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Ecosystem services inclusive strategic environmental assessment

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ABSTRACT

A consistent framework to address biodiversity, ecosystem services and their societal values is now established with the MEA (Millennium Ecosystem Assessment) and the TEEB (The Economics of Ecosystems and Biodiversity). These and other studies point to the urgency in considering actions that can revert the process of degradation of biodiversity values and its supporting ecosystems. Safeguarding livelihoods is a common objective in ecosystem approaches as well as in strategic environmental assessment (SEA) effort to promote sustainability. Human activities, as direct and indirect development drivers, are crucial targets for SEA to have a strategic contribution in influencing priorities, by showing strategic reasons for change. Rather than keeping only a control and mitigation role on the assessment of effects and impacts of development on the environment, SEA has the capacity to understand the decisional and development context and to drive development opportunities into pathways that are inclusive of environmental and sustainability priorities. The development opportunities provided by ecosystem services can be explored in SEA through strategic approaches to enhance the value of the benefits and avoid the negative impact of human actions on ecosystem services. SENSU, a research team at IST-Portugal, advocates the strategic-based and collaborative oriented approach in SEA based on Partidario (2007) SEA framework of critical decision factors (CDF). A methodology to allow the consideration of ecosystem services in SEA is being developed and tested. This paper will share research advances on how ecosystem services can be incorporated into SEA as a fundamental component of strategic assessment in support of decision-making.

1. Introduction

The Millennium Ecosystem Assessment (MEA, 2005), and subsequently The Economics of Ecosystem and Biodiversity (TEEB, 2010a) are global studies carried out to assess, respectively, the consequences of ecosystem change on human well-being and the economics of biodiversity loss. Both studies highlighted the relationship between biodiversity and ES and their importance for human well-being.

Changes in ES are mostly driven by socioeconomic factors. Human demands on the provision of services increase with population growth, socioeconomic dynamics and land use changes, accounting for the most important drivers of change. The MEA revealed that 60% of the assessed ES were being degraded or used unsustainably, causing disproportionate impacts, contributing to social disparities, increased poverty and social conflicts around the world. Many other studies (Pereira et al., 2009; Slootweg et al., 2010; TEEB, The Economics of Ecosystems and Biodiversity, 2010a, 2010b; UNEP, 2011; WBCSD, 2011) point to the urgency of considering actions that can revert the process of degradation of biodiversity values, and its supporting ecosystems.

MEA (2005) suggested, and many authors and studies have confirmed (Geneletti, 2011; Haines-Young et al., 2012; Partidario and Slootweg, 2012; Pereira et al., 2009; Slootweg et al., 2010; TEEB, The Economics of Ecosystems and Biodiversity, 2010a, 2010b) that human well-being and the safeguard of ecosystems may be considered strongly linked. The recognition of this link is a strong argument to enforce the incorporation of ES in territorial development strategies. Extending the application of the ES concept at the level of land use public policies will allow the effects of certain land use development options on ecosystems, and on their ability to provide services, to be considered and evaluated while making land use proposals, and choices on future developments. This will mean a significant shift in the way land use planning is currently done, enhancing a major contribution to the strategic safeguard of ES maintenance, and consequently the well-being of the communities that depend on them. Strategic environmental assessment (SEA), as a strategic decision support instrument, can play a significant role in ensuring ES consideration through the environmental and sustainability assessment of spatial and land use plans. This means therefore that SEA and ES can be relevant to each other because both make sense at strategic levels, and share human well-being and safeguarding livelihoods as leading undertakings to promote sustainability.

Private (Coca-Cola, 2012; Walsh, 2011) and government efforts (Garbach et al., 2012) in considering biodiversity through ES confirm theoretical findings. But despite growing recognition, mainstreaming ES into decision-making and stopping ES unsustainable use are still an intended objective. The research question in this paper is about the extent SEA may be able to help achieve that objective by exploring and assessing territorial development options that may enhance

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the safeguard of ecosystems, and consequently their capacity to provide services. This opens an important opportunity for SEA in strategic decision-making, considering the role that SEA increasingly plays in territorial planning at different geographical scales.

The aim of this paper is to explore the role that SEA can play in placing ES in the decision-making agenda, and to discuss the relevance and possible approaches to integrate ES in SEA, by positioning biodiversity, and the services provided by ecosystem services, as a key factor in decision-making. For that purpose this paper advances a methodology for considering ES in SEA in an integrated way, after presenting arguments on why strategic approaches in SEA offer a greater potential than conventional environmental impact assessment (EIA) based SEA. The relationship between SEA and ES is explored before a methodological proposal for ES inclusive SEA is presented. This methodology is being tested in several contexts in Portugal. Results of a preliminary application of this methodology to the Alcochete Municipality will be presented to illustrate some of the steps and possible outcomes.

2. Strategic approaches to SEA and opportunities for integrated decision-making

SEA is frequently described as an environmental assessment approach which purpose is to address the environmental effects associated with policies, plans and programs. This concept relates to a primitive form of SEA based on its EIA origins and on an underlining *one-size fit all* rationale to control the effects of policy, planning or programmatic decision on the environment. Frequently named EIA-based SEA this approach, adopted by sectoral and environmental authorities in many world countries, reveals its strength in reducing uncertainty in relation to what needs to be documented to meet legal requirements. But its inefficiency in dealing with complexity and in providing effective strategic direction has for long been strongly argued in the literature (Kørnøv and Thissen, 2000; Nilsson and Dalkmann, 2001; Partidario, 1999, 2000).

A SEA that is more integrative, participative and interactive, proactively facilitating improvements in policy-making, planning and decision-making in constructive ways has been promoted by several authors as more appropriate to complex decision contexts (Bina, 2003; Eggenberger and Partidario, 1991; Kørnøv and Thissen, 2000; Nilsson and Dalkmann, 2001; Nitz and Brown, 2001; Nooteboom, 2006). In this new perspective SEA's main role is to upstream environmental and social issues into higher levels of decision-making to improve the policy and planning decision contexts, within which projects will eventually be conceived and developed. Rather than assessing the direct or indirect impacts of policies, plans and programs on the environment, through its projects, the rationale underlining this new approach is to take advantage of the SEA advocacy role for better environmental and sustainable decision-making, influencing policy and planning culture and contexts (Partidario, 2009, 2012).

What has been argued for many years (Partidario, 1996, 2000, 2007a, 2007b) is that in order to be effective and responsive to decision needs, SEA must offer flexibility and cannot be formatted as a standard, streamlined sequence, of conventional activities, and in EIA-based SEA. A strategic based model for SEA was proposed by Partidario (2007a, 2007b) to enable a mutual molding process of SEA and strategy formation, working through problem perception and policy design to flexibly respond to problems. This new concept of SEA is based on a framework of elements and activities to enable its flexibility and adaptive design as needed, multiplying SEA opportunities to fit different decision processes. SEA's key role is to facilitate decision-making by involving key actors, enabling dialogues towards mutual understanding, and ensuring long-term and large scale perspectives when considering development options (Partidario, 2009). Methodologically this SEA model is based upon a strong focus on key integrated factors – the critical decision factors (CDF) – and respective assessment criteria that structure the assessment to hit the core of the decision strategic issues, processes and contexts.

The CDF methodological framework (Partidario, 2012), which supports the ES inclusive SEA methodology (Section 4), follows this strategic based model, and is structured in three fundamental stages in a cyclical process (Fig. 1): 1) SEA context and strategic focus; 2) pathways for sustainability and guidelines; and 3) a continuous stage of follow-up, process linkage and engagement.

