting biodiversity?"; the speaker is Erik Gomez-Baggethun (Faculty of Landscape and Society, Norwegian University of Life Sciences); the discussant is Andrea Arcidiacono (Department of Architecture and Urban Studies, Polytechnic University of Milan).

The second plenary session concerns "Managing urban ecosystems for goods and services"; the speaker is Kevin Gaston (Environment and Sustainability Institute, University of Exeter); the discussant is Bernardino Romano (Department of Civil, Building-Architecture and Environmental Engineering, University of L'Aquila).

The third plenary session is related to "Mapping and modeling ecosystem services: A cascade ES modeling approach applied to the Flemish Natura 2000 Network"; the speaker is Jan Staes (Department of Biology, University of Antwerp); the discussant is Beniamino Murgante (School of Engineering, University of Basilicata at Potenza).

The topics presented in the plenary sessions are the background of the discussions which characterize the parallel tracks. These tracks are featured by studies which consider protection of nature and natural resources, ecosystem services and their relationship with spatial planning processes and practices, as regards the following topics:

1. Ecosystem services and spatial planning;
2. Integrated management of marine protected areas and Natura 2000 sites;
3. Rural development and conservation of nature and natural resources;
4. Geodesign, planning and urban regeneration;
5. Green and blue infrastructure;
6. Smart city planning;
7. Water resources planning, ecosystem services and nature-based solutions in spatial planning;
8. Conservation and valorisation of architectural and cultural heritage;
9. Accessibility, mobility and spatial planning;
10. Tourism and sustainability in the Sulcis area;
11. Ecological networks and landscape planning.

The closing plenary session of the Conference proposes a roundtable discussion on "Planning Nature 2000 Network and protected areas: The integration of conservation measures into regulations." The roundtable will involve panelists from several institutions who participate in the GIREPAM Project.

Carmela Gargiulo is full professor of Urban Planning Techniques at the University of Naples Federico II. Since 1987 she has been involved in studies on the management of urban and territorial transformations. Since 2004, she has been Member of the Researcher Doctorate in Hydraulic, Transport and Territorial Systems Engineering of the University of Naples "Federico II". She is Member of the Committee of the Civil, Architectural and Environmental Engineering Department of the University of Naples "Federico II". Her research interests focus on the processes of urban requalification, on relationships between urban transformations and mobility, and on the estate exploitation produced by urban transformations. On these subjects she has co-ordinated research teams within National Project such as Progetto Finalizzato Edilizia - Sottoprogetto "Processi e procedure" (Targeted Project on Building – Subproject "Processes and procedures), from 1992 to 1994; Progetto Strategico Aree Metropolitane e Ambiente, (Strategic Project Metropolitan Areas and Environment) from 1994 to 1995; PRIN project on the "Impacts of mobility policies on urban transformability, environment and property market" from 2011 to 2013. Principal investigator of the Project Smart Energy Master for the energy management of territory financed by PON 04A2\_00120 R&C Axis II, from 2012 to 2015. Scientific Responsible Unit Dicea Project by Fondazione Cariplo "MOBILAGE. Mobility and aging: daily life and welfare supportive networks at the neighborhood level" 2018-2020. Scientific Responsible Unit TeMALab Dicea ERASMUS+ Key Action2: Project "Development of a Master Programme in the Management of Industrial Entrepreneurship for Transition Countries" (MIETC), partners: University of Santiago de Compostela (leading organization), University of Ljubljana, Academy of Science of Turkmenistan, Karaganda Economic University of Kazpotrebsouz (2020-2022). Author of more than 130 publications. Since 2008 Associate Editor of TeMA Journal of Land Use, Mobility and Environment.

