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Ecosystem services-based SWOT analysis of protected areas for conservation strategies

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ABSTRACT

An ecosystem services-based SWOT analysis is proposed in order to identify and quantify internal and external factors supporting or threatening the conservation effectiveness of protected areas. The proposed approach concerns both the ecological and the social perspective. Strengths and weaknesses, opportunities and threats were evaluated based on 12 selected environmental and socio-economic indicators for all terrestrial Italian protected areas, belonging to the Natura 2000 network, and for their 5-km buffer area. The indicators, used as criteria within a multi-criteria assessment, include: core area, cost-distance between protected areas, changes in ecosystem services values, intensification of land use, and urbanization. The results were aggregated for three biogeographical regions, Alpine, Continental, and Mediterranean, indicating that Alpine sites have more opportunities and strengths than Continental and Mediterranean sites. The results call attention to where connectivity and land-use changes may have stronger influence on protected areas, in particular, whereas urbanization or intensification of agriculture may hamper conservation goals of protected areas. The proposed SWOT analysis provides helpful information for a multiple scale perspective and for identifying conservation priorities and for defining management strategies to assure biodiversity conservation and ecosystem services provision.

1. Introduction

Many studies and meta-analyses corroborate the significant role of biodiversity for the provision of ecosystem services (e.g. Anderson et al., 2009; Costanza et al., 2007; Egoh et al., 2007; Isbell et al., 2011) and examine the consequences of biodiversity loss on human society (Cardinale et al., 2012). The EU Natura 2000 network was designed to "to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020" (Communication from the European Commission, COM/2011/0244). It consists of over 26,000 areas which were identified according to ecological and biogeographical criteria to preserve the habitats and species, but only a part is protected by national instruments. Recently, studies on land-use dynamics and global change have raised awareness of weaknesses in European conservation management strategies and policies (Haslett et al., 2010). To support conservation approaches, the notion of ecosystem services has a great potential (Goldman and Tallis, 2009), but its added value is still scarcely explored (Egoh et al., 2007) and lacking in the EU nature conservation law (Heneberg, 2013). Several studies have assessed the costs and benefits of Natura 2000 sites (Bastian, 2013; Bugalho, 2009; Jacobs, 2004; Kettunen et al., 2009). Generally, Natura 2000 sites offer various advantages to the local population and contribute to the regional development (Berghöfer et al., 2011). Although these effects are difficult to translate in monetary terms, the economic advantages of the Natura 2000 network are estimated between three and seven times its annual running costs of EUR 5.8 billion (Gantioler et al., 2010).

Although ecosystem services have become a leitmotiv of conservation policies (e.g. European Strategy for Biodiversity 2020) in recent years, methods and tools to systematically and quantitatively assess the benefits of ecosystem services to human society and to measure the effectiveness of conservation measures are still

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lacking. To establish an effective policy design of biodiversity conservation and ecosystem services provision, there is a need for accounting for factors that may hamper or facilitate the protected areas' mission, from both the ecological and the social perspective (Jones-Walters and Čivić, 2013). From the ecological perspective, protected areas are expected to maintain local biodiversity, by supporting habitat, species and ecological processes and functions. From the social perspective, protected areas provide a set of ecosystem services (e.g. water provision, air quality, recreation) to local users as well as to regional and global beneficiaries. While delineating protected sites, two distinct areas are clearly identifiable: those inside and those outside the protected area. This distinction also influences the relationships between the local population and the nearby one. While the first may be negatively affected by restrictions in the use of natural resources, the latter may benefit, for example, from maintaining recreation opportunities and scenic beauty. To date, only a few studies have assessed the influence of the surrounding lands on conservation objectives in Europe (Palomo et al., 2012; Svancara et al., 2009). Current land-use changes (such as urbanization) and the increasing human pressure (e.g. tourism) have negative impacts on conservation effectiveness of protected areas. Major threats to protected areas (Salafsky et al., 2008) include: development, agriculture, accessibility, and resource extraction. Moreover, the on-going climate change increases the pressure on Natura 2000 sites (Araújo et al., 2011).