The point made is that, when conceived with a strategic insight, SEA offers a greater potential to integrate the fundamental factors that need to be considered in policy, planning and programmatic decisions to ensure a development that must be sustainable. That potential is enhanced by the strategic role of SEA in influencing decision-making through the integration of relevant "big picture" environmental issues at the core of strategic decisions to help identify pathways for sustainability. ES represent critical biodiversity aspects that must be factored into decision-making, particularly within spatial and land-use policies and planning. At strategic levels SEA must take ES as "big picture" sustainability issues, related to human well-being and sustainable livelihoods. SEA needs to act strategically in relation to why doing, who to engage, what to consider and when and how to influence decision-making to increase its chances of success. As such, SEA and ES will be mutually relevant.

3. SEA and ecosystem services

The Convention on Biological Diversity (CBD) requires that appropriate arrangements are established to ensure that environmental consequences of policies, plans and programs that are likely to have significant adverse impacts on biological diversity are taken into account, and whenever possible to allow public participation on those processes (article 14). On the other hand ES are seen as an important tool for communicating and mainstreaming biodiversity in various sectors and policies (TEEB, The Economics of Ecosystems and Biodiversity, 2010a, 2010b), and a crucial element in the reporting towards new biodiversity targets (Toivonen, 2010).

The integration of biodiversity in EIA and SEA has been evolving from conservation to an integrated approach. For Slootweg et al. (2006) biodiversity should be seen as a provider of goods and services set through ES in EIA and SEA contexts. Emphasis has been placed particularly on the role of SEA in creating opportunities for local and regional planning (TEEB, 2010b). Considering the socio-political nature and the broad geographical scale in the assessment of policies and plans, the assessment of ES can be a smart way to consider the strategic importance of biodiversity for given regions and communities.

SEA and ES are both concepts aiming to protect the environment and the promotion of human well-being. The success of this objective is enhanced through integrative approaches that interwoven social, economic and environmental factors as highly inter-related dimensions (Gibson et al., 2005), particularly when conducted in a strategic sense (Partidario, 2009).

Recent methodological guidelines to assess and integrate ES in decision-making have been published by the WRI (2008), the OCDE (2008), and Slootweg et al. (2010), however the practice, and evidence, of integration of ES in SEA are still in its infancy (Geneletti, 2013). Van Beukering et al. (2008) found, through the integration of ES in the SEA process, that SEA has harnessed the potential and the opportunity to generate the expected benefits. Despite difficulties in finding practical evidences for the application of ES on an SEA context, the authors present ten cases studies where the identification, quantification and valuation of ES effectively contributed to the decision-making, recognizing that a methodological reference is still lacking. Geneletti (2011 and 2013) provides valuable insights and further examples on how to promote the ES inclusive SEA, suggesting actions for increasing information on ES in SEA, but still using a rather standard SEA flow of activities and linkage to planning.

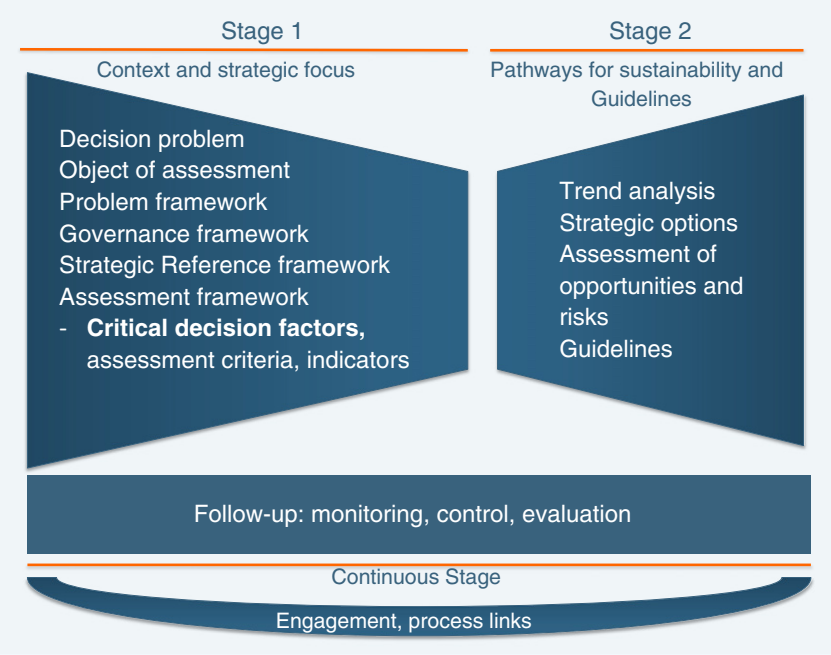

Fig. 1. Three stages of the strategic thinking model for SEA (Partidario, 2012).

While the potential synergy between SEA and ES seems promising, in exploring their linkage it is important to recognize the complexity that surrounds ES, particularly in relation to biodiversity. Echoes of concern reveal controversies based not only on ethical – biodiversity and ES have an intrinsic value – but also on technical grounds. Despite synergies between biodiversity and ES, some authors consider that many ES depend on ecological patterns and configurations not related to biodiversity (Kinzig, 2010). Others argue that ES are not sufficient by themselves to target biodiversity protection (Chan et al., 2006). Recent trends in ecological economics integration, when considering natural resources management, were extended to ES advancing market-based mechanism, such as Markets for ES and the Payments for ES schemes (Gómez-Baggethun et al., 2010). TEEB (The Economics of Ecosystems and Biodiversity) (2010a, 2010b) has drawn attention to the economic benefits of biodiversity to support the mainstreaming of biodiversity, and ES, into policy making. This economic trend is based on the assumption that putting a price on ES will be useful for decision-making (TEEB, The Economics of Ecosystems and Biodiversity, 2010a, 2010b). However limitations related to ES' contribution to decision-making include ambiguities in the definitions of key terms (e.g. ecosystems processes, functions and services) (Wallace, 2007), fragilities in economic methodologies, subjective valuation (Farber et al., 2002) and ES approaches leading to too resource-intensive activities. But as pointed out on TEEB (The Economics of Ecosystems and Biodiversity) (2010a, 2010b) not valuing nature in monetary terms can imply that it has no value, running the risk of being considered 'worthless' rather than 'priceless'. Likewise, placing a value where there is no price is a major concern, and appropriate methods to deal with uncertainties in a quantitative manner are still missing (Grêt-Regamey et al., 2012).

What appears to be missing is the capacity to address the complexity associated to the valuation of ES in general (Chee, 2004; Farber et al., 2002), and particularly in strategic contexts, such as in policy and planning decision-making. This paper argues that such complexity requires specific methodologies perhaps less based in the quantification of ES and more on dialogues, agreements and commitments to broader policy objectives that set actions.

An integrated approach for addressing ES in policy options in strategy development was proposed by Partidario and Gomes (2011) to highlight the role of governance in keeping the balance between ecosystem services and human well-being in face of direct and indirect drivers of change (Fig. 2). This framework concept, represented as a simple systems model in Fig. 2, supports the argument that good governance is indispensable in complex decision-making to enable adequate planning and management of socio-ecological systems towards human well-being (Ostrom, 2009). But it also shows how the system represented in Fig. 2 is interconnected, such that both governance and drivers of change need to become the target of SEA while addressing the whole systems inter-linkages: how indirect drivers strategically influence direct drivers; how drivers may directly change ecosystem services, or indirectly, through changes in human well-being; how drivers can directly change human well-being, or indirectly via changes to ecosystem services; and how governance, with strategy development through policies and planning instruments, can directly influence human well-being, or indirectly through drivers, or through ecosystem services.

