

A minimum indicator set for assessing resources quality and environmental impacts at planning level in a representative area of the European Mediterranean Region



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ABSTRACT

According to some European Institutions (European Environment Agency, Commission of the European Communities), Environmental Impact Assessment (EIA) could be a better tool to assist natural resource protection in the context of land use planning than when used only for assessing specific projects. Environmental assessment of planning instruments allows the comparison of different alternatives and to scope the analysis and evaluation of relevant impacts when developing projects in the alternatives selected. This paper develops a minimum indicator set useful to evaluate natural resources quality at municipality level as a basis for assessing environmental impacts derived from land use planning instruments and from specific projects in the Valencian region, a representative area of the European Mediterranean Region. Using Principal Component Analysis (PCA), a minimum set of 12 indicators which referred to relevant natural resources (air, water, soil and biodiversity) was defined and used to assess the resources quality of different municipalities of the Valencian region, following a value-function based approach. The results obtained were very similar to those obtained in another study done in the same area that applied a broader set of indicators. These results and the potential reduction in costs estimated show the usefulness of the minimum set of indicators defined in this work for evaluating resources quality. As a demonstration exercise, the indicator set was applied to three municipalities representative of the different land use conflicts and environmental problems of the Valencian region, in order to assess the environmental impacts on natural resources that could be produced from the implementation of a hypothetical urban-industrial expansion plan, a usual land use pattern that has occurred in the European Mediterranean Region in the last decades. The results obtained show that coastal municipalities are better alternatives to implement an urban-industrial expansion than inland and intermediate municipalities in terms of environmental impacts although the loss of high productivity soils must be avoided. Given that the environmental issues considered are representative of the European Mediterranean Region, it follows that the approach developed in this work can be useful to predict environmental impacts on natural resources from planning instruments in the whole region.

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1. Introduction

The Environmental Impact Assessment (EIA) European Directives (DOCE, 1985, 1997, 2001, 2012) state the projects and plans for which environmental impacts have to be assessed in the European Union. The adoption of these Directives by the Member States of the European Union has resulted in the inclusion of EIA in their National legislation. Within some Member states (e.g. Spain), Regional Gov-

ernments (e.g. Generalitat Valenciana) have also established EIA legislation for specific plans and projects that are relevant at regional level (DOGV, 1989, 1990, 2005, 2006), adapting the legislation to the particularities of each region.

Different methods have been proposed in order to carry out Environmental Impact Assessment since the implementation of this tool in the seventies (e.g. Leopold et al., 1971; Odum, 1972; Odum and Odum, 1976; Whitman et al., 1973). Indicator-based methodologies are one of the most important approaches used in EIA (Petrosillo et al., 2012) since they reduce the volume and complexity of information (Benini et al., 2010) that is required by stakeholders and decision makers (Donnelly et al., 2007).

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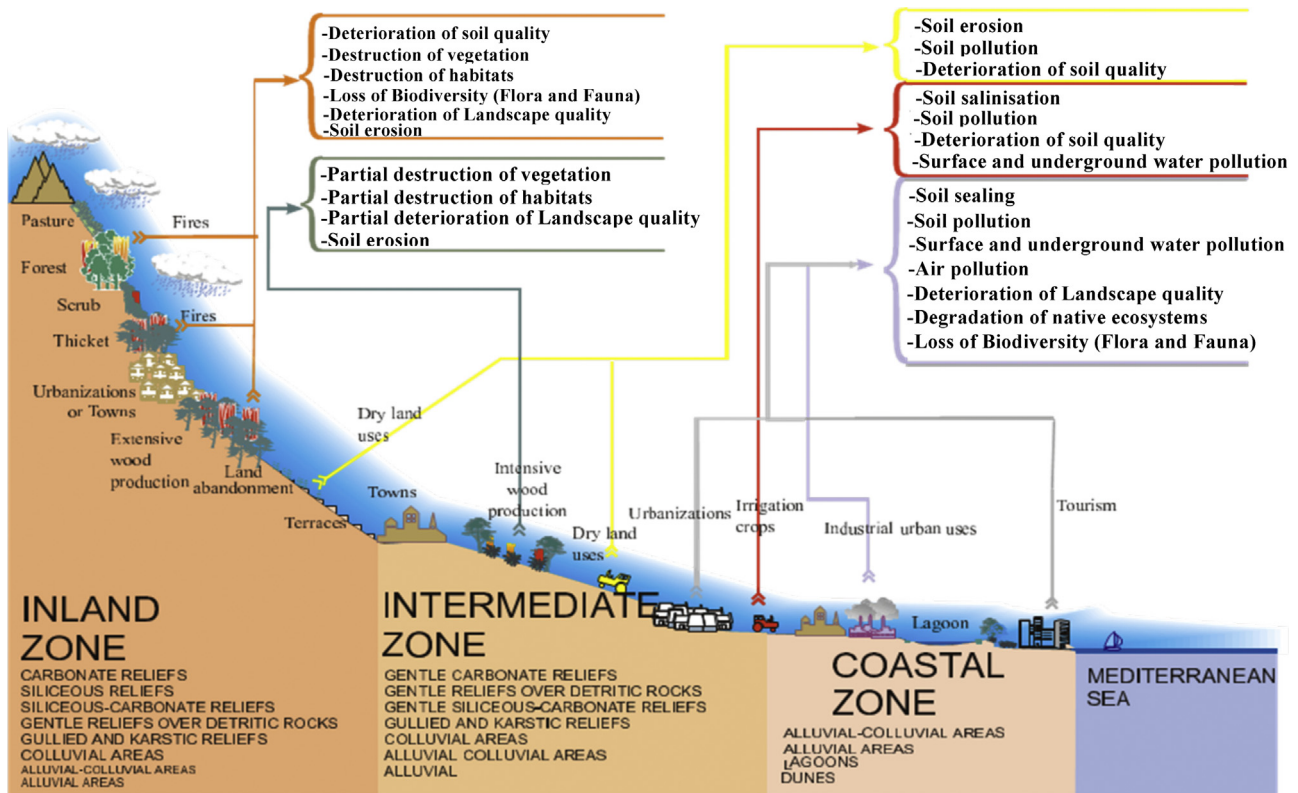