Corrado Zoppi, Civil engineer, is Doctor of Philosophy in Economics (Northeastern University, Boston, Massachusetts, United States, 1997), Doctor of Research in Territorial Planning (University of Reggio Calabria, 1992), and Master of Science in Economic Policy and Planning (Northeastern University, 1990). Since October 1 2015 he is Professor (Full Professor, Scientific Disciplinary Sector ICAR/20 Urban and Regional Technique and Planning)) at the Department of Civil, Environmental Engineering and Architecture. In the past, he taught at the Faculty of Engineering of the University of Cagliari, and at the Faculties of Architecture of the Universities of Rome "La Sapienza" and Sassari-Alghero. He is presently the Official Professor of the Module of Strategic Planning of the Integrated Course of Strategic Environmental Planning and of the Course of Regional and Urban Planning at the Faculty of Engineering of the University of Cagliari, and the Coordinator of the Undergraduate and Magisterial Degree Programs at the Faculty of Engineering and Architecture of the University of Cagliari. He was the Coordinator of the Panel for the Assessment and Evaluation of Public Investments of the Sardinian Regional Administration in the period 2007-2013. He was the Coordinator of the Graduate Committee of Environmental and Territorial Engineering of the University of Cagliari in the period 2012-2015. He is the President of the Faculty Committee of Engineering and Architecture of the University of Cagliari.

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## RELATIONSHIPS BETWEEN CONSERVATION MEASURES RELATED TO NATURA 2000 SITES AND COASTAL LAND USE PLANS

A STUDY CONCERNING SULCIS (SARDINIA, ITALY)

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Leone, F. & Zoppi, C. (2019). Relationships between conservation measures related to Natura 2000 sites and coastal land use plans: A study concerning Sulcis (Sardinia, Italy). In C. Gargiulo & C. Zoppi (Eds.), *Planning, nature and ecosystem services* (pp. 971-982). Naples: FedOAPress. ISBN: 978-88-6887-054-6, doi: 10.6093/978-88-6887-054.6

*plans and land management strategies concerning coastal areas.*

*The methodology proposed in this study defines a theoretical and technical approach to ICZM-related planning processes at the municipal (local) level, based on integration of strategies related to different spatial scales. Municipalities adopt spatial plans which regulate land uses in the coastal areas (PLUCs), whereas the regional and national public administrations define policies concerning environmental conservation and protection. The methodological approach is implemented with reference to two coastal towns located in South-West Sardinia, in the region of Sulcis. The outcomes highlight that PLUCs and the environmental protection-oriented plans are consistent with each other as regards themes and objectives. Three specific questions are crucial as regards the integration of social and economic development goals and sustainability objectives, namely relationships between natural ecosystems and services located in the coastal areas, ecosystem conservation and protection, and accessibility of the seashore.*

### KEYWORDS

*Natura 2000 Sites; Coastal land use plans, Management plans of Natura 2000 Sites*

## 1 INTRODUCTION

Since the 1970s, spatial planning policy of the European Union has been characterized by a marked attention to integrated coastal zone management (Saffache & Angelelli, 2010), as per Resolution no. (73)29 (26 October 1973) of the Council of Europe, which suggests implementing a holistic approach to conservation and protection of coastal heritage.

At the moment, at the international level, integrated coastal zone management is progressively increasing its relevance in theoretical and practical terms, since it is generally assumed as a fundamental point of reference to define and implement spatial policies oriented to sustainable development (Billé, 2008). The "Protocol on Integrated Coastal Zone Management"<sup>1</sup> (ICZM Protocol) was adopted by the European Union (EU) Council in 2008, and ratified in 2010 (Decision no. 2010/631/EU). The Protocol defines coastal zone management as a dynamic process which implements the sustainability paradigm into management and use of the coastal areas (article no. 2), by taking account of the weakness of landscapes and ecosystems, the heterogeneous mix of ongoing activities, which include maritime activities, their interdependency, and the impacts generated as regards coastal and marine contexts. Moreover, the context-specific nature of the ICZM approach should be carefully considered (Soriani et al., 2015), since coastal and marine planning issues are not questions that can be addressed on a one-size-fits-all basis.

Nevertheless, integrated coastal zone management as regards the relationship between theory and practice is still a critical issue (Burbridge & Humphrey, 2003; Soriani et al., 2015) identify two kinds of problematic questions that may arise, which, on the one hand, are related to policies and strategic approaches, and, on the other hand, are connected to the implementation phases of spatial plans.