As discussed above, socio-economic dynamics and population change are major drivers of change that can be both indispensable and detrimental to balanced socio-ecological systems. Rather than pursuing a discussion on the link between biodiversity and ES, this paper is more focused on the link between human well-being and ES. Recognizing this link is accepting the argument that it is necessary to consider and integrate ES in territorial development strategies. A fundamental condition for success however is to ensure that different stakeholders are engaged earlier on to set different preferences and trade-offs with respect to the use and contribution of ES to their well-being. These different view points on the value of ES are one of the key reasons for complexity in ES and SEA. Because well-being is also not necessarily measured in quantifiable monetary terms, this discussion needs not to be dependent on the availability of market values and economic methods, increasing its inherent complexity. The proposed methodology for ES inclusive SEA, presented in Section 4, is grounded on this fundamental stakeholder engagement principle, but not necessarily on the market valuation of ES.

The SENSU (Strategic Approaches to Environment and Sustainability) research group at IST (Instituto Superior Técnico) has been testing, since

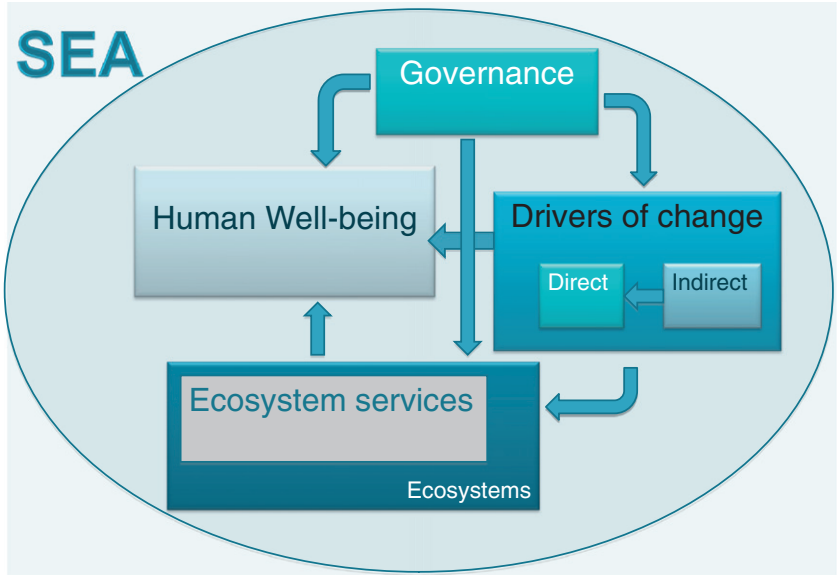

Fig. 2. ES inclusive SEA conceptual model in strategy development (Partidario and Gomes, 2011).

2008, an ES inclusive SEA approach, incorporating the safeguard and the enhancement of biodiversity and ecological systems in SEA as a key factor for consideration when assessing development options in a strategic context. SENSU follows the Partidario (2007a, 2012) strategic-based model for SEA (see Fig. 1), applying it in multiple contexts and has considered biodiversity, and ES, in the form of CDF or assessment criteria (Table 1). The strategic-based SEA model approach has helped to ensure integration of ES at strategic level in the assessment of territorial and sectoral policy and planning options. Policies and plans are governance instruments that direct drivers of change in ways that influence human well-being and ecosystem services, as conceptualized in Fig. 2.

When integrating ES with SEA at policy and planning formulation levels, ES becomes visible and part of the strategic issues. This creates conditions to discuss development options also in relation to opportunities and risks for ES. Whether as a CDF or an assessment criterion, "ecosystem services" is not just additional data, or information that is included into SEA (e.g. through baselines or market values). ES becomes embedded in the assessment framework and in the values system that will be on the decision table when it comes to considering priorities and conditions for success. As shown in Table 1, the integration of ES in SEA can be materialized in multiple ways, depending on how relevant different ES and biodiversity values are in different cases (natural and cultural resources, ecological structure, landscapes, environmental and ecological integrity).

Table 1 reveals the integration of ES through structural dimensions, for example when using the ecosystem approach as an assessment criteria in the National Strategy for Integrated Coastal Zone Management (NSICZM) (to ensure the NSICZM meets the sustainable management of human activities that ensure the integrity of ecological systems and the valorization of ecosystem services) or when adopting ecological connectivity as a CDF in the Palmela Municipal Master Plan. But the integration of ES may also happen through functional dimensions as specific resources (case of Water Resources as a CDF in the Regional Plan for the North Region), or generally as natural and cultural resources (as the CDF in the Maritime Spatial Plan). The Regional Plan for the Metropolitan Area of Lisbon has adopted both the structural and functional dimensions, by selecting the ecological structure and function as a CDF. In the case of the Alcochete Municipal Master Plan the ecosystem services are directly used as assessment criteria. All these cases show that ES were on the decision table with SEA and were considered throughout the SEA. This means that when formulating and assessing strategic development options due consideration was given to ES au par with other strategic issues. Risks and opportunities for ES were considered when choosing the most adequate pathways for development.

In line with Slootweg et al. (2006), van Beukering et al. (2008), Slootweg et al. (2010) and Pereira et al. (2009), it is also the SENSU SEA experience that ES cannot be adequately addressed in SEA unless the ES stakeholders are part of the process to allow the value of benefits to be interpreted by their respective users. At SENSU the need was felt to materialize ES for SEA through stakeholders' engagement and values assessment in order to make it meaningful in the medium to long term. Based on SENSU experience and on international practices and guidelines, SENSU developed a methodology to assess and integrate ES on SEA (Section 4). Preliminary results from the application of SEA to the Alcochete Municipal Spatial Plan will be presented (Section 5).

4. Methodology for ecosystem services inclusive SEA

Based on the international approaches and guidance developed by Slootweg et al. (2006), van Beukering et al. (2008), OECD (2008), WRI (2008), and also based on the Partidario (2007a, 2012) SEA model (Fig. 1), a methodology was developed to link ES to SEA as a first step towards the valuation of ecosystem services, increasing the tangibility of SEA (Fig. 3). In this methodology the ES are an essential element of analysis and assessment. As discussed in the previous section, and shown in Table 1, ES can be considered in SEA as CDF, or as assessment criteria. The integration of ES in SEA should take place right at the outset and be part of studies to be conducted, namely for trend analysis and institutional contexts. The identification of the relevant ES must happen through stakeholders' engagement, as well as its valuation, particularly in its own terms (and also market terms when available), in terms of its relevance for development. When setting the appropriate macro-policy framework (strategic reference framework) as a referential for assessment, all relevant ES related macro-policies should be considered.

The ES inclusive SEA methodology is based on the following premises:

- Stakeholders are crucial in outlining the importance of ecosystem services;
- Stakeholders are engaged in collaborative processes to identify CDF, strategic options, and in the assessment of opportunities and risks;

Table 1
Examples of SENSU developed cases of SEA inclusive ES.

