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Dynamic simulation of forest management normative scenarios: the case of timber plantations in the southern Chile

Nicolas Maestriperi*, Thomas Houet, Martin Paegelow, Gilles Selleron, Dario Toro Balbontín, Nicolas Sáez Villalobos

CNRS UMR 5602, GEODE—Géographie de l'Environnement, Maison de la Recherche, Université Toulouse le Mirail, 5, Allées Antonio Machado, 31058 Toulouse, France

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ABSTRACT

Accounting for spatial issues (spatially explicit simulation, geographical amenities and advantages of land use and cover changes, etc.) to build prospective scenarios is a crucial issue for better assessment of possible impacts on the environment. Such spatialized scenarios and their implications allow societies to reduce the uncertainty of the future by exploring various strategies for land use changes. Despite the wide diversity in existing scenario-building techniques, two different approaches can be distinguished (exploratory vs. normative) for their methodological implications. The originality in this study comes from the use of a relevant exploratory (dynamic) approach to map normative scenarios which, in most cases, are represented throughout the combination of narratives and synchronic land use and cover maps. The objective of the article is to apply this dynamic exploratory simulation approach to spatialize normative scenarios within the framework of forest management in southern Chile. In the results, two contrasting images of the future are compared, with the preservation of native forests on one hand and the spread of exotic timber plantations on the other.

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1. Introduction

The promulgation of Decree Law 701 (DL 701) under the military government of Augusto Pinochet has caused profound land use and cover changes in southern Chile. The main one concerns the increase in large-scale pine (*Pinus radiata*) and eucalyptus (*Eucalyptus globulus*) plantations on cleared land but also on areas of second growth native forests (Armesto et al., 2010). From 1975 to 2007, more than 95,000 ha per year of forest were planted (afforested and reforested) nationally, reaching 2.2 million ha in 2007 (INFOR, 2008). The initial goal was to both protect eroded soil and to encourage the landowners to forest their land. DL 701 turned out to be a major driving force in intensive forestry practices oriented towards the international pulp market. Environmental and socio-economic impacts of intensive forestry in southern Chile are well known in the scientific community. They include poverty and the expulsion of the indigenous population (the Mapuche, meaning “people of the land”) (Lara, 1985; Leyton Vasquez, 2009), a loss of biodiversity (Donoso and Otero, 2005) and soil

* Corresponding author. Tél. +33 5 61 50 36 30.

E-mail addresses: nicolas.maestriperi@univ-tlse2.fr, <http://w3.geode.univ-tlse2.fr/postdocs/maestriperi.php> (N. Maestriperi), thomas.houet@univ-tlse2.fr (T. Houet), martin.paegelow@univ-tlse2.fr (M. Paegelow), gilles.selleron@univ-tlse2.fr (G. Selleron), dario.toro@cncr.cl (D. Toro Balbontín), nsaez@ulagos.cl (N. Sáez Villalobos).

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and water acidification (Cannell, 1999). The conversion of native forest into timber plantations remains the most important threat in this highly recognized eco-region (Cavelier & Tecklin, 2005; Echeverria et al., 2006; Altamirano & Lara, 2010).

However, some uncertainties remain regarding the region's future, i.e. future land use and cover changes (LUCC) and their impacts. Decision making, whether in private lives or public affairs, depends on our degree of knowledge and the level of confidence we have in this knowledge (Sigel, Klauer, & Pahl-Wostl, 2010). This state of mind reflects the extent of uncertainty that people or societies have and can use *a posteriori* to face environmental and socio-economic issues (LUCC, silvicultural yields, climate hazards, economic crises, etc.). Uncertainty leads a society to project its plans into the future and to find points of reference in order to better control the present and to optimize its choices/strategies for the future. Thus, apprehension of differing possible futures (Phdungsilp, 2011), plausible (Wilkinson, 2009; Amer, Daim, & Jetter, 2013) or undesirable ones (Godet, 2010) makes it possible to deal with uncertain events (extreme or not) to the extent that each future may be accompanied by targeted adaptation measures.

