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**PLAYING BEFORE PAYING? A PES SIMULATION GAME FOR ASSESSING POWER INEQUALITIES AND
MOTIVATIONS IN THE GOVERNANCE OF ECOSYSTEM SERVICES**

Pierre Merlet^{a,b,c}, Gert Van Hecken^{a,b}, René Rodriguez-Fablenia^a

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^a Research and Development Institute Nitlapan-UCA, Central American University (UCA), Rotonda Rubén Darío 150 mts al oeste. Apartado A-242. Managua, Nicaragua

^b Institute of Development Policy (IOB), University of Antwerp, Prinsstraat 13, B-2000 Antwerp, Belgium.

^c Association pour améliorer la gouvernance de la Terre, de l'Eau et des Ressources Naturelles (AGTER), 45 bis avenue de la Belle Gabrielle, 94736 Nogent sur Marne Cedex, France.

Corresponding author:

Pierre Merlet.

Research and Development Institute Nitlapan-UCA, Central American University (UCA), Rotonda Rubén Darío 150 mts al oeste. Apartado A-242. Managua, Nicaragua ; Phone: (+505) 22780627/28; E-mail address: pmerlet@nitlapan.org.ni

Playing before paying? A PES simulation game for assessing power inequalities and motivations in the governance of Ecosystem Services

Abstract:

Market-based conservation instruments, such as Payments for Ecosystem Services (PES), have become a dominant paradigm for environmental policies. Despite their broad endorsement, the implementation of PES schemes often rests on deep-seated power asymmetries and, therefore, risks reproducing existing inequalities. Thus, examination of PES should include how these schemes are constructed and negotiated between different actors, explicitly recognising their varying social positions, value frameworks and conflicting or collaborative relations. In this article we present a 'PES simulation game' as an alternative methodology to enhance understanding of complex negotiations between diverse actors involved in Ecosystem Services (ES) governance. The game mimics historical processes of agrarian change and social differentiation, simulates a range of ES governance interventions, and creates space for participants to collectively reflect on the motivational and socio-political dynamics triggered by the interventions. We discuss some of the main game dynamics as well as reflections generated by the game while examining a PES intervention in the Nicaraguan agricultural frontier. We illustrate the game's potential for improving understanding of farmers' constraints in decision-making processes and of the ways in which patron-client relationships within divergent value systems interact with specific ES governance interventions.

Key words: Payments for ecosystem services (PES); simulation game; Nicaragua; development pathways; action-research; power

1. Introduction

Following the widespread adoption of the Ecosystem Services (ES) framework novel market-inspired instruments, such as Payments for Ecosystem Services (PES), have gained increasing influence in international and national environmental policies (Engel et al., 2008; Schomers and Matzdorf, 2013; Wunder, 2015). These instruments assume that direct financial incentives to encourage management practices that will produce ES are an efficient and effective way to align individual interests with the common good (Ferraro and Simpson, 2002; Pagiola et al., 2002; Wunder, 2005). However, growing empirical evidence suggests that the behavioural changes with market-based conservation policies vary substantially, depending on the social context, local notions of justice, the psychological and cultural embeddedness of the desired behaviour and the type of incentives (e.g. individual or collective payments) (Agrawal et al., 2015; Kerr et al., 2012; Pascual et al., 2010; Salk et al., 2017; Travers et al., 2011; Van Hecken and Bastiaensen, 2010). More fundamentally, the increasing use of these instruments has also resulted in growing concerns about how they can conceal deep-seated power asymmetries, thus risking exacerbation of inequalities in access to and use of natural resources (Fairhead et al., 2012; Fletcher and Büscher, 2017; Kolinjivadi et al., 2017b; McAfee, 2012; Muradian et al., 2013). An examination of PES and market-based instruments as emerging power-laden and relational phenomena is therefore necessary and should include how these schemes are constructed and negotiated between different actors with differentiated social positions, value frameworks and oppositional or collaborative relationships (Kolinjivadi et al., 2017a; Mann et al., 2015; Van Hecken et al., 2015). Such analysis could also lead to a better informed integration of procedural and contextual equity concerns into the design of these instruments (Loft et al., 2017; McDermott et al., 2013; Pascual et al., 2010). From a conceptual-methodological perspective, these issues pose a significant challenge in terms of developing tools that allow for meaningful exploration of the multiple ways in which involved actors mobilise differing rationalities to understand institutional settings for ES governance (Van Hecken et al., 2018).