Such ecological and social factors can be grouped into four categories as defined the acronym SWOT suggests: Strengths, Weaknesses, Opportunities, and Threats. The SWOT analysis is widely applied in strategic decision support for business management, but recently it was also used for environmental management and assessment (e.g. Lozano and Vallés, 2007; Martins et al., 2013; Nikolaou and Evangelinos, 2010; Nouri et al., 2008; Srivastava et al., 2005; Terrados et al., 2007). The application of SWOT alone, however, has several limitations: it does not analytically determine the importance of factors and it expresses individual factors which often bring to a generalization or to a brief account. Consequently, the SWOT analysis may result in an imprecise list or incomplete qualitative assessment of internal and external factors (Kurttila et al., 2000). Recent developments have improved the usability of SWOT by integrating quantitative approaches, such as the Analytic Hierarchy Process (AHP) (Saaty, 1990) and the Multiple Criteria Decision Support (MCDS) methods. This generates hybrid methods or quantified SWOT analyses, which systematically appraise the SWOT factors and explicit their relevance (Chang and Huang, 2006; Kajanus et al., 2012; Kurttila et al., 2000). In particular, MCDS methods can enhance the SWOT analysis and its results by allowing for prioritizing alternative decisions which support stakeholders in management strategies (Kajanus et al., 2012). In the four-quadrant SWOT diagram (Fig. 1), the vertical Y-axis refers to external factors, while the horizontal X-axis refers to internal factors. In the case of a protected area, if it is located in the first right quadrant, it has favourable internal and external conditions for achieving conservation goals.

We propose and test a tailored SWOT analysis to support conservation policies and environmental decisions considering the factors driving conservation success or failure of protected areas within human dominated landscapes. In particular, internal and external key factors affecting biodiversity conservation and ecosystem services provision were identified and assessed by means of environmental and socio-economic indicators. Thus, the concepts of strengths, weaknesses, opportunities, and threats, originally used in business management, were adapted to conservation planning. The quantification of the key factors allowed a benchmark of Natura 2000 sites and provided helpful information, in the four-quadrant SWOT coordinates, to guide conservation policies at different spatial and governance levels.

1.1. Study area

In this study, all the terrestrial sites out of 2287 Italian sites, officially listed in the Natura 2000 network, were selected. They belong to three biogeographical regions:

- Alpine: including the European mountain ranges;
- Continental: consisting of mainly flat or hilly landscapes with a continental climate and intensive agriculture;
- Mediterranean: characterized by warm and dry climate conditions, a long cultural influence, tourism and high species diversity (EEA, 2013a; Ministero dell'Ambiente, 2011).

To simplify spatial analyses, overlapping or bordering sites belonging to the same bioregion were merged into single areas, while maintaining information on the bioregion, which resulted in 1815 study areas (Table 1, Fig. 2).

2. Method

To identify strengths, weaknesses, opportunities, and threats related to protected areas, the SWOT analysis used in business management was adapted in the conservation planning perspective, by considering both the ecological and the social perspective (Table 2).

Based on the quantified SWOT analytical method proposed by Chang and Huang (2006), a 4-step approach to assess Natura 2000 sites was used in this study, including:

Step 1: Decision on what has to be compared.

All Italian terrestrial sites included in the Natura 2000 network were selected and categorized according to their biogeographical region.

Step 2: Identification of internal and external key factors to build a hierarchical structure.

As internal factors (strengths and weaknesses) environmental quality and dynamics of the site were considered. As external factors (opportunities and threats), territory characteristics and dynamics in the surrounding areas were considered, within a 5-km buffer. These factors were expressed by ecological and economic proxy indicators in the site or in buffer areas (Table 3). Since landscape metrics are effective spatial indicators for nature

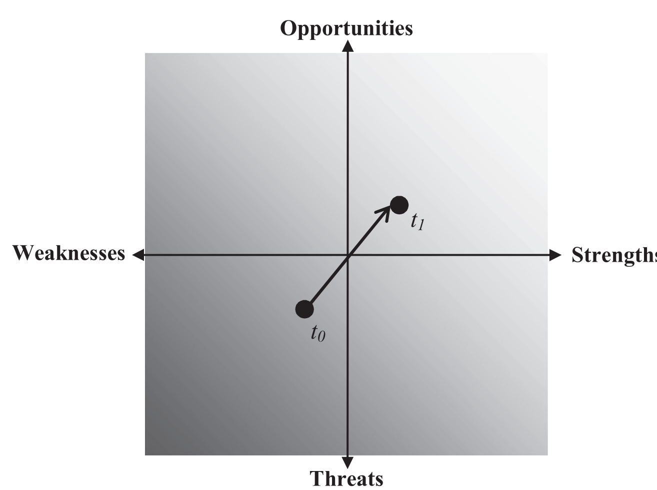

Fig. 1. The four-quadrant SWOT coordinates and an illustrative direction for scenarios (t_0, t_1) for strategic decisions (modified from Chang and Huang, 2006).

Table 1
Natura 2000 sites included in the study and distinguished according to their biogeographical region.

