

Article

Conservation Measures and Loss of Ecosystem Services: A Study Concerning the Sardinian Natura 2000 Network

Federica Leone and Corrado Zoppi *

Dipartimento di Ingegneria Civile, Ambientale e Architettura, University of Cagliari, Cagliari 09123, Italy; federicaleone@unica.it

* Correspondence: zoppi@unica.it; Tel.: +39-070-6755 (ext. 213)

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Abstract: The seeming dichotomy between the protection of biodiversity and the supply of ecosystem services (ESs) represents an outstanding field of research that requires a structured and detailed analysis. The paper analyzes and discusses the role of ESs within spatial planning and strategic environmental assessment (SEA) procedures through the content analysis methodology and a logical framework (LF) implemented into the SEA of municipal masterplans (MMPs). We discuss the role of ESs as factors that improve the effectiveness of SEA-based processes related to management plans (MPs) of sites that belong to the Sardinian Natura 2000 Network with reference to their positive impacts on environmental quality. The empirical outcomes put in evidence the inconsistencies between MMPs and MPs in terms of sustainability-oriented objectives and potential losses of the ESs productive output due to measures adopted by the MPs in order to protect habitats and species. The scant attention paid to ESs in the operational context of MMPs, MPs and SEA reports, particularly as regards their regulative framework, entails that the issue of the protection of ESs has to be carefully taken into account within the process of the definition and establishment of MPs through an SEA report that integrates the MPs and MMPs LFs.

Keywords: ecosystem services; Natura 2000 Network; strategic environmental assessment; conservation measures; spatial planning

1. Introduction

Ecosystems and ecosystem services (ESs) are commonly-used terms in the international scientific and political debate [1]. The origins of the ES concept can be traced back to the late 1970s, when the pioneer studies on the connections between the environment and the quality of human life started to entail assessments of the economic value of the services supplied by the ecosystems [2]. Thereafter, the category of ES has become very important for ecologists and environmental economists, as source of the supply of common or public goods and services whose values need an analytical assessment in the context of the definition, application and evaluation of public policies. From this perspective, Daily [3] defines ESs as conditions and processes that support human life through the supply of goods, and Costanza et al. [4] argue that ESs may be considered as the direct and indirect benefits that human populations derive from goods and services supplied by the natural environment. Moreover, although the issue originates from the late 1970s, a systematic scientific discussion of the technical meaning, use, tentative classifications and assessment approaches to ESs was only proposed in 2003 through the Millennium Ecosystem Assessment (MA), a comprehensive and analytical report that involves more than 1300 experts worldwide [5].

According to the classification proposed by the MA, ESs “[A]re the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such

as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits" [6] (p. 3). Afterwards, publications addressing the issue of ESs have largely increased [7], and in this context, the question of the potential inconsistency between environmental conservation and economic development can be identified as a central point within the international debate [2].

The complex and controversial relationship between environmental conservation and economic development is central in the spatial planning arena, as well. In the "Compendium of European planning systems", the European Commission [8] (p. 24) argues that spatial planning aims at influencing "the future distribution of activities in space. It is undertaken with the aims of creating a more rational territorial organization of land use and the linkages between them, to balance demands for development with the need to protect the environment, and to achieve social and economic objectives". Therefore, spatial planning focuses on land and resource uses and on the integration of different strategies concerning their spatial layout, while environmental protection is based on the organization of all activities aimed at preventing, reducing and eliminating any kind of environmental degradation. One of the two most critical global environmental threats in conjunction with climate change is biodiversity loss, where the term biodiversity means "the extraordinary variety of ecosystems, species and genes that surround us [...]. Biodiversity is also our natural capital, delivering ecosystem services that underpin our economy" [9] (p. 1). As a consequence, environmental protection entails an important role within the debate on spatial planning due to the implications and impacts of strategies and actions on ecosystems.

Moreover, although spatial planning should take account of ecosystems and their services, however their use within decision-making processes is limited by the lack of awareness of the importance of their integration in the international debate [10,11]. Many authors [11–14] put in evidence the strong link that connects quality of human life and ecosystem protection. Therefore, the implementation of the ES-related issues into spatial planning may effectively support decision makers to exploit the potential of services supplied by ecological systems and to characterize land uses and site planning by taking account of ES-related features [15,16].

In this context, strategic environmental assessment (SEA) represents a technical procedure very effective to support the implementation of ESs into spatial planning [11,16,17]. In fact, SEA is a procedure that improves substantially planning processes because it incorporates strategic issues and objectives from their initial phases through a continuous assessment of the potentially negative effects of plan actions [18].