In this article we present a methodological tool that (i) allows us to highlight different aspects of the struggles surrounding the local meanings and underlying social rationalities attributed to the ES framework; and that (ii) stimulates collaborative interpretation, learning and dialogue around institutional arrangements for ES governance. The development of such a tool requires adding a political — as opposed to a merely technical — perspective to ES analysis as well as a different view of scientific knowledge within the broader process of co-creation of shared ‘actionable knowledge’. From this perspective changing behaviour towards sustainability not only requires a better understanding of ‘knowledge encounters’, in which different bodies of knowledge and meaning are competing with each other to make sense of complex reality (Buytaert et al., 2014), but also the engagement of academics and practitioners in a new way which will encompass diverse world views. It means supporting the co-creation of knowledge by working with residents, activists and social movements who are already imagining or making new worlds (Gibson-Graham, 2008). Inspired by the learning potential offered by simulation games¹ in natural resources management (Barreteau et al., 2007; Bots and van Daalen, 2007; Katsaliaki and Mustafee, 2015), we present a PES simulation game as an alternative for engaging with socio-political and motivational issues in ES governance. The game simulates farmers’ decision-making processes and offers a forum to assess and interact with the motivational and socio-political dynamics triggered by ES governance interventions including PES.

¹ The literature also often refers to ‘Role Playing Games’. Conceptually there are differences between ‘Role Playing Games’ and ‘Simulation Games’; while the former mainly focus on analysis of participants’ behaviour (generally leaving leeway for participants to manoeuvre), the latter explicitly aim at reproducing real-life dynamics as closely as possible by simulating a simplified yet sufficiently reliable contextual reality. However, in the domain of natural resources management, the difference between the two types of games is quite indistinct (and often overlapping), leading to both terms often being used interchangeably.

Our PES simulation game is the product of a joint action-research process² by the authors and practitioners from the Nicaraguan environmental NGO '*Conservación con Desarrollo*'³ (CcD). This ongoing collaborative process, which started in 2013, has mainly consisted of joint reflections on the implementation of different methodological approaches to assess and possibly redirect the conservation strategies CcD has been attempting during the past two decades (see also Van Hecken et al. (2017)). It is within this process that a need for developing a PES simulation game surged. We realised that the more 'conventional' research methods initially used (e.g. observations, interviews, focus groups) did not sufficiently reflect the complexities of the decision-making processes of farmers regarding motivations for land use change and deforestation, nor how these are embedded in and shaped by local power-laden institutional arrangements. We also felt that these methods did not sufficiently stimulate necessary 'knowledge encounters' around possible changes. In contrast the implementation of the game brought important insights with respect to these issues. Firstly, it allowed practitioners and researchers (i) to more vividly envisage the constraints that farmers face in their everyday decision-making; (ii) to challenge simplistic assumptions about the reasons for farmer resistance to so-called 'pro-environmental' practices; and, more generally, (iii) to increase their empathetic relationship with farmers. Secondly, game sessions were used to trigger collective reflective processes on how power relations in rural Nicaragua are based on unequal, yet very common, patron-client relationships. Such reflections allowed for a more informed and nuanced analysis of the complex ways in which farmers' behaviour is influenced by external interventions. Thirdly, the analysis of game dynamics enabled us to jointly construct and discuss a tentative farmer typology that helped enhance engagement with different views on forests and natural resources,

² An action-research approach implies that researchers and practitioners reflect together on concrete experiences in order to co-construct knowledge and translate this knowledge into actions or intervention policies (Borda, 2006). This requires a commitment from researchers and practitioners to closely collaborate and to share responsibility, both in knowledge co-production and in the implementation of actions in the field.

³ In order to protect the identity of all actors, we have changed the names of the communities, organizations, and individuals involved in this research.

ultimately leading to the recognition of the need for more flexible and socially embedded ES intervention strategies.

In this article we first provide a brief overview of the use of simulation games for ES governance (Section 2). In Section 3 we then discuss the general design principles of our PES simulation game and underline the importance of debriefing sessions for turning the game experience into collective learning. Section 4 provides a specific PES simulation game example adapted to the local context of the Nicaraguan Agricultural Frontier. Section 5 illustrates the game's potential in generating actionable knowledge by discussing some of the main dynamics and reflection processes triggered in the field. Finally, in Section 6 we conclude by reflecting on some of the main challenges and future avenues for tailoring this game to different ES governance contexts.