Scenario-building methods have been generalized across the world in order to confront complex and uncertain phenomena. The method and the prospective for scenarios are closely linked to environmental and socio-political issues. Scenario approaches are used to guide land use policies, to anticipate the impact of city development and urban planning (Phdungsilp, 2011) and land use change (Oñate-Valdivieso & Bosque Sendra, 2010; Morán-Ordóñez, Suárez-Seoane, Calvo, & de Luis, 2011) or to assess the international environment (Zurek & Henrichs, 2007). La prospective (Godet, 1986; Hatem,

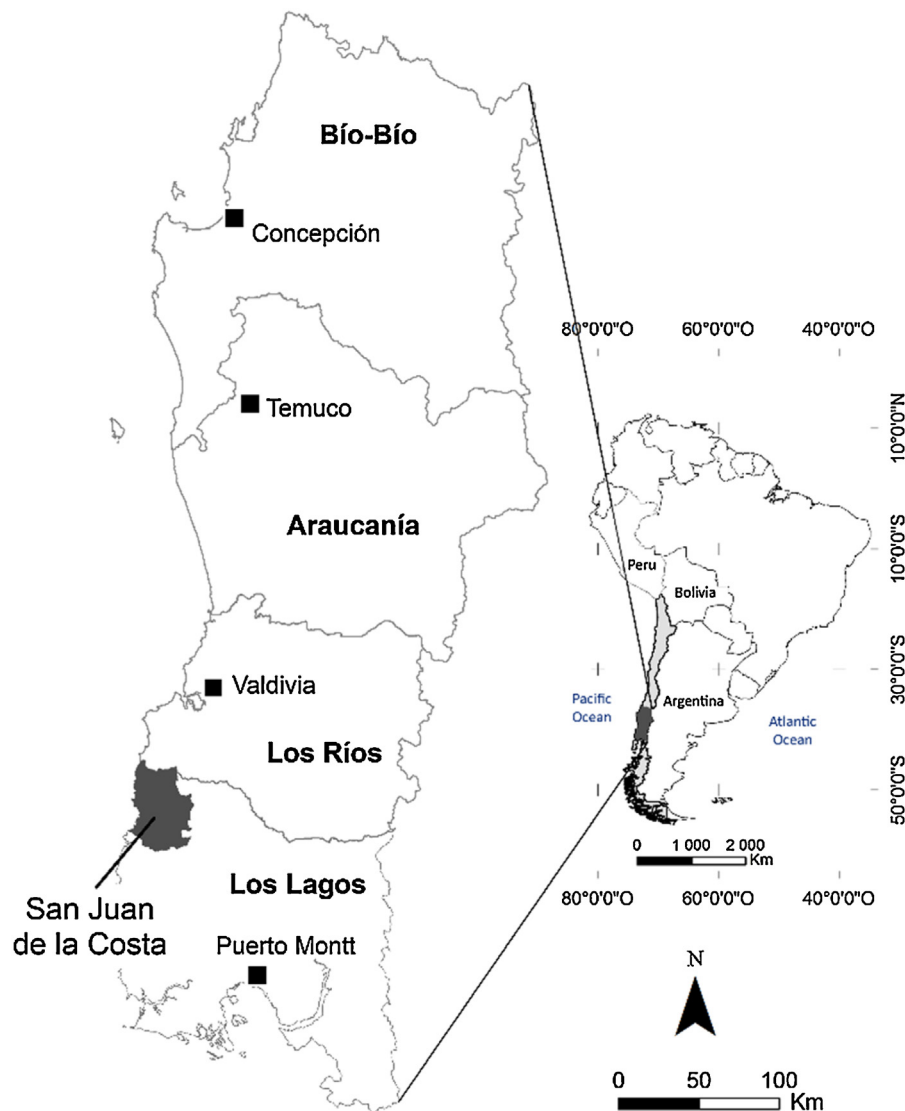


Fig. 1. Municipality of San Juan de la Costa (10th Lake Region—Chile).

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