



# Integration of ecosystem services in strategic environmental assessment across spatial planning scales



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## ABSTRACT

Spatial planning is a key policy instrument for decision-making which drives future changes to land systems, and subsequently to the quality, quantity and spatial distribution of ecosystem services (ES). Supply and demand of ES vary from local to regional and global scales affecting a wide range of stakeholders. Therefore, a strategic analysis of the potential impacts is highly relevant. Strategic environmental assessment (SEA) is considered a suitable instrument for analyzing these impacts as well as for integrating ES during the planning process given its focus on sustainability and environmental aspects at strategic levels. However, an essential task consists of testing the applicability of the SEA-ES framework in real-world spatial planning. The objective of this research is to explore how ES have been considered in the development of spatial plans at different scales by considering a sample of SEA reports. We focused on a case study in Chile, where we conducted a content analysis of different stages of the SEA process at regional, inter-municipal and municipal planning scales. Our results demonstrate that ES were always present across each SEA stage and planning scale. Additionally, we suggest a relation between specific ES and the scope and focus of the different spatial planning instruments. Although ES are clearly necessary for achieving a number of development objectives and dealing with a range of environmental problems, a critical aspect is the lack of an explicit consideration which might decrease the potential advantages offered by the integrated framework SEA-ES.

## 1. Introduction

Land is one of the most important and limited resources and provides a range of essential ecosystem services (ES) for human well-being (Fürst et al., 2013). However, increasing human demands for natural resources, cultivable lands, and a variety of ES along with intensive changes to biogeophysical structures and processes might negatively impact the development of societies (Mooney et al., 2009; Sonter et al., 2017). In this context, land management and policy decision-making are recognized as the most important drivers for these impacts and the subsequent losses in the ES supply at multiple scales (Schosser et al., 2010; Verburg et al., 2015). Spatial planning is a key instrument for decision-making in terms of coordinating human activities and their influences on land systems, and subsequently on the quality, quantity and spatial distribution of ES (Geneletti 2011, 2013; Mascarenhas et al., 2015). Including ES in spatial planning is considered to be a suitable approach for informing, communicating and facilitating consensus

building among different actors because it provides a basis for multi-sectoral and interdisciplinary collaboration (Albert et al., 2014; Galler et al., 2016).

An essential aspect in the integration of ES in spatial planning is the issue of scale and the multiple levels of decision-making involved. Supply and demand of ES, as well as their interrelations, vary from local to regional and global scales, which at the same time affect a wide range of stakeholders (Geijzendorffer and Roche, 2014; Hein et al., 2006). Thus, spatial planning has the potential to mainstream ES across multiple governance levels, since it provides an umbrella for coordinating different policy instruments in a more strategic manner (Greiber and Schiele, 2011). As discussed by Geneletti (2011) and Mascarenhas et al. (2014), the integration of ES into spatial planning should consider existing instruments, such as strategic environmental assessment (SEA). This is considered a suitable instrument for integrating ES given its strategic role in the development of policies, plans and programs (Geneletti 2011; Partidario and Gomes 2013; Rozas-

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Vásquez et al., 2017). The considerable benefits of SEA for including ES in strategic decisions have led to a rapid increase in the number of scientific papers, analyses of legislation and practices (Geneletti, 2015). Similarly, international organizations such as OECD and DAC (2008), UNEP (2014) and World Resource Institute (Landsberg et al., 2013) have developed guidance material focused on the integration of ES in environmental assessment (Baker et al., 2013).

An essential task consists of testing the applicability of the SEA-ES framework in real-world spatial planning and environmental policy making (MA, 2005; Ruckelshaus et al., 2015). Some studies propose the use of content analysis and recommend it for exploring the degree of integration of ES in decision-making (e.g. Honrado et al., 2013; Rosa and Sánchez 2015; Mascarenhas et al., 2015; Diehl et al., 2016). Krippendorff (2004) defines content analysis as a research technique for making replicable and valid inferences of answers to specific research questions from textual information as provided through SEA reports. These inferences are more systematic, explicitly informed and verifiable than a normal read of a text. Consequently, content analysis of SEA reports is a valuable approach for helping to clarify how this process supports the integration of ES in spatial planning. This is highly relevant for evaluating opportunities and challenges for practical implementation. A critical aspect in this approach pointed out by Honrado et al. (2013), is the mainly implicit consideration of ES along the SEA reports. Thus, special attention needs to be paid to this aspect when conducting the content analysis.

The objective of our study is to explore how ES have been considered in the development of spatial plans at different scales of planning. We analyzed a sample of SEA reports in order to answer the following research questions:

- i) How has the ES concept been addressed throughout the SEA process?
- ii) Does the spatial planning scale affect the consideration of specific (groups of) ES?
- iii) Is there a planning scale that appears more suitable for the integration of ES?