In this conceptual context, Strategic environmental assessment (SEA) may help decision-making processes related to coastal zone management to be effective in addressing the issue at stake (Rochette & Billé, 2010). The Directive of the EU concerning SEA (no. 2001/42/EC) states (article 1) that "The objective of this Directive is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant

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<sup>1</sup> Available online: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22009A0204\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22009A0204(01)&from=EN).

effects on the environment.” In other words, SEA processes enhance the quality of decision-making by making consistent and integrated economic and social development objectives and sustainability goals (Leone & Zoppi, 2015).

Furthermore, SEA is effective in supporting national administrations in implementing the ICZM Protocol into strategies and plans related to coastal management (UNEP et al., 2011). Harvey (2000) analyzes the use of SEA with reference to Australian coastal management. Procedures based on SEA-related approaches are used on a voluntary basis in the definition and implementation of the “Strategy for integrated coastal zone management” of Portugal in 2008, as a decision-making tool (Partidário et al., 2009), even though a systematic technical procedure which integrates the ICZM Protocol provisions and the SEA procedure is not available at present.

The approach proposed in this study builds on SEA in order to define a methodology which supports spatial planning processes in implementing the ICZM Protocol into local decision-making procedures. The objectives identified in different plans, namely spatial plans which regulate land uses in the coastal areas (PLUCs) and plans related to management of Natura 2000 Sites<sup>2</sup> (PMN2s), are examined and compared as regards their mutual coherence. Their strategies are made consistent with each other and negative effects of PLUCs on PMN2s are highlighted and addressed. The methodological approach is applied to two case studies concerning two coastal towns located in South-West Sardinia, in the region of Sulcis.

In the next section, the methodology is discussed, the documents and materials, upon which the spatial analyses are based, are identified, and the two urban contexts, considered in the two proposed case studies, are synthetically presented. The third section shows the results of the implementation of the proposed methodological approach, while implications, limits and suggestions for further research are discussed in the concluding section.

## 2 METHODOLOGY AND CASE STUDIES

The methodology implemented and discussed in this study focuses on building mutual consistency between PMN2s and PLUCs. It is based on the integration of strategies of PMN2s and PLUCs implemented through a logical structure (LS) which makes reference to the SEA procedure. The LS builds on the conceptual category of sustainability, mutual endogeneity of spatial planning and environmental assessment and the presence of planning alternatives, which feature SEA-based procedures according to the Italian Law concerning SEA (Decree no.

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<sup>2</sup> Three types of protected areas feature Natura 2000 Sites: Sites of community importance (SCIs) and Special areas of conservation (SACs), identified under the provisions of EU Directive 92/43/EEC (the Habitats Directive), and Special protection areas (SPAs), identified according to EU Directive 2009/147/EC (the Birds Directive).

152 of April 2006), which embeds the EU Directive on SEA into the Italian legislative framework (Leone & Zoppi, 2015).

The LS was already used by Leone & Zoppi<sup>2</sup> 2015 and 2016, who proposed a comparison between the provisions of the city masterplans and the PMN2s based on the reciprocal consistency of their goals. Here, the relationships between PLUCs and PMN2s are assessed as regards sustainability goals, through the identification of the PLUCs’ operations which may generate negative effects on habitats and species protection-related goals identified in the PMN2s. Tab. 1 shows the diagram of the LS. The five columns refer to: i. sustainability goals; ii. thematic issues; iii. PLUC’s goals; iv. PMN2’s goals; and, v. PLUCs’ operations which may generate negative effects on habitats and species protection-related goals identified in the PMN2s.

SUSTAINABILITY GOALS	THEMATIC ISSUES	PLUC’S GOALS	PMN2’S GOALS	NEGATIVE PLUC’S OPERATIONS	
Sustainability goal 1	Thematic issue 1	Goal 1 of PLUC	Goal 1 of PMN2	Operation 1 Operation k	
			Goalj of PMN2	Operation 1 Operation k	
		Goalj of PLUC	Goal 1 of PMN2	Operation 1 Operation k	
			Goalj of PMN2	Operation 1 Operation k	
		Thematic issue h	Goal 1 of PLUC	Goal 1 of PMN2	Operation 1 Operation k
				Goalj of PMN2	Operation 1 Operation k
	Goalj of PLUC		Goal 1 of PMN2	Operation 1 Operation k	
			Goalj of PMN2	Operation 1 Operation k	

Tab. 1 The framework of the Logical structure (LS)

The proposed methodological approach is applied to the towns of Carloforte & Calasetta, two spatial contexts of South-West Sardinia located in the Sulcis region (Fig. 1). The small Island of San Pietro (San Peter), where Carloforte is located, is connected to the mainland by ferryboats which depart from the Port of Calasetta. These towns were selected since they identify a consistent spatial system, whose coastal and marine areas require an integrated management approach, even though each urban area is governed by an autonomous municipal administration. Furthermore, a number of Natura 2000 Sites are located in each spatial context.