In this essay, we analyze and discuss the role that ESs can eventually play with regard to spatial planning and SEA procedures through the assessment of the Sardinian municipalities of Muravera, Sassari, Dolianova and Nuoro. In particular, two typologies of plans and their related SEA-based processes are considered: management plans (MPs) of sites that belong to the Natura 2000 Network and municipal masterplans (MMPs). The discussion is based on two levels. The first aims at verifying whether and to what extent the issue of ESs is addressed within these documents through a methodological approach based on content analysis. The second is based on a logical framework (LF), which takes account of the identification of objectives related to the provision of ESs as a tentative specification of the founding objective of the SEA of MMPs, that is the implementation of the sustainability paradigm into the planning process.

In the second section, we analyze the role of ESs as factors that improve the effectiveness of SEA-based processes related to MPs of sites that belong to the Natura 2000 Network in order to increase their environmental quality. In the third, we present the methodological approach concerning the content analysis and the LF. In the following section, we discuss the results of the application of content analysis and of the LF carried out with regard to the four municipalities. In the last section, we provide final considerations and implications for future works.

2. The Role of ESs as Factors that Improve the Effectiveness of Decision-Making Processes

The role of ESs within decision-making processes and ecosystem management has increasingly acquired importance at the global, regional and local scales due to the necessity of effective strategies for biodiversity conservation [19]. Indeed, biodiversity plays a key role in providing human societies with goods and services.

At the European Union (EU) level, biodiversity conservation is based on Natura 2000, which is a coherent network of areas established under the provisions of Directive 92/43/EEC (the “Habitats” Directive). Natura 2000 includes Sites of Community Interest (SCIs) and Special Areas of Conservation (SACs) identified under the provisions of the Habitats Directive itself, as well as Special Protection Areas (SPAs), identified under the provisions of the “Birds” Directive (Directive 2009/147/EC). The Network was established to protect biodiversity, species and habitats that are threatened with extinction, or deemed valuable, or typical within a certain biogeographic area. In order to protect sites belonging to the Network, Member States must adopt appropriate conservation measures. These may include, if needed, appropriate MPs (which can be conceived of as stand-alone plans or can be integrated into other, more comprehensive, spatial and regional strategies) and specific rules, consistent with the ecological needs of habitats and species, concerning land uses, site management and agreements involving public and private subjects [20].

On the structure and contents of MPs, the European Commission only provides a few directions, but not strict guidelines. Consequently, the comprehensive planning approach of the Natura 2000 MPs is not rigid and conservative; rather, it implies the incremental building of a territorial network of sites whose management is based on an approach sustainable in ecological and economic terms. In Italy, in compliance with Decree of the President of the Republic No. 357 of 1997 [21], regional administrations are in charge of the application of conservation measures, hence also of the approval of MPs; however, in the absence of common rules and procedures, regional administrations are taking different approaches with reference to the identification of the authorities responsible for the preparation of MPs and for the SEA and with reference to their approval.

According to the Habitats Directive, Natura 2000 Sites are not conceived of as nature reserves where human activities are forbidden. Indeed, they are often located either within or close to urban settlements, where the interactions between natural processes and human activities have established social-ecological relationships [19]. Therefore, the management of protected areas has to deal with the physical and social characteristics of surrounding zones, such as landscape dynamics [22] and user attitudes [23]. As a result, despite the growing attention to ESs, their inclusion within decision-making processes and the management of protected areas is limited for different reasons [24], such as lack of awareness of the ecological underpinnings of ESs [25], gaps between the political and ecological scales and problems concerning the quantification of ESs [26].

From this perspective, SEA is certainly fundamental in the definition and implementation of MPs of Natura 2000 Sites, because it carries out its strategic character into the planning process from its starting phases, that is the structure of the conceptual framework to analyze and interpret the local environment, society, economic situation and settlement characteristics. The SEA procedure is based on a continuous assessment of the use of planning policies and of their impacts in order to evaluate if and to what extent they are consistent with environmental protection- and sustainability-related objectives, with particular attention to the role of planning alternatives in the context of decision-making processes [27].