	Alpine	Continental	Mediterranean
Number of Natura 2000 sites	394	549	872
Total area (ha)	1,714,175	921,610	3,197,870
Max. area (ha)	80,251	29,663	127,062
Mean area (ha)	3474	1426	2717
Min. area (ha)	0.12	0.64	0.09
Max. altitude (m a.s.l.)	4081	2005	3236
Mean altitude (m a.s.l.)	1712	603	719
Number of habitats	61	73	90
Most extensive habitats (by area)	8210	91E0	6210
	8340	3150	6220
Most common habitats (by number)	6210	91E0	6210
	91E0	3150	6220

3150 Natural eutrophic lakes with *Magnopotamion*or *Hydrocharition*.
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (important orchid sites).
6220 Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*.
8210 Calcareous rocky slopes with chasmophytic vegetation.
8340 Permanent glaciers.
91E0 Alluvial forests with *Alnusglutinosa* and *Fraxinus excelsior*.

conservation (Bock et al., 2005), proxy indicators were selected from those landscape metrics being considered as appropriate for incorporating ecological knowledge into landscape planning (Botequilha Leitão and Ahern, 2002) or landscape monitoring (Cushman et al., 2008). The economic indicators concern the ecosystem services value assumed to be relevant in promoting a positive attitude towards protected areas by local population, involving, for example, self-limitation in resource use or collaboration with conservation actions (Palomo et al., 2012). The value of selected ecosystem services (Climate and Atmospheric Gas Regulation, Disturbance Prevention, Freshwater Regulation and Supply, Waste Assimilation, Nutrient Regulation, Habitat Function, Recreation, Aesthetic and Amenity, Soil Retention and Formation, Pollination) was derived by Delphi-based benefit transfer, which has been recently developed for the Italian provinces (Scolozzi et al., 2012). Based on ecosystem services values for each ecosystem type from literature, mean values were weighted with a Delphi-process (i.e. expert consultation) to account for the influence of variables, like distance from urban areas and elevation.

Step 3: Calculation and normalization of the performances to uniform the scales of the key factors.

The performance of all key factors was quantified by calculating proxy indicators and by converting the relative values into a score by means of the following normalization methods (Chang and Huang, 2006):

Benefit-criteria normalization (the higher the better)

$$r_{ij} = \frac{p_{ij}}{\max_{ij} p_{ij}}, \forall j$$

Cost-criteria normalization (the lower the better)

$$r_{ij} = \frac{\min_j p_{ij}}{p_{ij}}, \forall j$$

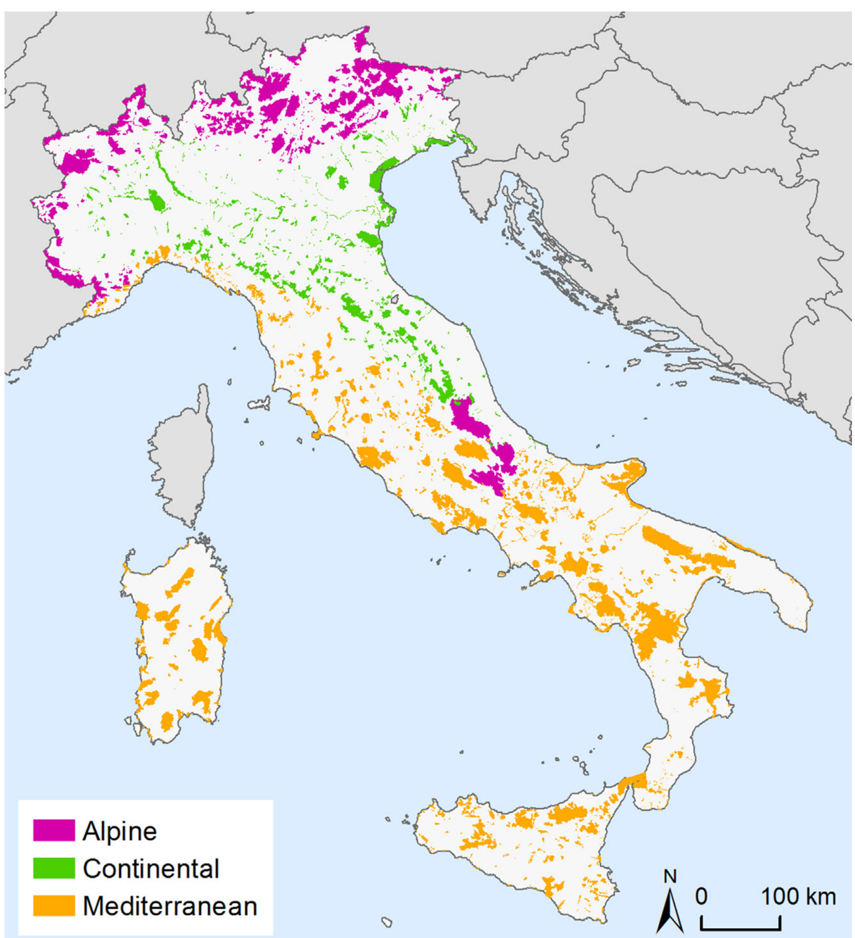

Fig. 2. Natura 2000 sites included in the study according to their biogeographical region.