2. The potential of simulation games for ES governance

Simulation games create an environment where participants enter a fictional situation and take decisions and act according to a set of rules and a particular narrative, while bringing in their own views and beliefs. Games can take many forms such as card games, board games or computer-based games. They usually involve several participants who develop strategies influenced by decisions taken by the rest of the participants – or by virtual agents generated within computer-based models – and by particular events. Though the purpose of games is usually entertainment, they are also increasingly used for research and education goals (Crookall, 2010). In socio-ecological research they represent an alternative methodology that prompts a range of social, political and behavioural responses and raises participants' awareness of environmental issues (Barreteau et al., 2007; Bots and van Daalen, 2007; Costanza et al., 2014; Katsaliaki and Mustafee, 2015; Villamor and van Noordwijk, 2011). Games have the potential to simulate in a simplified way the complexity of socio-ecological dynamics (e.g. Ansoms et al. (2015), Villamor and van Noordwijk (2011), Boisseau et al. (2004)) by temporarily creating a space for 'potential realities'

(Barreteau et al., 2007, p. 187). Thus they provide imaginative entry points for thinking about and discussing existing and alternative practices with a diversity of actors involved in the complex process of environmental governance in real-life situations.

The type of knowledge that is generated through policy-oriented simulation games, and the way in which this knowledge is then mobilised to influence policymakers or practitioners, varies by approach. Generally games can either focus directly and explicitly on informing the design of ES-related interventions and policies through direct participation of relevant actors in the game, or they can take an indirect approach, in which the insights obtained are processed by researchers or other 'intermediaries' and used as inputs for recommendations to decision-makers (Barreteau et al., 2007; Bots and van Daalen, 2007). Games designed for multi-agent modelling research, for example, focus on the generation of mostly quantitative data on socio-ecological dynamics and individual actors' preferences and strategies. This data can then be an input for computer-based modelling for policy design (Bousquet et al., 2002; Campo et al., 2010; Pak and Brieva, 2010). Simulation games are also increasingly used to analyse cooperation or conflict dynamics in environmental governance settings (Anderies et al., 2011; Cardenas et al., 2000; Narloch et al., 2012; Reutemann et al., 2016; Rommel, 2015; Salk et al., 2017; Travers et al., 2011). This type of game focuses on the strategic interaction of multiple players by asking participants to make choices based on predefined payoff structures that mimic individual and collective trade-offs. The design and objectives usually measure key parameters and provide insights into the various equilibrium predictions or optimal solutions offered by institutional theories (Rommel, 2015). These modelling and experimental approaches have illuminated important aspects of motivation and decision-making.

When game designs allow for open communication and dialogue between participants (Cardenas et al., 2000; Salk et al., 2017; Travers et al., 2011; Villamor and van Noordwijk, 2011), the analysis of the discourses, conflicts and negotiation processes can lead to a profound understanding of the discursive struggles surrounding various value frameworks and the ways in which they are shaped by unequal power

relations. Some games include a more creative dimension to these spaces for dialogue, and more explicitly use them as forums where actionable knowledge can be co-constructed by participants (Ansoms et al., 2015; Stefanska et al., 2011). The 'Land rush game' developed by Ansoms et al. (2015) simulates contemporary land dynamics in Africa, and offers a platform for participants to collectively reflect on 'the ways in which different social classes face both opportunities and constraints in securing their land rights in an extremely competitive environment' (ibid. 2015, p. 743). This more in-depth qualitative approach emphasises the importance of debriefing sessions in which participants (and facilitators) are encouraged 'to make a connection between experiences gained from playing the game and experiences in real-life situations' (Peters and Vissers, 2004, p. 70; see also Salk et al. (2017) and Stefanska et al. (2011)). Debriefing sessions allow new perspectives to emerge and create space to discuss how these insights might be relevant for actual future situations (Lederman, 1992; Peters and Vissers, 2004). The creation of such spaces for collective reflection, in which participants have the opportunity to jointly reflect, compare, analyse, and discuss different perspectives, is the very essence of the learning process of the 'PES simulation game' we have developed.

3. The PES simulation game

3.1. Setting the scene

The PES simulation game is not a ready-made, one-size-fits-all type of game. It has been designed taking into account the specific context of our action-research setting and needs. While the gaming platform and basic rules could serve as a basis for replication, it is important to underline that the game specificities are dynamic. The game should always be adapted to evolving contexts and, ideally, be part of a broader action-research process. The activities involved in designing and preparing a simulation game are learning processes in themselves, and are necessary to help better understand the real-life situation the simulation game refers to (Peters and Vissers, 2004). The preparation process is also an opportunity to address one of the most important simulation game challenges: striking a balance between approximating complex

real-life situations and keeping the game sufficiently simple and fun. An unrealistic game design would generate few relevant insights, while one that mimics the full complexity of reality would be hard to play – and impossible to design (Ansoms et al., 2015). In seeking this balance explicit choices need to be made about which elements of real-life dynamics will be emphasised and which left out. During the design phase developers should sufficiently engage with the socio-ecological dynamics the game seeks to simulate. Necessary background can be obtained in different ways ranging from the use of secondary data from existing studies to conducting specific field work⁴. Key to the final design is prior analysis that allows for an informed and negotiated decision on the variables to be included in the game, and those elements to be simplified or left out altogether.

