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Social sensitivity analysis in conflictive environmental governance: A case of forest planning

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ABSTRACT

In environmental governance, there is a need to include tools that analyze the robustness of the assessment processes, as well as the validity of policies and measures. This requires a methodological framework that integrates formal techniques such as sensitivity analysis with what the authors have called social sensitivity analysis. The latter consists of participatory processes in which stakeholders analyze the robustness of the assessment process used as well as the validity of the results of such assessments. This methodology was applied to a procedure for assessing planning alternatives for forest tracks. Sensitivity analysis studies the technical robustness of the results of the assessment, as well as exploring the social validity of these results, thus facilitating processes of dialogue and consensus needed in decision-making in conflictive situations. These results are considered interesting, not only from the perspective of implanting polices, but also as a reference for other places with similar situations.

1. Introduction

Forestry management and planning "often concern large areas, long time horizons and multiple stakeholders, which complicates the planning process and increases the uncertainty involved in it" (Kangas and Kangas, 2004, p. 169). Forest planning processes, as Funtowicz and Ravetz stated, can be characterised, "by uncertain facts, disputed values, high stakes and urgent decisions" (Funtowicz and Ravetz, 1991, p. 141). Thus, this planning is not free from situations where different stakeholders have conflicting interests, such as those described by Hiltunen et al. (2008), who proposed a management plan for natural resources, Pravat and Humphreys (2013) with their study of management and use of forests, or Acosta and Corral (2015) in their investigation into the use of forest tracks. These conflicts are also aggravated by the uncertainty that characterises environmental systems, themselves (Corral Quintana, 2004; Funtowicz and Ravetz, 1993; Funtowicz and De Marchi, 2000; Giampietro et al., 2006. These circumstances greatly hinder the application of traditional scientific methodologies to tackle environmental governance issues. In these cases, where uncertainty and ignorance are present and clashes between different interests occur, science must seek solutions that allow the participation of society (Ravetz, 2004).

During such participation, there can be an exchange of views, discussion and sometimes consensus, thereby achieving an enriched decision-making process. In this process, it is essential to identify the most relevant stakeholders (Kangas et al., 2014; Nordström et al., 2010). Failure to do so may result in a lack of information that will lead to inappropriate alternatives being chosen to solve problems (Nordström et al., 2010). In this sense, Buchy and Hoverman (2000) indicated that when different groups with different interests participate in consultations, meetings or negotiations there is an increase in participants' knowledge of alternatives thus, promoting better understanding between the parties. In addition, when the planning of forest resources is carried out with the participation of the communities concerned, these processes are more transparent and easily understood, as affirmed by Vainikainen et al. (2008).

Thus, in recent decades, approaches that support decision-making and integrate tools through which stakeholders can be part of the planning process have proliferated. Guimarães and Corral (2002) reviewed how Decision Support Systems (DSS) have evolved from more technocratic approaches to assessment processes with varying levels of participation (Arnstein, 1969) in the search for mutual learning (Corral, 2011; Corral-Quintana et al., 2016; Funtowicz and De Marchi, 2000; Giampietro et al., 2006) or as Gibbons (1999, p. C82) coined "socially robust knowledge".

This need to involve stakeholders in the planning and decision-making has also been highlighted in the case of forest planning. There has been a steady evolution towards more inclusive processes such as

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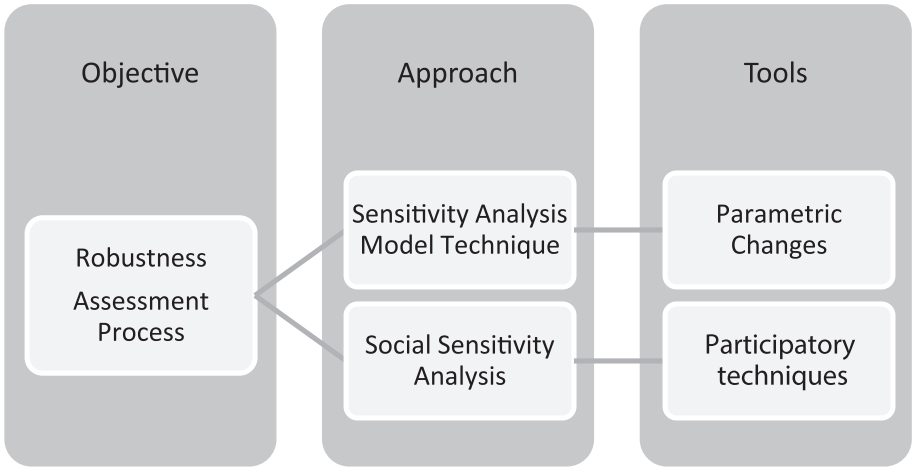