Table 2
Definitions of SWOT factors from a trans-disciplinary interpretation.

		Business/management	Protected area management	
			Ecological perspective	Social perspective
Internal origin	Strengths	Characteristics of the business or of the project that give it an advantage over others	Characteristics of the site that support ecosystem biodiversity and resilience	Characteristics of the site that support ecosystem services flows
			E.g. connectivity, size, diversity of the site habitats	E.g. valued ecosystem services from the site
	Weaknesses	Characteristics that are a disadvantage for the business/project as compared to others	Characteristics that make the site vulnerable in terms of ecosystem biodiversity and resilience	Characteristics that make the site scarcely productive in terms of ecosystem services
			E.g. internal fragmentation	E.g. disturbance sources within the site
External origin	Opportunities	Elements that the project could exploit to its advantage	Characteristics of the surrounding area that strengthen ecosystem biodiversity and resilience	Characteristics of the surrounding area that promote services flows
			E.g. being part of a wider ecological network	E.g. proximity of beneficiaries[a]
	Threats	Elements in the environment that could cause trouble for the business or project	Characteristics of the surrounding area that could decrease ecosystem biodiversity and resilience	Elements in the environment that could shrink ecosystem services flows
			E.g. intensification of surrounding land-uses	E.g. overuse or abandonment of natural assets

[a] Some variables may have opposite effects, e.g. increasing visitors and congestion effects for nature-based tourism.

Precisely, normalization for some criteria slightly differs from these; the specific normalization method for each indicator can be found in Appendix A.

Step 4: Calculation of the SWOT coordinate values for internal and external assessment.

In line with Chang and Huang (2006), criteria scores were multiplied by criteria weights, the sign of weakness and of threat factors was inverted, weakness scores were summed to strength scores, and threat scores were summed to opportunity ones to obtain two-dimension values (from the four-dimension evaluation) and a visualization of scores in the SWOT four-quadrant diagram with a scale ranging from −1 to 1.

In total, 12 indicators were calculated as specified in Table 3: five indicators were related to internal factors and seven indicators to external ones. Opportunity and threat factors, associated with internal and external land-use change, were calculated for the 1990–2006 period. This period was selected because of the availability of CORINE land cover data (EEA, 2013b, 2013c). All indicators were separately analysed according to the three biogeographical regions and tested if they were significantly different for the three regions by the median test.

3. Results

All indicators were calculated for each Natura 2000 site (the mean values for the different biogeographical regions are reported in Table 4). The four factors of the three regions are significantly different according to the median test. The Continental sites, characterized by smaller areas than the other two regions (Table 1), have also smaller core areas (S1) and lower ecosystem services values (S2). Ecosystem services (S3) for the Alpine sites have a mean economic value of 3533 EUR/ha/year, while the Continental and Mediterranean sites 2767 and 3127 EUR/ha/year respectively. Whereas the total ecosystem services value (W2) increases for the Alpine and the Continental sites, it decreases for the Mediterranean sites (Fig. 3). The economic value of the 5-km buffer areas (O4) is generally lower than the site values, especially for the Continental and the Mediterranean regions. The proportion between the ecosystem services value of Natura 2000 sites and the one of the buffer areas ranges between 1/3 for the Alpine region to 1/6 for the Continental region (1/4 for all sites on average). All buffer areas lose 0.4% of the ecosystem services values (T3) and changes are positive only for the Alpine region (Table 4). In terms of connectivity (O1) and naturalness (O2), the Alpine sites have the best scores. Their surrounding area is also less affected by human activities (T1) than those of the Continental and the Mediterranean regions. While urbanization (T1) in the buffer area is higher for Continental sites, Mediterranean sites are the most affected by the intensification of agriculture (T2).