SEA is a procedure that entails the assessment of the potentially-negative effects of the plan actions, carried out to address the plans’ specific goals, on sustainability objectives and the definition of alternative operations, which may possibly either mitigate or eliminate these effects. Such alternatives may eventually imply the deletion of environmentally-harmful plan actions. Under this perspective, we assume that the SEA of MMPs and/or MPs should be considered the most proper process to grant consistency between MMPs and MPs in terms of sustainability-oriented objectives and related plan actions.

With reference to the Common International Classification of Ecosystem Services (CICES) [28], ESs provided by habitats and species are part of the section “Regulation and maintenance”, and they belong to the “Regulating service” category of MA. However, in the literature, the CICES’s rigid position is not shared by many authors who consider the protection of habitats and species aimed at enhancing biodiversity as a supply source of provisioning, cultural and supporting ESs [29].

As a consequence, the sustainability objectives of the MPs, which are identified in terms of regulating ESs, have to be implemented into MMPs as sustainability objectives, which are the founding points of reference of the SEA of MMPs. As a result, the SEA process, as related to regulating ESs, aims at making consistent MPs and MMPs by an adequate and effective effort towards the general goal of protecting and possibly increasing biodiversity, that is habitats and species, in the context of the municipal area.

Moreover, in our view, the implementation of the MPs’ objectives into the sustainability-based framework of the SEA of MMPs may possibly imply a loss of the ESs’ productive output due to measures adopted by the MPs in order to protect habitats and species. This issue is of particular concern if we consider its implications in terms of the conservation of the potential output of ESs, which can be assumed as a comprehensive goal both in the MPs’ and in the MMPs’ set of the SEA-related sustainability objectives. Indeed, conservation measures related to habitats and species could possibly imply that productive uses of parcels of the municipal land suitable for ES-based productive activities are prevented, which would entail a net loss of ESs.

3. Materials and Methods

We analyze the implementation of ESs-related issues into the SEA procedures concerning MMPs and MPs of Sardinian municipalities. Under this perspective, we assess the MMPs, the MPs and the SEA environmental reports of the municipalities of Muravera, Dolianova, Nuoro, and Sassari [30]. These are the Sardinian municipalities that are endowed with the MP of a site of the Natura 2000 Network, the MMP and the SEA procedure related to the MMP. Our assessment is based on:

- (1) content analysis, in order to check if, and to what extent, ES-related terms are used in the MPs-, MMPs- and SEA-related documents;
- (2) on the LF (see the Introduction), in order to control for the consistency of MPs and MMPs within the SEA procedure.

In the concluding section, on the basis of the application of the LF, we analyze and assess potential trade-offs between the decrease in the supply of provisioning ESs due to the protection of habitats and species under the provisions of the MPs.

We discuss content analysis and the LF in the next two subsections.

3.1. Content Analysis

Content analysis can be defined in three ways [31] as follows:

- (1) “Content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communication” [32] (p. 55). Objectivity concerns the developing process of analytical categories, which follow explicit rules in order to make it possible to replicate and systematize outcomes and, by doing so, to assess the validity of the results in terms of relevance and generalization [33];
- (2) content analysis is “[A]ny technique to make inferences by systematically and objectively identifying special characteristics of messages” [34] (p. 608), which are described in terms of “what”, “how” and “to whom”;
- (3) content analysis is “[O]ne of the most important research techniques in the social science. It seeks to analyze data within a specific context in view of the meanings someone—a group or a culture—attributes to them” [35] (p. 403). In this case, the key element of the process of content analysis in semantic terms is the assessment carried out by an analyst [30].

In our study, we use content analysis according to the third definition, provided by Krippendorff, due to the paramount importance of the local spatial context. From this point of view, we assess the following documents: the MMP textual documents of the four municipalities; the MPs of the four Natura 2000 Sites; and the four SEA reports of the MMPs. The content analysis is carried out through the freeware software “QDA Miner lite”. Moreover, as regards the definition of the key terms, we reinterpret the classification provided by Mascarenhas et al. [16], where the key terms can appear either individually or combined with other terms, as shown in Table 1.

Table 1. Key terms used in the content analysis.

Key Term	Associated Key Term	Sub-Categories	Code
Ecosystem	Goods/services	/	A1
	Benefits		A2
	Human well-being		A3
Ecosystemic	Goods/services	/	B1
	Benefits		B2
	Human well-being		B3
Nature	Goods/services	/	C1
	Benefits		C2
Provisioning services	/	Agricultural crops Fodder	D1
Regulating services	/	/	D2
Cultural services	/	Environmental tourism Sustainable tourism Ecotourism	D3
Supporting services	/	/	D4
Natural capital	/	/	E
Ecosystem functions	/	/	F
Environmental services	/	/	G

Provisioning and cultural services are classed into sub-categories (third column of Table 1) in order to detect if and to what extent they are identified by the assessed documents, even though not explicitly as ESs.