Chile was selected as a case study because it meets three fundamental criteria. First, the administrative system is based on a tiered structure with national, regional, provincial and municipal levels (OECD, 2013). This allows exploring the ES integration at different scales of planning. Second, SEA has been mandatory in Chile for all levels of spatial planning since 2010 (Rozas-Vásquez et al., 2014). Hence, a sufficient number of recent SEA reports is available. Finally, the concept of ES has progressively been introduced into the political discourse in Chile to the point that in 2015 it was included in a national guideline for sustainable spatial planning (MMA, 2015).

For a consistent classification of ES, we used the Common International Classification of Ecosystem Services (CICES) (Haines-Young and Potschin, 2013). CICES classifies ES in three sections, mostly in concordance with those ES groups defined by the Millennium Ecosystem Assessment in 2005 and currently also in use by IPBES (Díaz et al., 2015): 1) provisioning, 2) regulation & maintenance, and 3) cultural (supporting ES were excluded in CICES). Each section is hierarchically structured for its assessment into division, group, class, and class type where it is possible to increase the detail of the ES classification in relation to the different spatial and thematic scales under analysis (Haines-Young and Potschin 2013; Díaz et al., 2015).

## 2. Methodology

### 2.1. Study area

Chile is located in South America, bounded by the Pacific Ocean in the west, the Andes mountain range in the east, the Atacama Desert in the north and the Chilean Antarctic in the south (Fig. 1). It extends over

4300 km and it presents a high variety of landscapes and biodiversity with unique autochthonous species given its location as a biogeographic island (Moreira-Muñoz, 2011; Squeo et al., 2012).

In Chile, until 2009 the integration of environmental objectives and impact assessment in the spatial planning process was included only through a standard environmental impact assessment (EIA). However, in 2010 EIA was replaced by SEA, which is today mandatory for the elaboration of any policy or plan, allowing the incorporation of environmental criteria for sustainable development (Rozas-Vásquez et al., 2014). SEA is applied for spatial planning instruments from regional to municipal level (it also includes some specific sections within the municipal level), as well as for the zoning of the coastal areas and integrated watershed management plans (MMA, 2012). Table 1 provides an overview on the most relevant spatial planning instruments applied in Chile.

A major concern in the current SEA application during the elaboration of spatial plans is a lack of approaches which allow combining nature conservation and territorial development by adding value to the nature for the society in the sense of a socio-ecological system (Rozas-Vásquez et al., 2017). For this reason, the ES approach has been formally included in national guidelines for sustainable spatial planning (MMA, 2015), but its real consideration has not yet been analyzed.

### 2.2. Framework for analyzing SEA reports

In this research we analyzed a set of SEA reports at regional, inter-municipal and municipal spatial planning scales. The methodological approach consisted of a content analysis of different stages of the SEA process. For each, we formulated analytical questions aimed to explore both the explicit and implicit consideration of ES and to reveal if they are more relevant or consistently considered at a specific scale of planning. To avoid terminology restricting the explanatory power of our study, we extended the analysis to related terms such as “environmental services”, “environmental functions” and “natural capital” usually used interchangeably to make reference to ES (Lamarque et al., 2011; Rozas-Vásquez et al., 2017).

The analysis of the SEA reports was based on a modified version of the approach proposed by Geneletti and Zardo (2016), where a “direct content analysis” was performed. This type of content analysis is conducted in a more structured process than a traditional content analysis by using existing theories or previous research. While traditional content analysis avoids using preconceived categories, direct content analysis makes use of the available knowledge that helps to focus the research questions as well as to identify key concepts or variables throughout the documents (Hsieh and Shannon, 2005). Consistent with Geneletti and Zardo (2016), we did not consider a “keyword-based analysis”, since in the fields of ES and SEA terminologies are not yet standardized (Braat and de Groot, 2012; da Silva et al., 2014).

For the content analysis, we divided the SEA reports into four stages which represent methodological steps at the moment of coupling ES in the SEA process. In a traditional SEA report, these stages are often not clearly defined. However, for operationalizing the content analysis, we considered the reflections of previous works by OECD and DAC (2008), Partidario and Gomes (2013) and Geneletti (2016, 2015) and divided the reports in: 1) context and objectives, 2) scoping and ES prioritization, 3) strategic analysis of alternatives, and 4) follow-up.

In each stage, we analyzed how ES have been included in the SEA process by using a set of analytical questions formulated in concordance with the aim of the respective stage (Table 2). We characterized the different stages according to how often one or more specific ES were identified, in which specific manner they were considered, and according to the planning scale.

### 2.3. Selection of the sample of SEA reports

We selected SEA reports of all the available spatial plans in Chile at

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