3.2. General game principles

The PES simulation game is a board game in which participants take up the roles of farmer households. The game is open ended which means there is no winner. The game is facilitated by at least two people. The first facilitator is the ‘game master’ who gives instructions to the participants and can intervene by asking questions aimed at a better sense of players’ actions. The game master is required to have a detailed understanding of both the game design and the way the simulation relates to real-life dynamics. The second facilitator is in charge of managing the cards (see below) and recording data about ongoing game dynamics for subsequent analysis. The type of data gathered (e.g. conversations, changes in land use, labour and land transactions), the social processes to focus on (e.g. power relations, gender relations, negotiations), and also the methods for recording the information (structured or free note taking; video or voice recording) will depend on the specific interests and practical conditions of the specific action-research process.

⁴ Useful methodologies in this regard are Participatory/Rapid Rural Appraisals (Freudenberger, 1996; Paul, 2013), or the Agrarian Diagnosis methodological package (Apollin and Eberhardt, 1999; Cochet, 2011).

Before beginning the game the facilitator explains the general principles and objectives to the participants, indicating that they are expected to develop the kind of farm they value or desire. The facilitator should not refer to maximising income or accumulating land as desired objectives, so as to avoid suggesting what farmers should value most when taking decisions. The playing board represents a physical space composed of a grid with each square representing 1 hectare of land. Within this grid different land uses are represented by different coloured square tokens (see Picture 1). At the outset each participant is randomly allotted a farm area on the board, a sum of initial financial capital (represented by printed bank notes), and an amount of yearly available family labour days (represented by labour cards). The initial farm size and corresponding land uses, as well as the financial capital and amount of labour each participant is initially endowed with, depend on the context and dynamics the game wishes to simulate and the objectives of the researchers. For example, they could be allotted unequally in order to simulate differences in social classes or farmer types. It is important, however, to note that the total available labour days for a particular participant is 'replenished' to its initial level at the start of each subsequent turn, i.e. the available labour days per year are fixed per participant.

The game proceeds through turns, each one corresponding to one agricultural year, in which participants are required to make choices within a limited set of productive options. During each turn three sequential steps are followed. Firstly, all participants receive the total amount of family labour days they possess yearly, and they are asked to hand in a fixed amount of labour days and financial capital to cover their yearly basic food needs. They are also asked to cover the maintenance costs of their current land uses, which are calculated with the help of the game facilitators through the use of an input-output matrix (example in Table 2 in Section 4). Secondly, participants decide on the changes they wish to implement. This decision is constrained by the available land, financial capital, and labour days each participant still possesses after step 1. Based on the input-output matrix, participants hand in the required financial capital and labour days corresponding to these investments. Finally, at the end of the turn, each

participant receives the financial returns corresponding to their land uses. Negotiations between participants are possible at any time. All types of deals (lending/borrowing money, selling land or labour, multilateral/bilateral deals, permanent/temporary agreements, etc.) are allowed, unless participants decide otherwise. There are no pre-defined rules about negotiations or conflict resolution; it is up to participants to collectively decide on measures to be taken in case of cheating, rule-breaking, etc.

As the game advances, and different turns are being played, participants gradually become acquainted with the game dynamics. When the facilitators think all participants are sufficiently familiar with the game procedures, different types of events are gradually introduced. These events may (temporarily) alter relative inputs and returns or influence the perception of the participants in more indirect ways. A first type of event is an external conservation intervention which represents new institutional arrangements for governing the conservation or provision of ES. Such interventions can range from command-and-control approaches (e.g. demanding farmers protect parts of their remaining forests or instead face substantial fines), to individual or collective payments for voluntarily protecting/establishing particular land uses. The features of the interventions (e.g. the specific rules and duration, the scope in terms of targeting some or all participants, etc.) are context-specific and depend on the objectives and interests of the researchers and practitioners. These features should be collaboratively designed and can be elaborated between games (i.e. they could evolve based on feedback from previous games).

A second type of event is a 'shock', representing unexpected climatic or family events that affect either all or some of the participants. Such shocks alter participants' assets and seek to assess the behavioural and perceptual changes that might be triggered under stress. For example, the sudden illness or death of a household member might temporarily or permanently reduce the available labour and/or financial capital; droughts or hurricanes might negatively affect harvest and income; forest fires can affect the outcomes of the earlier-introduced conservation intervention. Researchers and practitioners should again discuss and carefully choose the nature and characteristics of the shocks they wish to simulate.