Fig. 1. Scheme showing the land use conflicts and environmental problems characterising the inland, intermediate and coastal zone of the Valencian Mediterranean region (after Recatalá et al., 2000; Recatalá, 2009).

Furthermore, the application of indicators and the corresponding value functions allows assessing the quality of the different resources affected by a planning instrument or by a project in the same dimensionless unit (resources quality units), enabling this way to integrate different quality values and to assess global environmental impacts, in order to compare alternatives.

However, the use of indicators has some drawbacks. Firstly, many sets of indicators are developed to address specific environmental issues, following different procedures and for different spatial scales (regional, national, international), making it difficult to define a core set of environmental indicators that can be used extensively (Donnelly et al., 2007). Several International Agencies (European Environment Agency, Commission of the European Communities) have tried to develop a core set of indicators but when analysing these sets in detail, substantial overlaps between the information provided by different indicators can be found. This is another of the drawbacks identified when defining and using environmental indicators. According to Yu et al. (1998), most of the sets of environmental indicators developed to evaluate the quality of the natural resources are redundant. This makes it difficult to analyse and interpret the information collected, since having redundant information can increase background noise. Furthermore, it generates an avoidable cost overrun when acquiring information. Therefore, when developing a set of environmental indicators, it is important to analyse the underlying effective dimensionality between them, in order to finally select a non-correlated group of indicators.

The aim of this paper is to develop a minimum indicator set useful to evaluate natural resources quality at municipality level as a basis for assessing environmental impacts derived from land use planning instruments and from projects in the Valencian region, a representative area of the European Mediterranean Region. Municipalities are the basic planning units where primary decisions on

natural resources use are made in the Valencian region, as well as in Spain and in the European Mediterranean Region. Specifically, the minimum set of indicators was defined by applying Principal Components Analysis (PCA) to an initial set of indicators.

In order to show the relevance in economic terms of the minimum indicator set developed with respect to the initial set, an estimation of the potential reduction in costs was carried out.

As an example of the application at planning level of the set of indicators defined, this was applied to three municipalities representative of the different land use conflicts and associated environmental problems of the region (Fig. 1) (Recatalá et al., 2000; Recatalá, 2009), in order to assess the environmental impacts on natural resources derived from the implementation of a hypothetical land use planning instrument (a plan). Specifically, the situation referred to an urban-industrial expansion, a usual land use pattern that has occurred in the Valencian region and in the European Mediterranean Region in the last decades. For this demonstration exercise, in each municipality it was considered an increase of the land devoted to these uses equal to the mean occurred in the Valencian region for the last decades (from the nineties onwards), which has been of a 50%, one of the most intensive in Spain and even in Europe (OSE, 2007; Salom, 2010). This demonstration exercise was focused on environmental impacts referred to soil and biodiversity rather than to air and water, since these latter can be more properly assessed at project level because the type and amount of residues generated and released to the environment is specific for each activity projected (e.g. ceramic industry, car factory, metal industry, etc.).

2. Materials and methods

According to Recatalá (2009), the procedure to select an appropriate set of environmental indicators (Fig. 2) must include, firstly,

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