The planning documents used in the study are:

- the PLUC of Calasetta and the PMN2s of the following SACs: ITB042208 “tra Poggio La Salina e Punta Maggiore,” ITB042210 “Punta Giunchera” and ITB042209 “A nord di Sa Salina;”
- the PLUC of Carloforte and the PMN2 of the following Natura 2000 Sites: SAC ITB040027 “Isola di San Pietro” and SPAITB043035 “Coste e Entroterra tra Punta Cannoni e Punta delle Oche – Isola di San Pietro.”

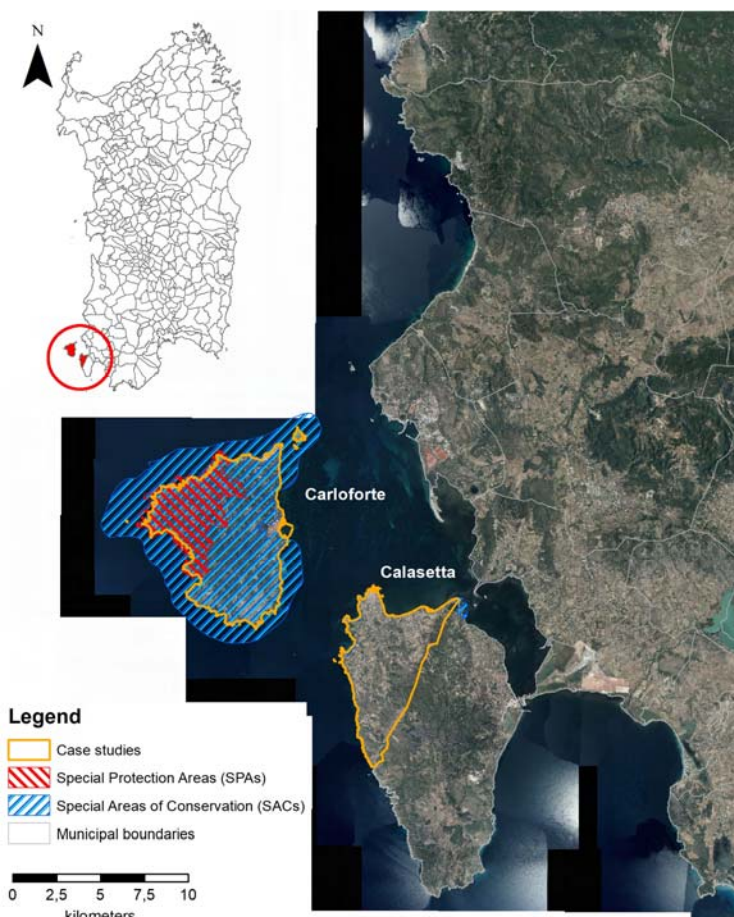


Fig. 1 The study area. (Source: elaboration by Federica Leone on an aerial photography drawn from Geoportal of Sardinian regional administration) (<http://www.sardegna-geoportale.it/index.php?xsl=2425&s=324505&v=2&c=14488&t=1&tb=14401>)

### 3 FINDINGS

The implementation of the methodological approach into the two urban contexts of the Sulcis region identifies and analyzes coastal and marine processes which combine planning strategies differentiated in terms of scale, since the local municipal administrations, which study and approve the PLUCs, and the regional and national administrations, which define and implement PMN2s, are involved at once.