PPP	Date	CFD	Assessment Criterion
Regional plan for the north Region	May 2008	Water resources: Consider development trends associated to the level of conservation, use and management of economic, energy and environmental potential of water resources, including their role in mitigation and adaptation to climate change.	Economic, energy and environmental value: Evaluation of water resources economic potential, particularly in tourism, hydrotherapy and spring water, energy production, and the enhancement of biodiversity and ecosystem services.
National strategy for integrated coastal zone management http://tinyurl.com/d58dd9x	December 2008	Ecological systems and coastal landscapes: Consider the biological richness, ecosystem services, cultural heritage, including underwater archeology, valorization of ecological goods and services and environmental protection.	Ecosystem approach: Sustainable management of human activities that ensure the integrity of ecological systems and the valorization of ecosystem services.
Palmela municipal master plan	December 2008	Ecological connectivity: Consider development trends in sub-regional and municipal ecological structure, natural values and ecosystem services functions.	Linkages between ecological networks: Evaluation of the maintenance of ecological corridor protection and role in establishing links between areas of fundamental importance to the maintenance of biodiversity and the balanced functioning of natural processes. Integrity of areas with ecological importance: Assessment of evolution of natural areas, including the existence of threats to its integrity in spaces of recognized ecological value.
Regional plan for the metropolitan area of Lisbon	March 2009	Ecological structure and function: Consider the regional structure of ecological values and ES functions, as well, as the integrated management of resources, in terms of connectivity, commitments and added value for regional competitiveness.	Agro-forestry and natural areas valorization: Evaluation of the valorization potential of ecosystem services in natural areas (classified or not) and agro-forestry services of high ecological value.
Maritime spatial plan http://poem.inag.pt/	June 2009	Natural and cultural resources: Consider respect for natural resources and cultural values, functions and values associated with ecosystems services and the marine ecological structure, as well as its management, according to a holistic perspective.	Ecosystem Services: Evaluation of the ability to provide ecosystem services, taking into account thresholds of acceptable change with coordination and multi-purpose logic.
Tomar municipal master plan	July 2009	Environmental valorization: Consider the integrity of the physical quality of the environment and prevention of technological risks and how natural resources contribute to the development of the area.	Green infrastructure and enhancement of natural areas: Evaluation of the use of the natural heritage of the municipality to ecological functions, enjoyment and recreation and economic value, from the standpoint of ecosystem services.
Alcochete municipal master plan	June 2010	Natural systems valorization: Strategic valuation of natural systems, with a particular focus on the estuary and wetlands as natural underground equipment, water and agro-forestry mounted resources.	Ecosystem services: Evaluation of the ability to provide ecosystem services, taking into account thresholds of acceptable change with coordination and multi-purpose logic.

- SEA and planning processes are enhanced by the identification and quantification of ES;
- Valuation of ES is more tangible to decision makers.

Following the rationale associated to the strategic based SEA model represented in Fig. 1, the methodology for ES consideration in SEA follows three basic steps: 1) identification and mapping of relevant ES and stakeholders (including local communities); 2) prioritization of ES; and 3) assessment of ES. Fig. 3 represents these three steps and its integration in the SEA strategic-based model. The fundamental methodological activities and conditions for success are outlined in the following paragraphs:

1) Identification and mapping of relevant ES and stakeholders (including local communities)
   The initial step in any SEA process (whether new assessment or following up from previous assessment cycles) must be to understand the context within which the object of assessment is defined and will be assessed. The relevant problems, and potentials, need to be identified, considering the systemic interwoven of broad environmental and sustainability issues (including social, physical, ecological, cultural, economic, political) that are relevant for decision-making in a strategic context. This will allow an integrated priority-setting agenda to lead the policy-making or planning process.
   It is at this stage that ES need to be integrated. That involves: a) identify and map existing ecosystems; b) identify current and potential stakeholders (including intergenerational); c) identify pressures on ecosystems, and conflicts in land or sector use; d) characterize the accessibility of stakeholders to ES; e) map the relationship between ecosystems and current or potential stakeholders, in terms of the benefits obtained from services, now or in the future; f) engage stakeholders to map their interest and their valuation of ES in their own terms, or through market values; g) consider the identified valuable ES in SEA as CDF or as assessment criteria; and f) fine tune respective indicators for assessment.
2) Prioritization of ES
   In the first step many linkages will have been identified between ecosystems, pressures, ES, land uses and stakeholders' interests. Most probably, conflicting situations in ensuring accessibility to services for all interested stakeholders, now and in the future, will also have been identified. Priority setting is therefore needed, not only to enable pragmatic inputs to the policy process, but also to make sure that the integrity of the ES is maintained to enable the provision of services for future generations. Stakeholders must be engaged in prioritizing ES and in establishing the ES value in its own terms. This prioritization needs to be informed by the analysis of trends. And trend analysis must consider the influence of major direct and indirect drivers of change on the integrity of the ecosystems that support the ES.
   Priority ES must be considered in the assessment of options for development. In order to formulate pathways for sustainability SEA needs to consider to what extent strategic development options may determine risks, or opportunities, on ES based on 1) the ecological, social, and economic value of ES, 2) the stakeholders (inter and intragenerational) value, 3) the ES sensitivity to the strategy key drivers of change, and 4) the ES relevance to the strategy. A prioritization scale should be established.

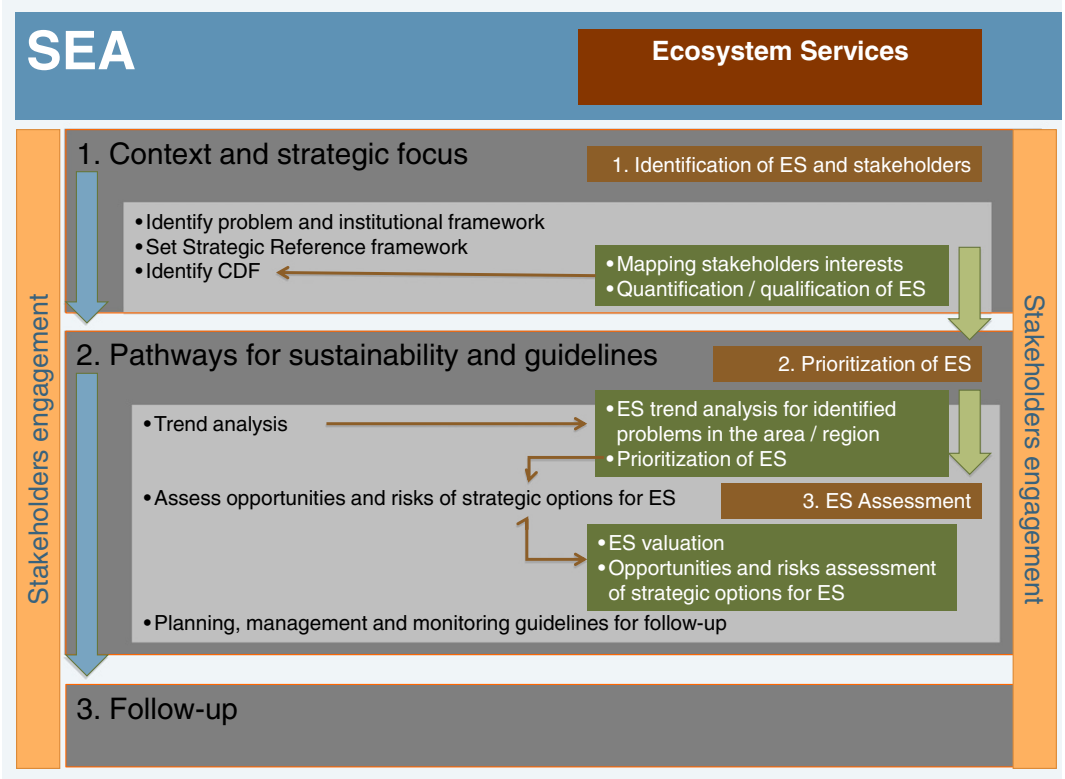

Fig. 3. ES inclusive SEA methodology, based on strategic-based SEA model.

3) Assessment of ES

Assessment of ES should use standard criteria and normalized scales for ES valuation that enable comparison and discussion across stakeholders. Qualitative as well as quantitative assessment may be used as appropriate, but at the end of the day they need to be comparable. A prioritization scale developed in step 2 will be very helpful.