For all sites, the SWOT coordinate values were calculated based on the indicators and plotted in separate diagrams for each biogeographical region (Fig. 4). Alpine sites are more homogeneous and generally better positioned than Continental or Mediterranean sites. In particular, the Mediterranean sites show high variability and include various sites with considerable weaknesses and threats. For each region, the extreme case was selected and separately analysed (see Fig. 4. For more detailed information see Table 5). The best positioned sites (Alpine and Mediterranean sites) are characterized by a large area, a large core area, high mean ecosystem services value with a few land-use changes, and a good connectivity with other sites. The most negative case of the Continental region is a very small and isolated site with a considerable reduction of the ecosystem services value in the period 1990–2006, especially inside the area.

4. Discussion

4.1. Insights for the Italian Natura 2000 network

The proposed SWOT analysis provides quantitative results on internal and external qualities (strengths and opportunities) and vulnerabilities (weaknesses and threats) of the Italian sites of the Natura 2000 network by means of environmental and socio-economic indicators. The SWOT diagrams indicate the relative rank of the conditions which support or threat biodiversity and ecosystem services provision. The results provide helpful information for a multiple scale perspective, i.e. for environmental decisions at local, regional or national level, even at European or international perspective. In terms of qualities (strengths and opportunities), an ideal site would be located close to 1, on a scale ranging from −1 to 1. The results show that most of the Italian Natura 2000 sites are positioned in the centre of the SWOT

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Table 3
Internal and external key factors of Natura 2000 sites and calculation method of the associated indicators.

		Variable or process	Assumptions	Proxy indicator	Calculation method	Main references
Inside the area	Strengths	Habitat functioning	Larger core areas → more habitats with less disturbance	S1: Core area (with 200-m edge distance)	V-LATE Normalization: as benefit criteria	Inspired by Bock et al. (2005), Botequilha-Leitão and Ahern (2002), Lang and Tiede (2003)
		Ecosystem services value	Higher ecosystem services flows → higher support to site maintenance	S2: € tot/year from the site S3: € tot per average ha/year	Benefit transfer Normalization: as benefit criteria	Scolozzi et al. (2012)
	Weaknesses	Proportion of site exposed to border disturbance	Less compact shape → more disturbance to the site	W1: 1-(Core area/Area)	V-LATE Normalization: as cost criteria	Inspired by Bock et al. (2005), Botequilha Leitão and Ahern (2002), Lang and Tiede (2003)
		1990–2006 Loss in ecosystem services values	Less land-use change within the site → more effectiveness of protection (by local authority or public acknowledgement)	W2: 1990–2006 (%) change in total ecosystem service value	Benefit transfer based on CORINE land cover Normalization: adapted (cost)[a]	Scolozzi et al. (2012)
Outside the area	Opportunities	Connectivity	Less distance to other sites → more potential connectivity	O1: minimum cost distance to another Natura 2000 site	Cost distance based on CORINE land cover and road network: Highways and water: 0 Natural surfaces: 1 (classes 3xx) Agricultural surfaces: 2 (classes 2xx) Artificial surfaces: 10 (classes 1xx) Urban green: 5 (classes 14x) Normalization: adapted (cost)[a]	Inspired by Botequilha Leitão and Ahern (2002), Cushman et al. (2008), Schindler et al. (2008)
		Support to habitat functioning from the surroundings	More surrounding natural areas → more functional habitat and connectivity	O2: hemeroby of 5-km buffer	Reclassification of CORINE land cover[a] Normalization: as cost criteria	Inspired by Acosta et al. (2003)
		Ecosystem services provision in the surroundings	Higher ecosystem services flows → higher (ecological and social) support to site maintenance	O3: € tot/year within 5-km buffer O4: € tot per average ha/year of 5-km buffer	Benefit transfer Normalization: as benefit criteria	Scolozzi et al. (2012)
	Threats	Urbanization in the surroundings	More urbanization → more direct disturbances (e.g. pollution, human intrusion).	T1: 1990–2006 (%) change of urban area of 5-km buffer	CORINE land cover classes 1xx Normalization: adapted (benefit)[a]	inspired by Schindler et al. (2008)
		Intensification of agriculture	More intensive agriculture → more direct disturbances for biodiversity (e.g. by pollution, water extraction)	T2: % 1990–2006 of intensive agriculture of 5-km buffer	CORINE land cover classes 21x, 22x Normalization: adapted (benefit)[a]	inspired by Schindler et al. (2008)
		1990–2006 Loss ecosystem services delivery from surroundings	Less ecosystem services flows → less “ecological” support to the site	T3: % of 1990–2006 change in total ecosystem service value of 5-km buffer	Benefit transfer for each buffer Normalization: adapted (cost)[a]	Scolozzi et al. (2012)

[a] Further details in Appendix A.

diagrams, the Alpine sites having more opportunities and strengths than Continental or Mediterranean sites. While the Alpine sites are more similar to each other, more connected among them, and less disturbed by surrounding urbanization and intensive agriculture, the Mediterranean sites are characterized by higher variability.

