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Gaming for smallholder participation in the design of more sustainable agricultural landscapes

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ABSTRACT

Smallholder farming systems often consist of a mosaic of interlinked forested and cleared-field patches that together provide a diversity of services to local and non-local stakeholders. Designing and adopting more sustainable farming systems for such mosaic landscapes involves communal decision-making and active participation of local smallholders. Currently, a wide variety of participatory approaches to involve individual farmers in such design processes is available. However, methodologies that address communal decision-making processes as seen in complex smallholder agricultural landscapes are still rare. Here, we present a gaming methodology developed to (i) actively involve farmers in the process of agroecosystem design, and (ii) to identify factors and patterns of communal decision-making through an in-depth analysis of game strategies deployed by participants. At the basis of this methodology is the RESORTES board game; a stylized yet complex land-use game rich in ecological and social outcomes. Results of four pilot sessions in a usufruct community in the buffer zone of a Man and Biosphere Reserve in Chiapas, Mexico, showed that the game sessions created an open and active discussion among participants. Discussions concerned land-use issues in the game and in real-life. It allowed participants that were new to active involvement in communal decision-making to openly discuss and share their ideas. The highly structured monitoring and analysis scheme for ex-ante/ex-post analysis was easy in use and identified communication, leadership and relatedness among participants as influential factors that smoothened the collective decision-making process. The RESORTES board game and related games can shed light on farmer's actual views on and responses to multifunctional agricultural landscape planning and the land sharing vs. land sparing dilemmas currently in debate in academic and policy-making settings. The findings of this paper can be useful to inform strategies for community involvement in agroecosystem design in a broader set of complex socio-environmental context, using serious game to guide agricultural landscape planning processes.

1. Introduction

Smallholder farming systems often consist of a mosaic of interlinked forested and cleared-field patches that together provide a multitude of services to local and non-local stakeholders (e.g. Speelman et al., 2006; Jackson et al., 2007). Over the last decades, many of these ecosystem services degraded due to unsustainable land-use change triggered by institutional, market and policy drivers (Wadley et al., 2006; García-Barrios et al., 2009; Ribeiro Palacios et al., 2013; Speelman et al., submitted for publication). Consequently, the design of more sustainable agricultural landscapes gained importance among a wide range of institutes and organizations (Wegner and Pascual, 2011; Astier et al., 2012). Increased societal awareness on the negative externalities of agriculture pushed governments and markets to develop mechanisms that directly and/or indirectly reward farmers for developing and/or adopting more sustainable agricultural systems that maintain ecosystem services within an agricultural landscape e.g. shade coffee certification, Payment for Ecosystem Services (PES) and carbon sequestration (Antle et al., 2003; Perfecto et al., 2005; García-Amado et al., 2011). Nowadays, farmers are influenced in their decision-making by often conflicting schemes. The associated economic incentives can deteriorate local social norms and institutions by inducing or increasing competition and individualism among community members (Gómez-Baggethun et al., 2010). However, the requirements and the environmental effects of many of these schemes extend beyond farm level and thereby challenge farmers to coordinate their activities. Coordination is particularly important in smallholder farming where a multitude of farmers manage a mosaic of plots (van Keulen, 2006; Herrero et al., 2010). Therefore, the study of the design of more sustainable

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agricultural landscapes and institutions for their stewardship requires the active participation of local farmer groups as a first step towards adoption of the designed landscapes and institutions, especially where landscape planning includes coordination among individual farmer's decisions.

Participatory approaches to enhance stakeholder involvement in agroecosystem design and implementation processes have been available for some time now (e.g. Rapid Rural Appraisal, Participatory Rural Appraisal, Participatory Action Research – cf. Pretty, 1995). However, methodologies that specifically allow participants to safely enact and explore the benefits and challenges of complex collective land-use decision-making during the learning process are scant. Since the first development of games as tools to facilitate learning in business education (Duke, 1974), games have been developed and used in a variety of settings for distinct goals (e.g. Dörner, 1996; Speelman and García-Barrios, 2010a; ISAGA, 2013). In the field of agriculture and natural resource management, games have in particular been developed as discussion and decision support tools (e.g. Barreteau et al., 2003; Collectif ComMod, 2013). These games are commonly developed as open-ended board games in which goals and rules have many degrees of freedom and therefore the solution space of the game is mostly unknown. Games with an unknown solution space are difficult to reproduce and options for systematic comparison of results are limited (Bousquet et al., 2002). Some of these games are closed games, in which the goals and rules define a large but countable set of solutions which can be revealed through analytical and simulation methods. These generally simpler and more stylized games are used in an experimental set up that allows replication of results with various groups of participants (Janssen et al., 2010; Falk and Heckman, 2009) and allow the testing of specific experimental hypotheses about the relation between game outcomes and the attributes and behaviors of players (García-Barrios et al., 2011; Janssen, 2010).