Often the valuation of ES in its own terms (e.g. the cultural value of a given feature, or traditional activity in a landscape) may be more important to stakeholders than a market value (e.g. how many tourists are willing to pay to visit). Negotiation techniques may be indispensable, as well as the development of trust and keeping openness in the negotiation processes. Open dialogues are recommended, to allow different perspectives to be exchanged and learning processes to take place. Mediation may be needed to assist the negotiation processes and help find common long-term objectives. Resulting assessment expressed as risks and opportunities, both for development and for the conservation of the ES, will be an input to the assessment of strategic options in SEA, when looking for pathways for sustainability (see Fig. 3), as well as in defining follow-up and monitoring programs.

The success with the application of this methodology may be hindered by lack of political willingness to have an early stakeholders' engagement process, or to undertake an open and transparent assessment process. Other factors affecting success include not only limited stakeholders' engagement capacity and limited stakeholders' capacity building, but also constraints on data and valuation methods, as discussed in Section 3. Relevant also is the limited capacity of consultants to address stakeholders and the value of ES in its own terms, as well as the endless controversies based on the use of methods, or in semantics rather than on grounded concepts.

5. Preliminary results and discussion based on the Alcochete municipal plan SEA

Alcochete is a municipality with 18,000 inhabitants aiming to duplicate its population after a new 17 km bridge, built in the mid 1990s, improved its accessibility to Lisbon City (Fig. 4). With only 6% of artificial land, Alcochete lies across an important wetland area, mixed saltmarshes, fish natural ponds and other important bird and fish nursery marshes that border the Tagus estuarine and the respective Natural Reserve. This is the most extensive Portuguese wetland, a Natura 2000 site of European relevance due to its habitats and migratory species. The current proximity to Lisbon and natural conditions turned Alcochete into a very attractive area for residential and tourism purposes. It is now under pressure by major urban development intentions, while also intending to keep its key natural and rural characteristics.

Alcochete 2025 is a strategic economic development plan aiming to set strategic direction for the municipal spatial master plan, placing biodiversity, and the ecological value of the municipality at the centre of the development priorities. The strategy for the municipality of Alcochete includes:

- Valuing the Natural Reserve of the Tagus Estuary as a public facility of national and metropolitan importance;
- Capitalizing on the natural value, and conserving nature functions (for example develop knowledge and research polo on estuarine biodiversity theme);
- Establishing an urban biodiversity strategy, promoting an urban environment that benefits from the “privileges” of rural environments;
- Enhancing the tourism potential linked to the enjoyment of natural areas and the relationship with farming and forestry.

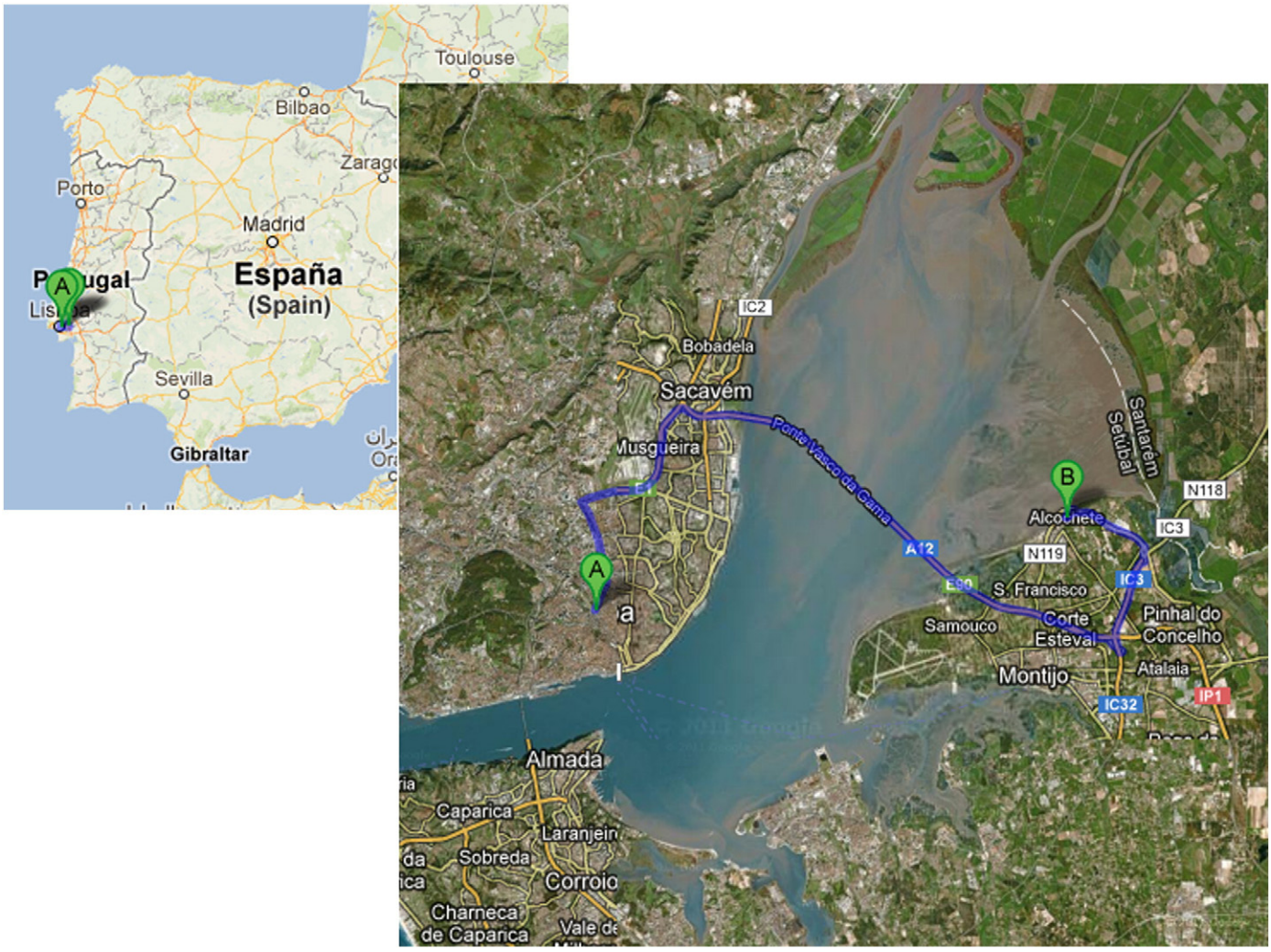

Fig. 4. Alcochete geographical context.

As legally required, the SEA will have to formally assess the municipal spatial master plan. However, while the spatial master plan has been evolving very slowly (through lengthy preliminary characterization studies), SEA started along with the strategic economic development plan, with which it has much more affinities. Because of recent economic crisis in Portugal, and suspension of major projects, such as the new international airport and the high-speed train, both affecting the development in the municipality of Alcochete, the whole municipal planning process is on hold, and the SEA has not been able to do much progress. Therefore the methodology presented in Fig. 3 has only been initiated in the Alcochete context and has not been completely met. For example the identification of CDF, in this case, preceded the stakeholders' engagement.

As part of the first stage of the SEA – context and strategic focus – four CDF were proposed for the assessment of the master spatial plan strategy (Table 2). These four CDF are strongly in line with the Alcochete 2025 strategic economic development plan axes and priorities. CDF 1 explicitly considers ES as assessment criteria.

While the SEA has been slowed down, together with the plan, specific work on the ES has been undertaken in the context of a PhD research on 'Ecosystems services conservation as a valuable asset to local communities sustainability' which is being applied to Alcochete municipality. A group of 27 students of the 2010–11 course on Environment and Spatial Management, at IST Masters in Environmental Engineering were engaged in this study and asked to:

1. Identify and map existing ecosystems
2. Identify stakeholders
3. Engage stakeholders, through interviews, to identify pressures and also their interests.