In general, internal factors show less variability than external factors. This can be explained by lower numbers of different land-cover classes and of land-use changes. The Alpine sites have the most of opportunities, because their buffer areas are characterized by natural land-cover types and less land-use changes. This stresses the importance of the surrounding areas, but it also draws the attention on the weaknesses of Mediterranean and Continental sites, which are more threatened by urbanization and intensification of agriculture. Loss in ecosystem functioning around the protected areas can break the ecological linkages and the synergies existing between the protected areas and the surrounding ones, thus isolating the former and consequently reducing their biodiversity (Hanski and Ovaskainen, 2002).

4.2. Limits of proposed SWOT analysis

SWOT analysis is a widely used and simple concept which allows identifying key factors able to support management strategies and decisions. Integrating such a concept with a quantitative

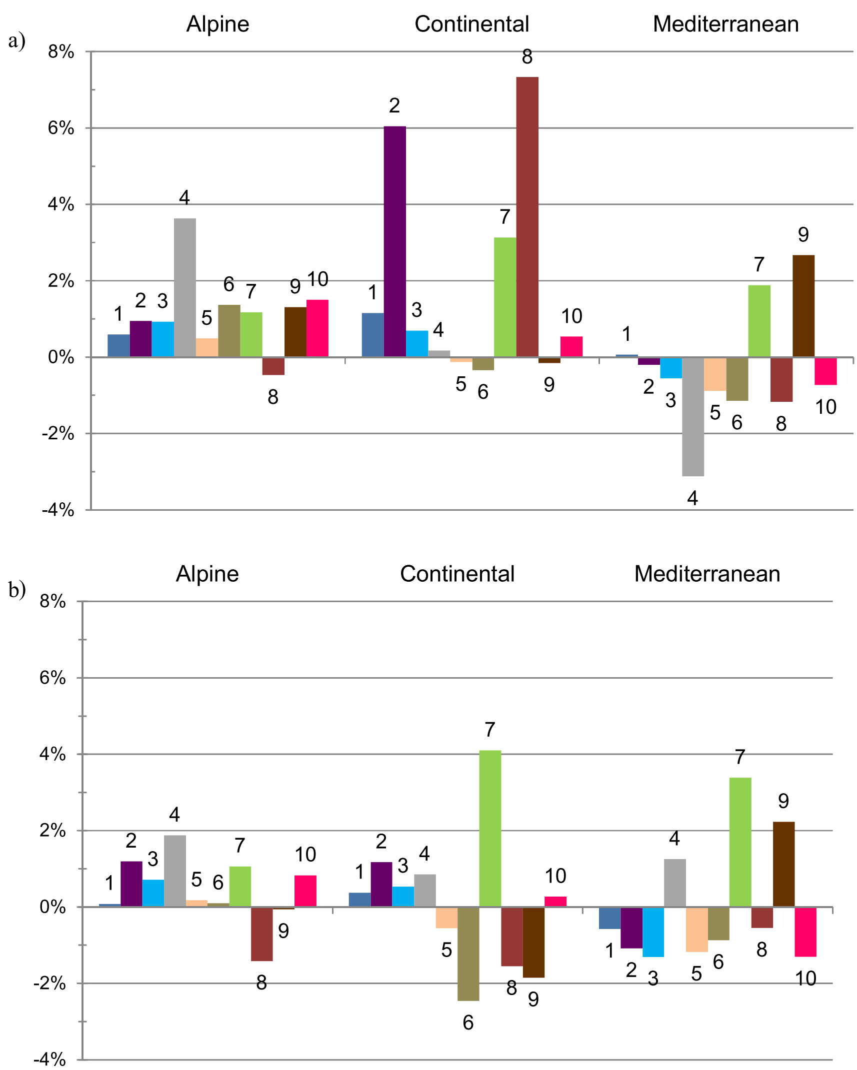
Table 4
Mean values with Standard Deviation (SD) of all indicators for the different biogeographical regions. High SD is due to high variability of the spatial extent of the sites and, in particular, to disjointed small areas (<5 ha) belonging to a site.