Each document is divided into single parts in order to identify the specific location within their texts of references to the classes (Table 2).

Table 2. Categorization of management plans (MPs), municipal masterplans (MMPs) and SEA reports.

Document	Categories
MP	Normative and planning context
	Territorial, abiotic, biotic, agroforestry, socio-economic, urban and planning and landscape characterizations
	Synthesis of impacts
	Identification of objectives and management strategies
	Monitoring plan
	Management organization
MMP	Normative and methodological aspects
	Fact-finding phase
	Analysis and interpretation of territory
	Objectives, actions and strategies
SEA report	Normative and methodological aspects
	Identification of the planning and programmatic contexts
	Environmental analysis
	External consistency
	Internal consistency
	Definition and assessment of alternatives
Monitoring phase	

The summary of the MPs and the SEA reports follow the structure provided by the Regional Government of Sardinia [36].

3.2. The Implementation of the LF

EU Directive 2001/42/EC (SEA Directive) and its implementation into the Italian legislation, represented by legislative Decree No. 152 of 3 April 2006, define the goals, aims, competences and framework of SEA-based procedures. In Sardinia, the Regional Government of Sardinia provides a methodological approach to develop SEA processes in relation to the adjustment of MMPs to the Regional Landscape Plan (RLP), where sustainability, endoprocedimentality, the identification of alternatives and public participation are the key concepts that characterize the SEA of plans and programs [37]. In particular, on the one hand, the application of the concept of sustainability, which is the main goal of SEA, is reflected by the integration between local development objectives and sustainability criteria; on the other hand, the identification of alternatives derives from the analysis of potentially-negative impacts of plan actions, which carry out specific objectives of the plan, on sustainability-oriented objectives. Leone and Zoppi [18] interpret these relations within an LF of the SEA of the MMPs, as indicated in the Introduction, where the objectives of the MPs are implemented in terms of internal consistency. The LF consists of the following: sustainability-oriented objectives; the specific objectives of the MMP; specific objectives of the MP; and the potentially unfavorable actions of the MMP in relation to the specific objectives of the MP (Table 3).

Table 3. The structure of the logical framework (LF). ESs, ecosystem services.

Sustainability-Oriented Objectives	MMP-Specific Objectives	MP-Specific Objectives	Potentially Unfavorable MMP Actions	Potentially Unfavorable Impacts on ESs Supply
Sustainability-oriented Objective 1	Specific Objective 1 of MMP	Specific objective 1 of MP	Action 1 Action k	Impact 1 Impact l
		Specific objective j of MP	Action 1 Action k	Impact 1 Impact l
	Specific Objective i of MMP	Specific objective 1 of MP	Action 1 Action k	Impact 1 Impact l
		Specific objective j of MP	Action 1 Action k	Impact 1 Impact l

We add to the logical framework a fifth column in order to assess, in qualitative terms, the potentially-unfavorable impacts of the specific objectives of MPs on ESs (Table 3). Indeed, in our view, the identification of the objectives of MPs within the LF could possibly imply a loss in the ESs supply due to conservative measures adopted by MPs. Moreover, in relation to sustainability-oriented objectives, we focus on the environmental component “flora, fauna and biodiversity”, identified by the GM, in order to put in evidence and highlight possible relations between MMPs, which manage the entire municipal land in terms of land uses, and MPs, which aim at protecting biodiversity within Natura 2000 Sites. Moreover, it is important to stress that, in all cases, MMPs and the related SEA procedures were elaborated before implementing the corresponding MPs. Therefore, MPs were not included within the SEAs. As a consequence, a comparison between the SEA of the MMPs and the outcomes coming from the comparative analysis proposed in the paper through the LF is unfeasible since the SEAs of the MMPs were carried out before the definition of the MPs and of their SEAs.

Finally, we focus on provisioning ESs.

We use four LFs to carry out our assessment, through which we assess the following documents:

- (1) the MP of the SCI “Wetlands of Colostrai and of Saline” and the MMP of Muravera;
- (2) the MP of the SCI “Lake of Baratz—Porto Ferro” and the MMP of Sassari;
- (3) the MP of the SPA “Mountain of Sette Fratelli” and the MMP of Dolianova;

(4) the MP of the SPA “Ortobene Mountain” and the MMP of Nuoro.