The LSs concerning the PLUCs and the PMN2s related to the towns of Carloforte and Calasetta are reported in Tab. 2 and Tab. 3. Considering contents and objectives of PMN2s and PLUCs, each of the two tables shows sustainability goals concerning conservation of biological diversity, plants and animals. PLUCs and PMN2s are mutually consistent as regards goals and thematic issues. The PLUCs focus on the following thematic issues: i. relations between coastal and marine ecosystems and services provided on the beaches; ii. conservation and enhancement of coastal and marine ecosystems; and, iii. accessibility to beaches and coastal areas. For example, the objectives of the PLUC of Calasetta focus on the integration of services provided on the beaches and coastal and marine ecosystems, identifying ecosystem conservation as the core issue, whereas the goals of the PLUC of Carloforte focus on the same integration issue, assuming accessibility as the main question. This is explained by the fact that the SAC "Isola di San Pietro" overlays the municipal land of Carloforte and, as a consequence, the approval process of proposed spatial transformations is based on the Appropriate assessment procedure, established under the Habitats Directive<sup>3</sup>, which aims at preventing negative effects of projected operations on habitats and species of SACs, SPAs and SCIs.

It has to be put in evidence that, notwithstanding PLUCs and PMN2s are mutually consistent as regards their sustainability goals, the PLUCs' planned operations can generate negative impacts on the PMN2s.

In the case of Calasetta, the coastal and marine areas are planned both as environmental resources deserving protection-oriented measures and as factors of economic development related to leisure and tourism. The PLUC focuses on the definition of a set of planning policies to exploit tourist attractiveness (GoalC2) and on prevention or mitigation of erosional processes concerning beaches (Objective C3).

<sup>3</sup> Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives [...] [T]he competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public." (Habitats Directive, art. 6, paragraph 3).



The planned operations aim at developing tourism and at increasing the attractiveness of the seashores (Operations AO2, AO3, AO4, AO5, AO6, AO7 and AO8). On the other hand, the goals of the PMN2 focus on limiting tourist presence on the beaches (Objective AM3), on prevention or mitigation of the negative effects generated by human activities, animals and infrastructure on dunal habitats and species (GoalAM4), and in general, on habitats and species (GoalAM1).

Two issues characterize the case of Carloforte (Tab. 3). On the one hand, preservation of coastal waters (Goal BM1) and of *Caretta caretta* (Goal BM9), identified as a protected species under the provisions of the Habitats Directive, conflict with the authorized traffic of small boat charters (Operation BO1). Indeed, these boats are allowed to sail with no license or certification concerning the technical knowledge of the boaters as regards coastal ecosystems, habitats and plants, such as *Posidonia oceanica* seabed and other peculiar habitats, or protected species, such as *Caretta caretta*. On the other hand, the boardwalks installation which make it easier to access the beaches (Operation BO3), and the development of parking sites close to habitats and species protected under the Habitats Directive (Operation BO4), are likely to determine negative impacts with reference to preservation of dunes and of their habitats (Goal BM3) and to protection of habitats such as thickets, phrygana and arborescent matorral (Goal BM5).

SUSTAINABILITY GOALS	THEMATIC ISSUES	PLUC'S GOALS	PMN2'S GOALS	NEGATIVE PLUC'S OPERATIONS
Preservation and enhancement of coastal ecosystems and biodiversity	Relations between coastal and marine ecosystems and services provided on the beaches	C1. Planning beach services in relation to the rural, natural or urban features	AM1. Prevention or mitigation of the negative effects generated by human activities, animals and infrastructure on habitats and species protected under the Habitats Directive AM2. Restoration of natural coastal morphology	AO1. Authorization for pet-care services AO2. Installation of pedestrian boardwalks
		C2. Definition of a set of planning policies to exploit tourist attractiveness related to the reefs, in order to identify alternative options related to marine and coastal tourism	AM3. Mitigation of overuse of beaches by tourists, in particular during Summer	AO3. Installation of dressing rooms and small cabanas AO4. Placement of beach chairs and sun loungers AO5. Installation of cabanas for the watchpersons AO6. Installation of toilets and showers AO7. Installation of kiosks selling beverages and snacks AO8. Installation of small stands in support of beach services and activities such as small boat charters, diving and sailing schools
		C3. Prevention or mitigation of erosional processes concerning beaches	AM3. Mitigation of overuse of beaches by tourists, in particular during Summer	AO3. Installation of dressing rooms and small cabanas AO4. Placement of beach chairs and sun loungers AO5. Installation of cabanas for the watchpersons AO6. Installation of toilet and shower facilities AO7. Installation of kiosks selling beverages and snacks AO8. Installation of small stands in support of beach services and activities such as small boat charters, diving and sailing schools