		Alpine		Continental		Mediterranean	
Indicator	Unit	Mean	SD	Mean	SD	Mean	SD
S1	ha	3896	15,290	1277	4982	3241	14,168
S2	Mio. €	12.23	45.84	5.37	18.47	12.49	49.53
S3	€/ha	3533	1838	2767	2074	3127	1932
W1	[a]	0.67	0.34	0.66	0.29	0.58	0.31
W2	%	0.75	18.42	7.63	93.98	15.45	278.28
O1	km	2.34	3.32	5.52	13.02	4.29	9.80
O2	[a]	2.29	0.61	3.88	1.05	2.93	0.98
O3	Mio. €	56.11	61.48	31.30	38.48	39.33	46.51
O4	€/ha	3494	820	1818	1061	2304	1160
T1	%	20.04	83.00	862.76	19699.40	106.23	2302.14
T2	%	−0.73	29.56	0.57	14.99	735.43	21093.68
T3	%	0.72	3.45	−1.04	4.56	−1.32	6.01

[a] Dimensionless (e.g. ratio).

approach contributes to its robustness and effectiveness as far as strategy planning is concerned (Chang and Huang, 2006). The proposed method can be applied at different levels and needs relatively little input information, which is generally available, such as CORINE land cover. Nevertheless, the applied SWOT analysis shows some limitations:

1. Assessment of internal and external factors is based on general ecological assumptions (e.g. larger core areas mean more habitats with less disturbance), which are generally recognized and validated. However, such assumptions may not be valid in specific situations, thus making the used criteria (Table 3) appear ambiguous. For example, while urbanization near a Natura 2000 site is considered as a threat because it causes direct disturbances, it may increase cultural ecosystem services like a higher aesthetic value or recreation due to an increased demand.
2. The economic value of ecosystem services was derived from the transfer value method based on surrogate market data (Scolozzi et al., 2012). The method relies on remote sensing data and on land-cover data and does not include specific surveys for



1. Climate and Atmospheric Gas Regulation; 2. Disturbance Prevention; 3.Freshwater Regulation and Supply; 4.Waste Assimilation; 5. Nutrient Regulation; 6. Habitat Function; 7. Recreation; 8. Aesthetic and Amenity; 9. Soil Retention and Formation; 10. Pollination

Fig. 3. 1990–2006 change in each ecosystem service in a) Natura 2000 sites and b) for 5-km buffer areas.

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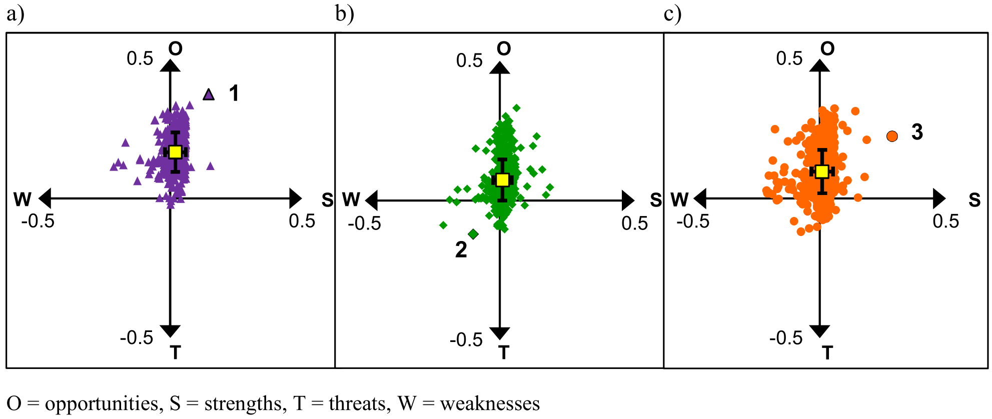

Fig. 4. Position in the SWOT quadrant of each Natura 2000 site for the a) Alpine, b) Continental, and c) Mediterranean biogeographical regions. The yellow mark represents the mean value with standard deviation for the whole biogeographical region. The indicator values of the extreme case (numbered site) of each region are shown in Table 5. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

ecosystems. The resulting values only reflect the ecosystem's ability to provide a given service. For this reason, they are potential values, to be considered and used as relative values rather than absolute values.

3. SWOT analysis shows correlations between ecosystem services loss and land-use changes, but the drivers of land-use changes and of the consequent ecosystem services loss are not highlighted.
4. The lack of updated land-cover data and its low resolution can compromise the accuracy of the analysis and the designing of effective strategies (Di Sabatino et al., 2013).
5. The proposed assessment framework, defined to use the commonly available data, do not include site specificity given by species and habitat lists, and neither their related characteristics of rarity or representativeness. This information could be integrated as further criteria in the SWOT framework. Anyhow, the uniqueness of a site (e.g. for including particular rare species) may not be directly related to its potential or capacity to achieve the conservation goal: two sites with the same uniqueness quality may have different ecological (spatial structural) and social (internal and external) conditions hampering or facilitating biodiversity conservation; the proposed approach can elicit that providing helpful information to decision makers.