The identification of specific ESs within the four Natura 2000 Sites is based on the technical approach proposed by Burkhard et al. [38], who assign specific capacity [39] to provide selected ESs to land cover types classified according to the Corine Land Cover classification.

4. Results

Our study investigates the role of ESs within spatial planning and SEA procedures by means of content analysis and an LF-related approach.

The application of content analysis is based on a preliminary scan to eliminate deceptive combinations that is around 18% of the total amount of quotations (360). It is not surprising that, given the nature of the plans, references to the key terms are more common within MPs, with the exception of Sassari (Table 4). On the other hand, SEA reports, excluding the document related to the MMP of Muravera, cite only “provisioning services” and “cultural services”, excluding any other term that could be connected to ESs.

Table 4. Number of key terms mentioned in the MMPs, MPs and SEA reports of the municipalities of Dolianova, Muravera, Nuoro and Sassari.

Code/ Document	A1	A2	A3	B1	B2	B3	C1	C2	D1	D2	D3	D4	E	F	G	Total
Dolianova																
MMP	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	5
MP	2	0	0	0	0	0	0	0	101	0	0	0	0	0	0	103
SEA	0	0	0	0	0	0	0	0	10	0	4	0	0	0	0	14
Muravera																
MMP	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
MP	2	0	0	0	0	0	0	0	28	0	2	0	0	0	0	32
SEA	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	4
Nuoro																
MMP	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
MP	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	17
SEA	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	10
Sassari																
MMP	0	0	0	0	0	0	0	0	37	0	6	0	0	0	2	45
MP	0	0	0	0	0	0	0	0	42	0	0	0	0	0	1	43
SEA	0	0	0	0	0	0	0	0	10	0	5	0	0	0	0	15
Total	4	0	0	0	0	0	0	0	260	0	21	0	1	0	5	

No plan nor SEA report mention the key terms coded as A2, A3, B1, B2, B3, C1, C2, D2, D4 and F, and only two MPs (Dolianova and Muravera) explicitly quote the term ESs (A1).

Moreover, although no plan nor SEA report explicitly refer to “provisioning services”, this category is the most popular (264 quotations), provided that it is looked up by using terms such as “agricultural crops” or “fodder”. On the other hand, in most cases, “fodder” is cited as a land use category rather than as an ES. Therefore, in relation to the four categories of ESs indicated by MA, only “cultural services” is explicitly mentioned in two MMPs (Muravera and Sassari), while “environmental tourism” and “sustainable tourism” are mentioned by one MP (Muravera), two MMPs (Nuoro and Sassari) and all SEA reports (Dolianova, Muravera, Nuoro and Sassari).

In addition, in most cases, key terms are quoted in order to describe specific characteristics of the areas in question. The most common categories are “Territorial, abiotic, biotic, agroforestry, socio-economic, urban and planning, and landscape characterizations” in the MPs, “Fact-finding phase” in the MMPs, and “Environmental analysis” in the SEA reports. From this perspective, in a few cases, ESs, looked up by using the key terms reported in Table 3, assume a prescriptive character.

In relation to the LF-related approach, we notice that, despite the apparent consistency between the MMPs and the MPs in all four cases in terms of sustainable-oriented goals, the MMPs operations may generate some conflicts in relation to the MPs. Moreover, the MPs' specific objectives and their consequent conservative measures may eventually entail a loss in the ESs' supply.

As regards the municipality of Dolianova (Table 5), a significant inconsistency concerns the relationship between the actions D1, D2, D3, and D4 and the MP's goal OD1. In fact, although environmental protection and minimization of fire risk should promote the protection of the areas and sites characterized by environmental and/or natural resources, the construction of new roads and pathways, the increment of rural areas and the promotion of rural tourism could potentially generate negative impacts. For example, according to Ganteaume and Jappiot [40], the presence of minor roads and tourism pressure are drivers for the occurrence of large fires and the size of burned areas, respectively. Moreover, we observe, following Burkhard et al [37], that the land use categories, included in the "Mountain of Sette Fratelli" SPA, have a high-to-medium capacity to provide livestock. Furthermore, pastoral activities and pasture may generate negative impacts in relation to habitats' protection (MP of the SPA "Mountain of Sette Fratelli") and fire occurrence [40].