SUSTAINABILITY GOALS	THEMATIC ISSUES	PLUC's GOALS	PMN2's GOALS	NEGATIVE PLUC'S OPERATIONS
	Conservation and enhancement of coastal and marine ecosystems		AM4. Prevention or mitigation of the negative effects generated by human activities, animals and infrastructure on dual habitats and species	AO2. Installation of pedestrian boardwalks
			AM5. Mitigation of coastal and erosional processes concerning beaches and restoration of dual systems	
			AM6. Integration of measures aiming at removing <i>Posidonia oceanica</i> deposits from the beaches and at protecting coastal and marine habitats	
			AM4. Prevention or mitigation of the negative effects generated by human activities, animals and infrastructure on dual habitats and species	AO2. Installation of pedestrian boardwalks
		C4. Promotion of environmental rehabilitation	AM1. Prevention or mitigation of the negative effects generated by human activities, animals and infrastructure on habitats and species protected under the Habitats Directive	
				AM2. Restoration of natural coastal morphology
		C5. Conservation of the salt pan	AM7. Protection and restoration of <i>Posidonia oceanica</i> meadows in the mooring areas	
				AM6. Integration of measures aiming at the removal of <i>Posidonia oceanica</i> deposits from the beaches and at protecting coastal and marine habitats

Tab. 2 Logical structure of the integration of the PLUC and of the PMN2 concerning the town of Calasetta

SUSTAINABILITY GOALS	THEMATIC ISSUES	PLUC's GOALS	PMN2's GOALS	NEGATIVE PLUC'S OPERATIONS			
Preservation and restoration of marine and coastal ecosystems, with a particular focus on species and habitats protected under the Habitats Directive	Relations between coastal and marine ecosystems and services provided on the beaches	R1. Planning beach and related services and activities consistently with landscape and environmental protection goals	BM1. Preservation of coastal waters	BO1. Authorizations released toboaters of small boat charters			
			BM2. Conservation of reef habitats	BO2. Provision of the minimum service level in support of tourism in the most popular sandy and rocky beaches			
			BM3. Preservation of dunes and of their habitats				
			BM4. Promotion of sustainable uses of sites and related environmental resources				
			BM5. Conservation of arboreescent matorral, thickets and phrygana habitats				
					R2. Organization of the access point system and of the parking sites in order to regulate public and coastal access to beaches and coastal areas, minimizing environmental impacts	BM6. Conservation of important botanical species ( <i>Astragalus maritimus</i> , <i>Rouyapolygama</i> )	BO1. Authorizations released toboaters of small boat charters
					BM7. Protection of the most significant bird species for Natura 2000 Sites in Carloforte		
					BM8. Protection of the local fauna	BO3. Boardwalks installation which make it easier to access the beaches	
					BM9. Protection of <i>Caretta caretta</i> , a species of Community interest		
					BM2. Conservation of cliff habitats		
			BM3. Conservation of dunal habitats	BO4. Development of parking sites close to habitats and species protected under the Habitats Directive			
			BM4. Promotion of sustainable uses of sites and related environmental resources				
			BM5. Protection of habitats such as matorral				

Tab. 3 Logical structure of the integration of the PLUC and of the PMN2 concerning the town of Carloforte

## 4 DISCUSSION AND CONCLUSIONS<sup>4</sup>

The outcomes of the proposed methodology based on the LS show that negative effects may occur on the achievement of the goals of the PMN2s as a consequence of operations planned by the PLUCs. The LSs defined to assess the coherence of the PLUCs and PMN2s concerning the towns of Calasetta and Carloforte put in evidence that the operations planned in the PLUCs may put at risk the effectiveness of the conservation measures identified in the PMN2s, related to habitats and species, since PLUCs and PMN2s were studied and approved following independent procedures, implemented by different public administrations, that is, the municipal administrations in the case of the PLUCs, and the regional administration in the case of the PMN2s. Furthermore, the two types of plan focus on different core issues, since PMN2s deal with conservation measures regarding habitats and species of the Natura 2000 Sites, whereas PLUCs are related to sustainable coastal zone management aimed at catalyzing social and economic local development based on tourist attractiveness.