Table 2
Critical decision factors and assessment criteria in the SEA Alcochete municipal master plan.

Critical decision factors (CDF)	Assessment criteria
CDF1 — valuation of natural systems	Criteria for assessment: valuation of wetland systems; valuation of dry systems; valuation of ecosystem services
CDF2 — human attraction and fixation	Criteria for assessment: housing, urban livelihood and proximity services, mobility, municipal environment quality
CDF3 — cultural identity and economic dynamics	Criteria for assessment: economic activities that value the municipal identity, employment attracting points, cultural heritage maintenance and valuation
CDF4 — energy and climate change	Criteria for assessment: energy efficiency in transports, buildings and economic activities, renewable energy sources use, adaptation and mitigation to climate change

4. Map stakeholders' interest, influence and interrelationship diagrams, power/interest grids
5. Map problems, using mind maps
6. Valuations in socio-ecological terms.

All these activities contributed to step 1 of the ES inclusive SEA methodology described in Section 4 (Fig. 3). Field work was conducted to identify and analyze Alcochete ecosystem services. Through field visits and literature review the group of IST master students visited places and interviewed the local community, small businesses, municipality officers and the Tagus estuarine natural reserve administration. This enabled the identification and mapping of ecosystems and a first identification of stakeholders. Considering a combination of geographic significance (area) and relevance to the local economy, four priority ecosystems were identified (Fig. 5):

- Agriculture: urban orchards, cropping systems, rice fields;
- Forest: cork (the "montado" ecosystem);
- Wetlands: marshes and salt marshes;
- Coastal zone: beaches, dunes and estuarine.

Two particular areas were adopted as specific case-studies given their multiple ecosystems, physical characteristics, and single stakeholder ownership. These were the Quinta da Barroca D'Alva and the Salinas do Samouco (João Gonçalves Junior Foundation). The above four priority ecosystems are particularly well represented in these areas. This will allow, in subsequent stages, an analysis of the cumulative benefits based on a diversity of ecosystems, as well as the associated management issues.

Quinta da Barroca D'Alva is a Lupi's family estate with 1800 ha. Main activities include agriculture and livestock, an equestrian center, rural hotel and movie studio, representing, or using, various ecosystems — urban area, rice fields, agriculture, cork forest and water plans. The cultural heritage is represented by two iconic monuments.

The Salinas do Samouco are managed by the João Gonçalves Junior Foundation, a private institution of public utility (http://fundacaosalinas.com.sapo.pt/apresentacao.htm), that aims to conserve and enhance the saltmarshes from a conservacionist point of view, while following a socio-ecological-economic model of development. The Foundation was established in 2000 following the Portuguese government commitment to compensate for the construction of the new bridge over Tagus, over the Tagus special protection zone. The Samouco saltmarshes complex has 360 ha of an intricate system of canals and tanks based on a traditional operating structure. It coexists with wetlands and dune areas along the Tagus river, together with a small patch of pine forest and farmland.

For each identified ecosystem, and for the particular case-study areas (Quinta da Barroca D'Alva and Salinas do Samouco), characterization of services, and identification and mapping of stakeholders and of problems related with the existent driving forces were done and are represented in Fig. 6.

This preliminary work will be followed by a stakeholder engagement process and, when possible, by an economic analysis. A preliminary qualitative analysis has been undertaken, based on some initial interviews to key stakeholders (including inhabitants of Alcochete, Tourists, Fishermen, Schools, Municipality, Land owners, among others) to analyze stakeholders' shared or opposite interests and their perceptions. Fig. 7 illustrates outcomes of the Alcochete preliminary analysis of stakeholders, concerning their shared interest, while Fig. 8 elaborates on the attitude of stakeholders, in terms of their interest/influence, based upon their shared or opposite interests and power share. Based on this information a workshop is being planned aiming to get a more

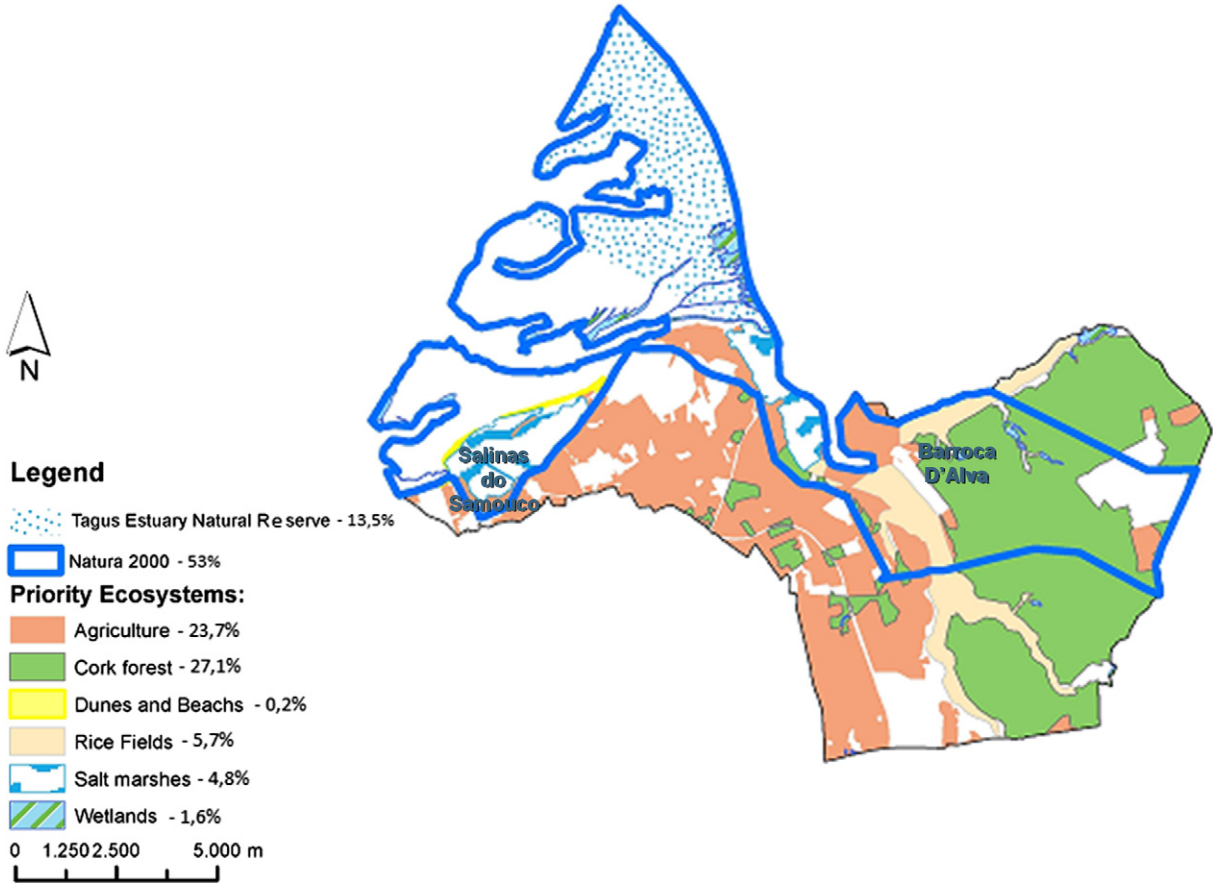

Fig. 5. Alcochete priority ecosystems.