In the case study concerning the municipality of Muravera (Table 6), we observe two inconsistencies. The first is related to the relationship between action M1 and the MP's goal OM1. Indeed, although the identification of areas of landscape value should promote the expansion of habitats areas, in the MMP, there is no rule related to the typology and extension of crops, as regards the overlap of the habitats and areas valuable in landscape terms. The second critical issue concerns the overlap of habitats and coastal tourist settlements. Therefore, the requalification of existing tourist settlements, represented by actions M2, M3, and M4, may possibly limit the expansion of habitats areas. In addition, although land use categories in the "Wetlands of Colostrai and of Saline" SCI have a medium capacity to provide livestock, in most cases, the MP identifies pasture and pastoral activities as dangerous for some habitats' conservation. In other cases, the implementation of balanced pastoral activity-related land uses is the best policy, since either lowly intensive or highly intensive pastoral activities can prevent very possibly the adequate conservation and expansion of habitats.

As regards the municipality of Nuoro (Table 7), all of the actions concerning the improvement of the road levels of service hinder the achievement of objective ON1 "Control and reduction of pollutant emissions". Moreover, within the SPA "Ortobene Mountain", land use categories have a medium-to-high capacity to provide crops and livestock, which entails a possible increase in pollutant emissions. It has to be stressed that one of the most important contributors to greenhouse gas emissions is the agricultural sector [41], and for example, in the U.K., a large part of NH₃ emissions from agricultural activities comes from livestock production [42].

In the case of the municipality of Sassari (Table 8), the promotion of tourist attractiveness through cycling and pedestrian pathways and of agricultural activities in terms of productive potential, the strengthening of the spatial fabric of the rural areas, the consolidation of the agricultural land and the support of multifunctional management of farms, are the main factors that negatively influence the conservation status of habitats and species. Moreover, despite the medium capacity to provide livestock, MP identifies pasture and pastoral activities as dangerous for the conservation of the majority of habitats within the SCI "Lake of Baratz—Porto Ferro".

In conclusion, our analysis puts in evidence important critical situations related to inconsistency between MMPs and MPs in terms of sustainable-oriented objectives and to potential productive losses in relation to the provision of ESs as a consequence of the application of conservation measures within the Natura 2000 Sites. Therefore, according to the content analysis and the implementation of the LF-related approach, the scant attention paid to ESs within MMPs, MPs and SEA reports, particularly in prescriptive terms, highlights the necessity to include them within the definition and establishment of MPs through an SEA report that integrates the MPs' and MMPs' LFs.

Table 5. Extract of the LF of the municipality of Dolianova.

Sustainability-Oriented Objectives	MMP-Specific Objectives	MP-Specific Objectives	Potentially Unfavorable MMP Actions	Potentially Unfavorable Impacts on ESs Supply
Analysis and promotion of the landscape and environmental system	Protection and promotion of the areas and sites characterized by an environmental and/or naturalistic value	<p>OD1</p> <p>Improvement of the effectiveness of the activities concerning communication and spatial management and control, related to the municipal area in terms of environmental protection, minimization of the risk of fire and maximization of rapid-intervention capability through the active participation of the stakeholders</p>	<p>D1</p> <p>Construction of a system of pathways and roads to connect the urban settlement to areas of environmental and natural interest with regard to tourism</p>	Pasture
			<p>D2</p> <p>Setting-up of rural areas to develop quality crops</p>	
			<p>D3</p> <p>Integration of agriculture and complementary activities, such as agritourism, and rural, environmental and didactic tourism</p>	
			<p>D4</p> <p>Promotion of the use of common lands through the elaboration and realization of appropriate recovery and enhancement projects</p>	

Table 6. Extract of the LF of the municipality of Muravera.

Sustainability-Oriented Objectives	MMP-Specific Objectives	MP-Specific Objectives	Potentially Unfavorable MMP Actions	Potentially Unfavorable Impacts on ESs Supply
Prevention and limitation of processes of degradation and fragmentation and reinstatement of conditions of high naturalness and of ecosystem functionality in relation to habitats	Protection of coastal environment through an ecosystem-based approach in order to protect its integrity and functionality	<p>OM1</p> <p>Reinstatement and expansion of habitats areas in order to promote conservation and protection of species of <i>Calandrella brachydactyla</i> and <i>Anthus campestris</i></p>	<p>M1</p> <p>Identification of zones labeled as “H2 areas of landscape value” near the coastal strip and the Wetlands of Colostrai and of Saline</p>	Pasture
			<p>M2</p> <p>Improvement of the environmental quality of already identified tourist zones</p>	
			<p>M3</p> <p>Requalification and compliance with planning rules of existing settlements in terms of service provision within zones labeled as “F2 spontaneous tourist settlements”</p>	
			<p>M4</p> <p>Landscape and functional requalification of existing settlements within the zones labeled as “F1 tourist settlements which are already subject to planning rules”</p>	

Table 7. Extract of the LF of the municipality of Nuoro.