Fig. 1. Sensitivity Analysis Approach for socio-environmental issues.

those conducted by Ananda (2007) related to policies of forest land use, Prell et al. (2009) linked to the use of national parks. Nordström et al. (2010) also investigated the role of participation in urban forest planning and finally Rosenberger et al. (2012) analyzed the issue of paying for access to forests. In recent decades, stakeholders have gone from being regarded as mere informants, to being involved in defining the issues of forest environments. In some cases, they have even defined the alternatives and criteria (e.g. Laukkanen et al. (2002) or Vainikainen et al. (2008)) that have served to address forest issues such as landscape planning, tourism and timber management.

The integration of social actors undoubtedly enriches planning processes; however, there are still uncertainties related to socio-environmental issues that need to be addressed regarding "technical (inexactness), methodological (unreliability), epistemological (ignorance), and societal (social robustness)" dimensions (Van Der Sluijs et al., 2005, p. 482). Often quantitative uncertainty and sensitivity assessment methods are used, although these only address the technical dimension. Thus, uncertainty mainstream methodologies such as Monte Carlo analysis or Bayesian updating alone are not suitable for environmental and societal issues because undeterminable uncertainties prevail over quantitative ones. According to Van Der Sluijs et al. (2005) although quantitative techniques are essential in any uncertainty analysis, they only provide a partial insight into what is a very complex usually mass of uncertainties (Pereira and Quintana, 2009; Van Der Sluijs et al., 2005; Van Der Sluijs et al., 2008).

As mentioned, in situations where conflicting interests prevail, it is not enough to deal just with uncertainties of a technical nature (those related to the information available, the variables used and the model applied). In these cases, the legitimacy of the planning process is affected by uncertainties of epistemological and social dimensions, putting these processes into dispute and hampering decision-making.

Given these characteristics, a methodology is implemented to explore the technical and social uncertainties that may arise in environmental governance issues. It can be seen that when developing forest planning processes or similar processes in which decisions are taken that may affect stakeholders, it is necessary to apply methodologies that allow society to participate as part of these processes. In particular, technical sensitivity analysis is necessary but not sufficient in these situations, where conflict may occur, as is the case with planning and management of natural resources.

This paper proposes a methodology to explore the robustness of techniques and processes used in environment planning in conflictive situations by involving different stakeholders. Furthermore, the results and conclusions are presented from the application of this approach to a case of integrated assessment of forest track planning and management issues.

2. Method

The proposed methodology aims to explore the robustness of forest planning processes. The social uncertainty arising from these planning processes is often characterised by systemic uncertainty and disagreements among the stakeholders involved.

To do this, an approach that combines formal and informal methods of analysis (see Fig. 1) is proposed. On the one hand, a sensitivity analysis is used to obtain a technical validation of the parameters in the forest planning process. On the other, complementary approaches are employed in which stakeholders assess the robustness of the process, the methods applied and the results obtained from forest planning assessment to achieve social validation of the process. This methodology will allow:

- the robustness of the procedures and processes used to be analyzed. In this sense, although not all results are accepted by all stakeholders, "their generation process is an open and transparent process in which the views of all parties are included" (Corral Quintana, 2004, p. 193).
- dialogue and debate among stakeholders to improve decision-making procedures and enables the needs and concerns of all involved to be met.

2.1. Sensitivity analysis techniques

Quantitative aspects of uncertainty have been debated and numerous techniques proposed to measure it (see Mowrer et al., 1996). Sensitivity analysis (SA) has been defined as "a process that aims to assess the response of a model to changes in input parameters" (Ligmann-Zielinska and Jankowski, 2008). Technically, it partitions the results of model's components and parameters to identify the key determining variables (Smith and El-shaarawi, 2002) through the assessment of small changes to input parameters on assessment outcomes (Crosetto and Tarantola, 2001; Munda, 1994; Saltelli et al., 2008; Tarantola, 2008) and, therefore, validating the robustness of the results.

There are a large number of approaches to perform a sensitivity analysis. Thus, for instance, the one-factor-at-a-time approach (OAT) explores the effect that changes of a factor produces on the outcome (Bailis et al., 2005; Campbell et al., 2008; Murphy et al., 2004). However, this approach is not able to find out relations between input variables (Czitrom, 1999). Generally speaking, there are two main techniques to approach SA: a) global SA and b) local SA. Other classifications, such as Saltelli et al. (2000) focus on the capability rather than the methodology of a specific technique.

Global SA refers to the techniques that pursue the quantification of output uncertainties resulting from simultaneous parameter changes