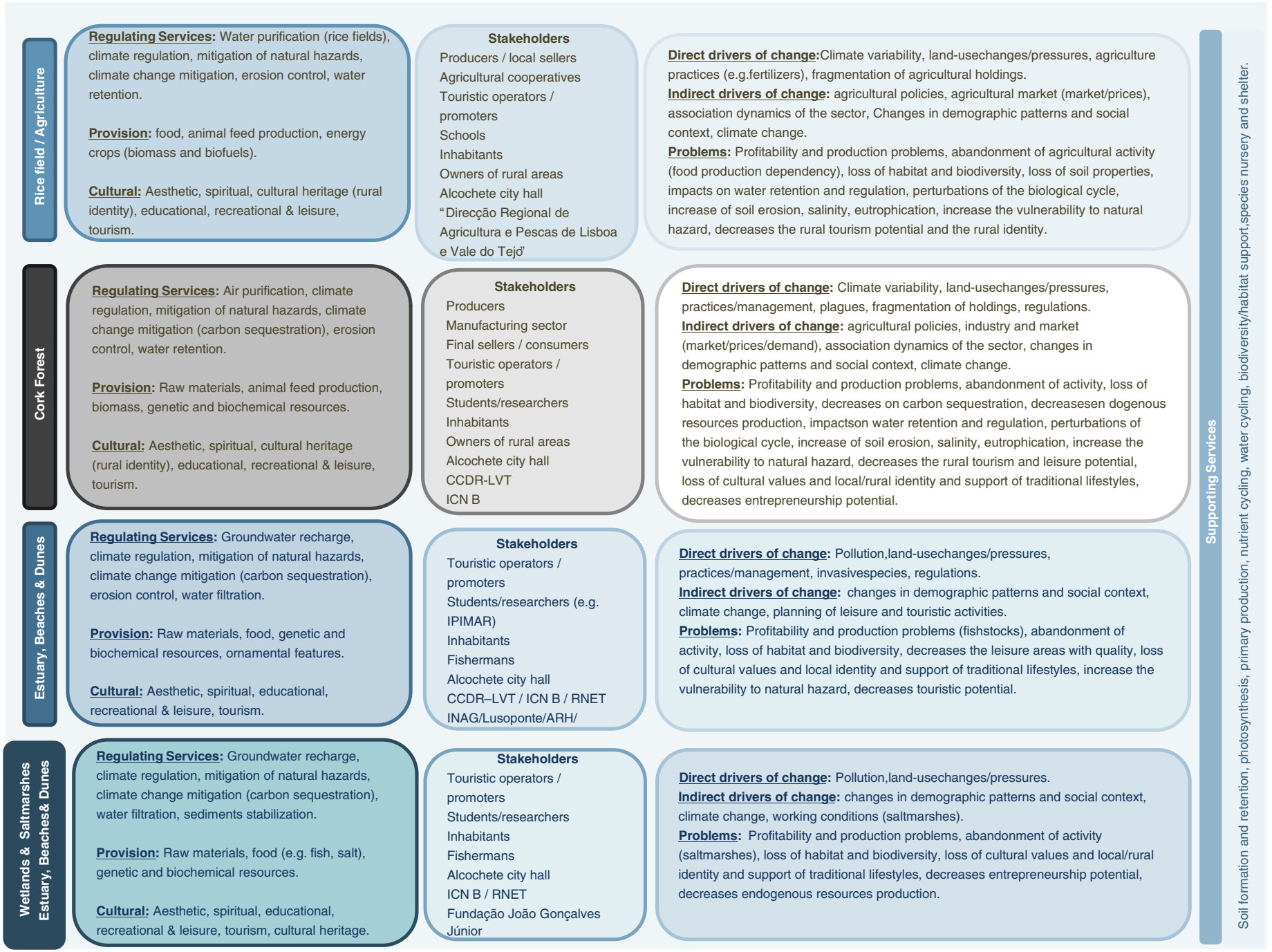

Fig. 6. Preliminary results on ecosystem services provided by the priority ecosystems, stakeholders and drivers of change.

Stakeholders' Interests	Stakeholders
Quality of products and services	• Product consumers • Service consumers
Ecological importance	• Neighbors • CCDR
Profits	• Owners • Employees
Image	• Owners • Municipality

Fig. 7. Shared interests based on the analysis of stakeholders' objectives, interests and perceptions on different ES, and the effects that ES have on them.

accurate perception of the agents in relation to the current and potential services provided by the Alcochete ecosystems, considering the existing problems, and the key driving forces that may affect the provision of those services. This way it will be possible to specify the connection between ecosystem services and the stakeholders identified in Fig. 6 and find out which stakeholders are actual beneficiaries of a service in a priority ecosystem. This will improve the trade-offs analysis that underlines the discussion and assessment of strategic options in the SEA. It is expected that the stakeholders' engagement may enhance sustainable solutions, contributing to the SEA and to policy and planning decision-making, not only through knowledge and information sharing but also by conducting a brainstorming discussion, mixing scientific and traditional knowledge, allowing the reinforcement of the stakeholders' collaboration, sense of ownership, and sense of place.

While still very preliminary results, this case-study shows how ES can be mainstreamed in the SEA right from stage 1, and how crucial it may be to influence the motivation of stakeholders into the policy and planning decision-making process, towards a more sound identification and assessment of strategic options that take into account ES. This case study shows how important it is to bridge traditional knowledge related to existing ecosystems and respective services with political and economic interests. It is expected it will improve land management in the municipal spatial master plan through more integrated decision-making.

6. Conclusions

There are strong arguments in the literature that support the need to consider ES in strategic decision-making. Concepts on ES have been developed for over a decade, and are getting consolidated not only particularly with the MEA (2005) and the TEEB (The Economics of Ecosystems and Biodiversity) (2010a), but also of course with an increasing body of specialized literature, including empirical applications. Guidance for SEA and ES is available since 2006 and several examples of application start being available. Integrating ES in SEA is nevertheless in its infancy but has a strong potential to materialize strategic opportunities and risks, and increase the tangibility of SEA.

This paper has made some contribution to the theoretical and empirical debate concerning ES and SEA. The aim was to explore the role that SEA can play in placing ES in the decision-making agenda, how to ensure the services provided by ecosystem services can be considered as a key factor in decision-making, and how this can be achieved methodologically.

The paper suggested that a more consolidated methodological framework is necessary, to help show the case for ES inclusive SEA. It proposed a framework concept for the integration of ES on strategy development, arguing for the role of governance in promoting adequate planning and management of drivers of change to enable ES contribution to human well-being. It also underlined that ES and SEA are relevant to each other in that they can both be used strategically, while sharing the safeguarding of livelihoods as a common objective.

The paper further argued that strategic based approaches to SEA are likely to enable more flexibility to deal with complex problems more adequately, such as those involved in perceptions and valuation of ES by different stakeholders. It has also advanced a new methodology for ES inclusive SEA arguing that more than information and indicators what we need is to have ES making part of the assessment framework and negotiated by stakeholders.

The case of Alcochete municipality is still in an early stage but served to illustrate how the initial analysis of ES can be developed as part of a SEA. Difficulties encountered so far relate to the insufficient practice with these kinds of approaches, the valuation methods available, as well as some resistance of the nature conservation authorities to accept the ES concept, as if ES were a threat to ecosystem conservation. The point made in the Alcochete case is that both the local authority and some economic and social stakeholders reveal a very positive perception on the potential of this approach to help

Fig. 8. Stakeholders analysis: interest vs influence capacity.

land management and investment decisions. Stakeholders learn about benefits associated to ecosystems and find a reason for their conservation and enhancement. This gives stakeholders some ownership over natural resources in their ecosystem context, and an interest for its conservation. Knowing that multiple stakeholders have an interest is a good motivation for local authorities to also wish to maintain, and enhance ecosystems. It will also stimulate the use of SEA as a strategic instrument to help management and negotiation through appropriate governance, when there is a value chain to stakeholders pinpointed by the valuation of ecosystem services.