Sustainability-Oriented Objectives	MMP-Specific Objectives	MP-Specific Objectives	Potentially Unfavorable MMP Actions	Potentially Unfavorable Impacts on ESs Supply
Conservation and improvement of biodiversity of community interest habitats and species	Requalification of the municipal ecosystem	ON1 Control and reduction of pollutant emissions	N1 Construction of a road tunnel	Crops Livestock
			N2 Construction of a road pathway	
			N3 Reorganization of the crossroads	
			N4 Construction of a partially-underground parking lot with 600–800 parking spaces	
			N5 Construction of a moving walkway connecting the parking lot with the Church of Our Lady of Snow	
			N6 Restoration of the existing buildings, routine and extraordinary maintenance, potential demolitions and reconstructions	

Table 8. Extract of the LF of the municipality of Sassari.

Sustainability-Oriented Objectives	MMP-Specific Objectives	MP-Specific Objectives	Potentially Unfavorable MMP Actions	Potentially Unfavorable Impacts on ESs Supply
Protection and conservation of habitats, and flora and fauna species with reference to degradation caused by human activities	Protection and conservation of SCIs with reference to pollutants and invasive species and/or activities	OS1 Reduction/elimination of factors that generate negative impacts related to: (i) habitats and species of community interest; and/or (ii) habitats and species conservation status with reference to agricultural and tourism activities	S1 Setting-up of greenways to connect the coastal areas in order to increase their environmental value and their tourist attractiveness	Pasture
			S2 Setting-up of cycling and pedestrian pathways to increase tourist attractiveness	
			S3 Protection and conservation of productive potential of agriculture	
			S4 Strengthening of the agricultural spatial texture through the maintenance and the expansion of the linear vegetal systems	
			S5 Land consolidation in rural areas with particular attention to the peri-urban zones, by protecting high-quality agricultural crops	
			S6 Promotion and support of multifunctional management of farms	

5. Discussion and Conclusions

In this essay, we put in evidence that the consistency between MPs and MMPs should be based on the implementation of the SEA procedure into the MMPs/MPs process. Indeed, as explained in Subsection 3.2, MMPs and the corresponding MPs were implemented in two different time periods. Therefore, their inconsistency, in terms of sustainability-oriented objectives and related plan actions, is mainly attributable to this timing mismatch. In other words, the sustainability objectives of the MPs should be shared by the MMPs through their SEAs. These objectives concern the supply of ESs related to biodiversity and consist of the protection and enhancement of habitats and species.

The analysis of the four cases concerning the municipalities of Muravera, Dolianova, Nuoro and Sassari puts in evidence that MPs and MMPs are studied and established quite independently from each other, and as a consequence, they are quite inconsistent. This is due to the different public administrations that rule over the two planning processes, that is the region in the case of MPs and the municipality in case of the MMPs, and to the scopes of the plans. Indeed, the MPs concern the spatial context of the SPAs and of the SCIs and are mainly focused on conservation and qualitative and quantitative enhancement of habitats and species, while the MMPs aim at defining and carrying out sustainable land uses, services and infrastructure in the municipal area.

Our assessment highlights the role that SEA can play in order to build consistency between the MMP and MP processes, which is founded on the common ground of sustainability objectives defined and established in terms of conservation and qualitative and quantitative enhancements concerning supporting ESs.

We show, by detailed comparative appraisals of four MMPs/MPs, that the SEA 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. SEA makes the issue a comprehensive and fundamental question related to the MMPs. The implementation of the MP-related sustainability objectives into the MMPs through the SEA procedure is based on the environmental characterization of the supporting ESs supplied by habitats and species. 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 SEA procedure, they become spatial and environmental characteristics of the whole municipal area.

The SEA-based logical framework we propose in order to implement MPs into MMPs not only is suitable to assess and drive the definition and establishment of planning decisions (ex ante phases of MPs/MMPs), but also to support the planning policies to be carried out, since 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 provisioning ESs, whose land uses may be prevented by conservative measures entailed by the MPs. Therefore, SEA 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 provisioning.