From this standpoint, this study defines, and applies to the urban contexts of Calasetta & Carloforte, a methodological approach whose scope is to integrate different plans, which take place in the local public domain, that is the Sulcis region, into a unique planning instrument which makes consistent nature protection-related and development-related objectives.

The study shows, by detailed comparative appraisals of two PLUCs and related PMN2s, that the LS-based procedure entails an enormous potential in order to build consistency and, much more important, to drive the issue of conservation and enhancement of habitats and species outside the narrow boundaries of sectoral policies concerning the Sites of the Natura 2000 Network. The application of the LS makes the issue a comprehensive and fundamental question related to the PLUCs. The implementation of the PMN2-related sustainability objectives into the PLUCs through the LS approach is based on the environmental characterization of the supporting ecosystem services (ESs) supplied by habitats and species (Millennium Ecosystem Assessment, 2003). In the first place, ESs are identified in the spatial context of the Sites of the Natura 2000 Network, and afterwards, during the application of the LS approach, they become spatial and environmental characteristics of the whole coastal and marine areas (Leone & Zoppi, 2016).

The proposed LS-based approach implements PMN2s into PLUCs and, that being so, not only is suitable to assess and drive the definition and establishment of planning decisions (ex ante phases of PMN2s/PLUCs), but also to support the planning policies to be carried out, since

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<sup>4</sup> This Section partially reproduces a discussion proposed in a previous study of the authors (Leone, Zoppi, 2016, Section "5. Discussion and Conclusions").

the ES-related sustainability objectives entail a monitoring system based on benchmarks concerning the environmental indicators related to the ESs.

Furthermore, it has to be stressed that the planning policies concerning supporting ESs may generate conflicts related to tourism-related ESs, whose land uses may be prevented by conservative measures entailed by the PMN2s. Therefore, LS-based procedures that imply ES-based sustainability objectives should take account of supporting ESs not only in terms of conservation and enhancement of habitats and species, but also as sources of conflict between alternative land uses related to alternative types of ESs, that is supporting and tourism-related. The conflicts are expressed by the trade-offs between protection and preservation of coastal and marine species and habitats, that is, supporting ecological systems, and the pressure for increasing the provision of services for tourists and local visitors in the coastal areas, that is tourism-related ESs, which is the main focus of PLUCs (Lai & Zoppi, 2017).

The results proposed in this essay are very robust in terms of exportability to other EU contexts, since the LS-based procedure implemented into spatial plans (PLUCs) at the municipal level is always based on the same normative framework, established by the SEA Directive. Moreover, the reference of the PMN2s is always the Natura 2000 Standard Data Form, approved by the European Commission with the Decision of 11 July 2011<sup>5</sup>. As a consequence, it can be applied as such in other EU countries, even though different institutional frameworks and planning practices at the national and regional levels may possibly imply more-or-less huge differences in terms of timing and duration and public authorities responsible for the PLUCs and the PMN2s' planning procedures, the quality of the participatory processes and the qualitative and quantitative size of the participating public and stakeholders.

## NOTES

Federica Leone and Corrado Zoppi have made substantial contributions to the study's conception, background and design remarks of section 1, and to discussion and concluding remarks of section 4. The methodological discussion proposed in section 2 is by Federica Leone. The results presented in section 3 are by Corrado Zoppi.

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<sup>5</sup> Available from the European Environment Agency's at <http://natura2000.eea.europa.eu/>.

fundamental or basic research for the implementation of interventions in relation to the research context of the Sulcis Plan” of the year 2015, implemented at the Department of Civil and Environmental Engineering and Architecture (DICAAR) of the University of Cagliari, Italy. This study is also presented at the AESOP Annual Congress 2019 (Venice, 9-13 July 2019), with the title “Management plans of Natura 2000 Sites and coastal land use plans: A study concerning an integrated approach to management of coastal zones in the Sulcis Area (Sardinia, Italy),” and will be published in the Congress Proceedings

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