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References

Bina O. Re-conceptualising Strategic Environmental Assessment: theoretical overview and case study from Chile. PhD Thesis, University of Cambridge, Cambridge; 2003.
Coca-Cola Company. The water stewardship and replenish report; 2012.
Chan KMA, Shaw MR, Cameron DR, Underwood EC, Daily GC. Conservation planning for ecosystem services. Public Libr Sci Biol 2006;4(11):e379.
Chee YE. An ecological perspective on the valuation of ecosystem services. Biol Conserv 2004;120(4):549–65.
Eggenberger M, Partidario MR. Development of a framework to assist the integration of environmental, social and economic issues in spatial planning. Impact Assess Proj Apprais 1991;18(3):201–7.
Farber SC, Costanza R, Wilson MA. Economic and ecological concepts for valuing ecosystem services. Ecol Econ 2002;41(3):375–92.
Garbach K, Lubell M, DeClerck F. Payment for ecosystem services: the roles of positive incentives and information sharing in stimulating adoption of silvopastoral conservation practices. Agric Ecosyst Environ 2012;156:27–36.
Geneletti D. Reasons and options for integrating ecosystem services in strategic environmental assessment of spatial planning. Int J Biodivers Sci Ecosyst Services Manag 2011. http://dx.doi.org/10.1080/21513732.2011.617711.
Geneletti D. Assessing the impact of alternative land-use zoning policies on future ecosystem services. Environ Impact Asses Rev 2013;40:24–34.
Gibson RB, Hassan S, Holtz S, Tansey J, Whitelaw G. Sustainability assessment: criteria, processes and applications. London: Earthscan; 2005.
Gómez-Baggethun E, de Groot R, Montes C. The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. Ecol Econ 2010;69:1209–18.
Grêt-Regamey A, Brunner SH, Altwegg J, Bepi P. Facing uncertainty in ecosystem services-based resource management. J Environ Manage 2012. http://dx.doi.org/10.1016/j.jenvan.2012.07.028.
Haines-Young R, Potschin M, Kienast F. Indicators of ecosystem service potential at European scales: mapping marginal changes and trade-offs. Ecol Indic 2012;21:39–53. http://dx.doi.org/10.1016/j.ecolind.2011.09.004.
Kinzig AP. Human well being and the natural environment: a focus on ecosystem services. In: Levin Simon A, Clark William C, editors. Toward a science of sustainability conference. Warrenton, Virginia: Airlie Center; 2010. p. 105–12. [November 29–December 2, 2009].
Kørnøv L, Thissen W. Rationality in decision- and policy-making: implications for strategic environmental assessment. Impact Assess Proje Apprais 2000;8(3):191–200.
MEA — Millenium Ecosystem Assessment. Ecosystems and human well-being: synthesis report. Washington, DC: Island Press; 2005.
Nilsson M, Dalkmann H. Decision making and strategic environmental assessment. J Environ Assess Policy Manag 2001;3(3):305–27.
Nitz T, Brown L. SEA must learn how policy making works. J Environ Assess Policy Manag 2001;3(3):329–42.
Nooteboom S. Adaptive networks. The governance for sustainable development. Erasmus University Rotterdam/DHV; 2006.
OECD (Organization for Economic Co-operation and Development). Strategic environmental assessment and ecosystem services. Endorsed by members of the DAC Network on Environment and Development Co-operation (ENVIRONET) at their 8th meeting; 2008.
Ostrom E. A general framework for analyzing sustainability of social-ecological systems. Science 2009;325(419):419–22.
Partidario MR. Strategic environmental assessment: key issues emerging from recent practice. EIA Rev 1996;16:31–55.
Partidario MR. Strategic environmental assessment — principles and potential. In: Petts J, editor. Handbook of environmental impact assessment, vol. 1. Oxford: Blackwell; 1999. p. 60–73.
Partidario MR. Elements of strategic environmental assessment. Environ Impact Assess Rev 2000;20:647–63.
Partidario MR. Scales and associated data—what is enough for SEA needs? Environ Impact Assess Rev 2007a;27:460–78.
Partidario MR. Strategic environmental assessment good practice guidance—methodological guidance. Amadora: Agência Portuguesa do Ambiente; 2007b [http://www.seataskteam.net/library.php) (http://www.iambiente.pt/portal/page?_pageid=73,426033&_dad=portal&_schema=PORTAL&not_c_qry=boui=15473913].
Partidario MR. Does SEA change outcomes? Proceedings of the 18th international transports research symposium, session 5 sustainable inter-urban mobility, discussion paper no. 2009–31, Madrid; 2009. [http://www.internationaltransportforum.org/Proceedings/Symp2009/index.html].
Partidario MR. Strategic environmental assessment good practice guidance—methodological guidance. Lisboa: Agência Portuguesa do Ambiente e Redes Elétricas Nacionais; 2012.
Partidario M, Gomes R. Ecosystem services inclusive SEA. IAIA'11 conference proceedings: impact assessment and responsible development for infrastructure, business and industry. Puebla, México; 2011.
Partidario MR, Slootweg R. Spatial planning and environmental assessments. In: Wittmer Heidi, Gundimeda Haripriya, editors. TEEB, the economics of ecosystems and biodiversity in local and regional policy and management. Abingdon and New Tor: Earthscan from Routledge; 2012. p. 165–94.
Pereira HM, Domingos T, Vicente L, Proença V, editors. Ecossistemas e Bem-Estar Humano: Avaliação para Portugal do Millennium Ecosystem Assessment. Lisboa, Portugal: Escolar Editora; 2009.
Slootweg R, Kolhoff A, Verheem R, Hoft R. Biodiversity in EIA and SEA — background document to CBD decision VIII/28: guidelines on biodiversity-inclusive impact assessment. The Netherlands: Commission for Environmental Assessment; 2006.
Slootweg R, Rajvanshi A, Mathur VB, Kolhoff A. Biodiversity in environmental assessment: enhancing ecosystem services for human well-being. Ecology, biodiversity & conservation series. U.K.: Cambridge University Press; 2010
TEEB (The Economics of Ecosystems and Biodiversity). Mainstreaming the economics of nature: a synthesis of the approach, conclusions and recommendations of TEEB; 2010a.
TEEB (The Economics of Ecosystems and Biodiversity). A quick guide to the economics of ecosystems and biodiversity for local and regional policy makers; 2010b.
Toivonen H. Ecosystems services and convention on biological diversity — how ecosystem services are reflected in the CBD COP decisions in Nagoya? Ecosystem services and biodiversity. Wien: Alter-Net; 2010 [3–5 November].
UNEP (United Nations Environment Programme). Towards a green economy: pathways to sustainable development and poverty eradication; 2011 [www.unep.org/greeneconomy].
van Beukering PJH, Slootweg R, Immerzeel D. Valuation of ecosystem services and strategic environmental assessment — influential case studies. Utrecht, The Netherlands: Commission for Environmental Assessment; 2008.
Wallace KJ. Classification of ecosystem services: problems and solutions. Biol Conserv 2007;139(3–4):235–46.
Walsh B. Paying for nature. Energy for tomorrow, TIME sponsored forum, Feb, 21th; 2011 [http://www.time.com/time/magazine/article/0,9171,2048324,00.html, accessed 4th August, 2012].
WBCSD (World Business Council for Sustainable Development). Guide to corporate ecosystem evaluation — a framework for improving corporate decision-making. WBCSD; 2011.
WRI (World Resources Institute). Ecosystem services — a guide for decision makers. World Resources Institute; 2008.

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