The results we propose in this essay are very robust in terms of exportability to other EU contexts, since the SEA procedure implemented into spatial plans (MMPs in the Italian case) at the municipal level is always based on the same normative framework, established by Directive 2001/42/EC. Moreover, the reference of the MPs is always the Natura 2000 Standard Data Form, approved by the European Commission with the Decision of 11 July 2011 [43]. 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 SEA and planning procedures, the quality of the participatory processes and the qualitative and quantitative size of the participating public and stakeholders.

Moreover, the outcomes and discussion proposed in this essay open the door to promising future researches concerning the following three directions. First, as we put in evidence above, the implementation of the objectives of MPs within the LF could possibly imply a loss in the supply of provisioning ESs, e.g., decrease in cattle farming and agricultural production due to restrictions in land uses related to conservative measures adopted by MPs in order to protect habitats and species of the Natura 2000 Sites. This entails an assessment that concerns the trade-off between the loss of provisioning ESs and the protection of supporting ESs.

The part of the trade-offs concerning provisioning ESs can be very effectively analyzed. Indeed, there are several studies in the current literature related to the economic evaluation of agricultural and cattle-farming ESs. The evaluation is usually based on the market value of the implied agricultural production and cattle [37,44,45].

On the other hand, studies on the economic evaluation of supporting ESs, such as biodiversity, habitats and species protected under the provisions of the Habitats and Birds Directives, are very rare, and as a consequence, the part of the trade-offs related to supporting ESs still needs attention in terms of future research. The approaches to the assessment of the ESs belonging to this category can be possibly identified by those suggested by the MA [46] and by Busch et al. [45] aimed at estimating direct or indirect willingness to pay, since supporting ESs is intrinsically a public good, and as such, their values cannot be determined in terms of their market prices, since they are non-rivalrous and non-excludable, and so, they are not priced. In our view, estimates based on techniques related either to hedonic models (direct willingness to pay) [47–49] or to contingent valuation (indirect willingness to pay) [45,50,51] may possibly be adequate and effective in order to address this complex issue, which should be an important development of the research discussed so far.

When future research, focused on methodologies to estimate the value of supporting ESs, is carried out, a comprehensive assessment of the issue at stake will make it possible to make informed decisions on the trade-off, that is on the most effective mix of supporting and provisioning ESs.

Second, there is the following nontrivial issue related to the decision concerning the trade-off question. The estimate of the economic value of the loss of provisioning ESs, which the protection of supporting ESs entails, should be based on the assessment of the demand for provisioning ESs, which may eventually remain unsatisfied, and of the additional demand for supporting ESs, which will be met. Therefore, it is not enough to compare the economic value of the lost production and the economic value gained in terms of protected habitats and species, but a correct assessment implies the availability of complete information on the size of the demand of provisioning and supporting services, since only truly-demanded ESs have an economic value. This issue is discussed in-depth by Bastian et al [52] in theoretical terms through the ecosystem properties, potentials and services (EPPS) approach, which could be an important starting point, together with the results proposed in this essay, to address the question of the demand side in the case of provisioning and supporting ESs.

Third, it has to be stressed, as Bastian, among many, maintains [53], that there is plenty of room for future research to explore trade-offs related to the supply of other types of ESs, such as regulating, cultural and supporting ESs. The outcomes of our analysis pioneer this research as regards trade-offs concerning the supply of provisioning ESs.

Finally, directions for future research can be generated by taking account of some important caveats that characterize our study, as follows.

Assessing ESs taking into consideration only land cover patterns detected on the basis of the Corine Land Cover classification is just a starting point to address a very complex issue. For example, given the local scope of the analysis, more detailed datasets can possibly be created and utilized. Inconsistencies between MMPs and MPs, found on the basis that land cover categories occurring in the assessed Natura 2000 Sites have potential to supply livestock activities, so generating a potential trade-off between conservation and provision, should be qualified, in future research works, by taking account of factors other than land cover, primarily land use (e.g., intensity of management) or the spatial configuration of the landscape.

We would like to conclude this essay by quoting two important sentences of Burkhard et al. [43] (p. 27), which adequately highlight that it is worth pursuing future research: “The selection of appropriate temporal and spatial scales as well as appropriate system borders is crucial for ecosystem service assessments”, and “[O]ne main obstacle in the evaluation of ecosystem services is the lack of appropriate data for the quantification of the individual services’ supply and demand”.

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