However, analysis of communal decision-making through games has mainly been conducted within relatively simple settings of joint management of a single common pool resource (e.g. Ostrom, 2006; Janssen et al., 2010) without capturing the complexity of the coordination of communal agricultural landscape planning – even in a very stylized manner. Some stylized natural resource games are now moving towards two or more resources, multiple choice decision-making with many interactions, both positive and negative externalities and stakeholder participation (e.g. García-Barrios et al., 2008, 2011; Janssen, 2010; Villamor and van Noordwijk, 2011; Castillo et al., 2011). Stylized yet complex land-use games have shown their potential for stakeholder engagement especially when stakeholders are in conflict, but at the same time they show difficulties for interpreting their richness of ecological and social outcomes. Therefore, the properties, behaviors, outcomes and possible analysis schemes of such games need to be explored through pilot sessions, before embarking on performing game sessions at large scale.

Here, we present a gaming methodology specifically developed to actively involve smallholders with conflicting interests and activities in the process of designing more sustainable agricultural landscapes. We use the role-playing board game RESORTES (literally coil-springs in Spanish), which is the Spanish acronym for Social Networks and Sustainable Land-use Planning (Speelman and García-Barrios, 2010b), embedded in a highly structured monitoring and analysis scheme. The RESORTES game is a closed and realistic land-use decision-making game that depicts an agricultural landscape and captures some of the current challenges in complex smallholder farming. We present explorative results of four pilot game sessions with local smallholders in a usufruct community in the buffer-zone of a Man and Biosphere (MAB) Reserve in Chiapas, Mexico. Game development and implementation were aligned with an ongoing NGO supported local participatory project on communal landscape planning. It also contributed to a larger multi-institutional research program on participatory development of innovative tools to create and expand social knowledge for more sustainable agricultural smallholder landscapes in the Sierra Madre de Chiapas, México and similar tropical mountainous territories (for a synopsis, see García-Barrios et al., 2012).

Over the past fifty years, our case study community has been confronted with economic and institutional pressures that strongly influenced social organization and land-use change. The tension between market pressures favoring cleared-field rather than forest-based land-use types led to distinct farm strategies based on one or both land-use types (Speelman et al., submitted for publication). Recently, the community has taken the first steps to more active communal land-use planning through the participatory project. Such planning processes can induce or unveil tensions among farmers who belong to different social networks and who have different preferences for cleared-field and forest-based land-use types with distinct incentive schemes.

Through individual discussions with local stakeholders, we previously identified land-use decisions that require or could benefit from coordination among farmers to jointly meeting requirements of incentive schemes such as Payment for Environmental Services (PES), and reaching production quantities to obtain benefits through Economies of Scale (EoS). In both types of land choice (i.e. cleared-field and forest-based) there are land-use types with different levels of market risk (high and low volatility). In the RESORTES game farmers choose among high and low risk forest-based and cleared-field land-uses, and where coordination among farmers concerning land-use decisions at the landscape level affect the returns to ecosystem service provisioning or scale-related benefits. Our main research questions for the highly structured and monitored pilot sessions were: (1) To what extent does this gaming method actively engage smallholders in jointly reflecting over the issues of collective agroecosystem design and landscape planning, and (2) Which key factors seem to allow or impede successful coordination among farmers, and conduce to hypotheses that could be formally tested in future trials with more elaborate experimental protocols?

2. Materials and methods

2.1. Study area

The smallholder community Tierra y Libertad (TyL) is situated in a MAB Reserve near the ridge of the Sierra Madre de Chiapas mountain range in the upmost part of a watershed. This community of circa 750 persons owns 3200 ha of land and has a young population (average age of 24 years St.Dev. = 18). The community is remote and poorly connected to the nearest urban center and market, but has basic facilities, e.g. a small health clinic and rural schools from kindergarten up to lower-secondary school.

In the early 1960s, people arrived to the area as laborers in a private sawmill. These laborers developed forest-based livelihoods consisting of wage labor in the exploitation of timber and individual exploitation of non-timber products. The ornamental leaves of the wild Camedor Palm (*Chamaedorea spp.*) complemented very low wages at the sawmill in the initial phase of settlement. After the closing of the sawmill in 1972, the National government officially gave people the right to use the land in social usufruct, under the legal form of the Mexican "*ejido*". Soon after, land was *de facto* parceled and some people started to cultivate the lands cleared by the sawmill for agricultural activities, mainly for maize cultivation. However, forest-based activities and especially the extraction of

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