4.3. Use of the proposed SWOT analysis in decision making

The results of the proposed SWOT analysis can be useful for defining management interventions or strategies and landscape planning. The analysis design can be easily adapted to support decision making at different levels of governance: local (e.g. a single site or multiple sites), regional (e.g. counties or smaller administrative units), or national and even international (e.g. biogeographical regions). SWOT analysis provides different insights of the ecological, spatial and socio-economic aspects of Natura 2000 sites which can support land management and policy making in different ways. In particular, it allows to:

- Analyse the external and internal factors contributing to the success or failure of a network of protected areas;
- Better understand the relationships between protected areas and their outside buffer zones;
- Prioritize mobilization and allocation of resources in order to implement policies and measures aiming at protecting critical sites, site networks or biogeographical regions;
- Compare different sites by ranking their conservation potentials;

These points can help designing strategies in order to reach a desired status in the SWOT quadrant, Management strategies could focus on both external and internal factors, building on strengths and opportunities, and minimizing weaknesses and threats. For example, economic instruments or markets can internalize environmental externalities, i.e. taking into account the possible costs, due to the loss of ecosystem services, or the benefits and the involved stakeholders (Engel et al., 2008; Schomers and Matzdorf, 2013). Building political and social support, and involving local stakeholders is an important component of conservation strategies (Morrison and Aubrey, 2010), aiming at, for example, mitigating the effects of intensive urbanization or intensive agriculture. If threats or weaknesses cannot be converted, they should be minimized through regulation.

Competitive advantages can derive from synergies between different strengths and opportunities. In particular, supporting and regulating services depend, to a large extent, on the maintenance and/or restoration of well-functioning ecosystems; therefore, highlighting the socio-economic importance of protected areas in delivering such services generally supports biodiversity conservation too (Kettunen and ten Brink, 2013). Managing synergies among conservation priorities and ecosystem services can help to meet conservation goals, to secure ecosystem services and to create social and economic benefits to local communities. The issue of water management and protection is particularly relevant in Italy, since the two critical regulating services, water regulation and water purification, are decreasing, especially within Mediterranean Natura 2000 sites and their surrounding areas. Italian Natura 2000 sites could benefit from synergies between Habitat and Bird

Table 5
Indicator values for the extreme cases (numbered site of Fig. 4) of each biogeographical region.

	Alpine (1)	Continental (2)	Mediterranean (3)
Area (ha)	141,613	103	252,656
Core area/area	0.928	0.268	0.942
Total ES Value (€/y)	522,049,651	181,427	894,060,033
ES value per ha (€/y)	3686	1768	3538
Change of total ES value (%)	−0.05	−53.4	+0.3
Change of total ES value in buffer area (%)	+0.4	−15.7	−1.1
Distance to the closest Natura 2000 site (m)	200	17,211	2600

Directives and Water Framework Directives, which allow for making value of humid areas for ecosystem services provision (D'Antoni and Natalia, 2010; Santolini et al., 2011).

5. Conclusions

In this study, a methodological proposal was tested, by applying and adapting a common management tool, the SWOT analysis, to achieve conservation objectives and ecosystem services provision. From results, the following conclusions can be derived:

- Strength, weakness, opportunity, and threat factors are based on ecological and economic indicators within a dynamic perspective which includes all land-use changes having occurred during the last decade. They can indicate the conditions of the Natura 2000 network which are most promising in terms of biodiversity conservation and ecosystem services provision.
- The proposed SWOT analysis can inform conservation policy making at different spatial scales and governance levels. Results for the Italian Natura 2000 sites, aggregated by biogeographical regions, indicate that the Alpine region is the best positioned in the SWOT quadrant as compared to the other biogeographical regions. The Alpine sites have indeed more opportunities and several strong points which allow achieving their conservation goal: they are better connected, they have larger core areas, and they provide more ecosystem services per hectare. Moreover, their land cover is more stable and more natural. Conversely, the sites belonging to the Continental region are the most threatened by external factors, in particular by an increase of urbanization. Finally, the Mediterranean sites have been losing many ecosystem services in the 1990–2006 period and show the most important increase in agricultural intensification in the surrounding areas. In general, all sites of the Natura 2000 network in Italy appear to be very distant to the speculative best conditions.
- The proposed SWOT analysis can be applied to conservation policy making, as well as to site monitoring in order to better inform its management.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jenvman.2014.05.040.

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