After ten to fifteen turns the facilitator ends the game and asks the players to participate in a debriefing session.

Picture 1: The PES simulation game playing board*

Source: Authors' own elaboration

* The picture represents a game with four farmer household participants

3.3. Stimulating collective learning through debriefing

Learning from the game should not be limited to insights gained from playing or from observing interactions during the game, valuable as these are. Rather, the most crucial learning potential of the PES simulation game resides in the debriefing sessions. The game itself provides a setting in which exploration and experimentation can take place, but the debriefing session is where game experience is turned into learning (Crookall, 2010). In these sessions facilitators should assist participants to learn about perceptions by other players so that they gain a more complete picture of the game scenario, and better understand possible effects of their own actions (Peters and Visser, 2004). These sessions are collective

learning platforms where different perspectives can be compared, where links to real-life situations can be established, and where alternative views can be openly discussed.

Our experience demonstrates that debriefing sessions can have high participation levels, are very enjoyable (for both participants and facilitators), provide many insights into the themes of inquiry, and can sometimes be even more engaging for participants than the game itself (see also Crookall (2010)). For this learning process to be most beneficial debriefing should be carefully set up, and can be facilitated by using general and specific guide questions (see Table 1). To prompt a collective discussion on particular aspects of interest facilitators can refer back to particular events, decisions, or discussions that took place during the game. Finally, debriefing sessions should not only be seen as part of one particular game but should be embedded in the broader action-research process, in which the game (and the corresponding debriefing session) is only one among other methodological and analytical entry points. Ideally debriefing should not be seen as a one-shot event, but as a cyclical iterative procedure that goes beyond particular game sessions (Peters and Vissers, 2004).

The discussions taking place during debriefing sessions are recorded by the game facilitator in the same way as the data collected during the implementation of the game (see above). Thus a substantial amount of information related to the specific interests of the broader action-research process is collected. Subsequently this information can be coded and analysed using a wide range of existing qualitative data analysis tools (e.g. NVivo or ATLAS.ti).

Table 1. Guide questions for debriefing in the PES simulation game

General guide questions*
<ul style="list-style-type: none">• What major events and processes were observed while participating, and do they resemble real-life events and processes?
<ul style="list-style-type: none">• Does this observed resemblance offer suggestions for action in real life, considering the course of events in the simulation game?

<ul style="list-style-type: none"> • Are these suggestions doable, desirable, and practical, in view of differences between the simulation game and real life and in view of expected reactions in real life?
Specific guide questions used in the PES simulation game
<ul style="list-style-type: none"> • Did you manage to create the farm you aspired to at the outset of the game? Why/Why not? To what extent is the imagined farm the same as your own farm?
<ul style="list-style-type: none"> • To what extent do the land use changes you observed during the game represent real-life experiences?
<ul style="list-style-type: none"> • Why did you decide to be part (or not) of the proposed intervention?
<ul style="list-style-type: none"> • Do you feel that the intervention rules were fair/unfair? Why/Why not?
<ul style="list-style-type: none"> • Does the intervention resemble actual interventions you have participated in?
<ul style="list-style-type: none"> • Would you have changed parts of the intervention rules? Why/why not? How would these changes have influenced your strategy?

* Taken from (Peters and Vissers, 2004, pp. 81–82)

Source: Authors' own elaboration

4. An example of the PES simulation game in the Nicaraguan agricultural frontier

4.1. Research context

This section briefly illustrates the use of the PES simulation game through a discussion of context-specific rules developed as part of our broader action-research process. The PES simulation game was developed to offer entry points for the conservation NGO CcD to improve dialogue about farmers' perceptions and decision-making processes around current deforestation dynamics in the buffer zone of the Indio-Maíz Biological Reserve in Nicaragua. This reserve was established in 1990; at 264,000 ha it is one of the largest protected areas in Nicaragua. Although a strictly protected area with no human activity allowed, complex socio-political and economic dynamics have moved the agricultural frontier from the established buffer zone into the reserve (Van Hecken et al., 2017). Alarmed by this detrimental dynamic, CcD has tried to defend the remaining tropical forests in this area. Since its creation in 1990 CcD has experimented with peasant-oriented conservation ranging from environmental education and agricultural diversification to the promotion of alternative income-generating activities such as ecotourism or cocoa production. CcD is

concerned that its interventions have offered only limited livelihood alternatives for local people, and thus have not succeeded in halting deforestation. In this context since 2013 we have partnered with CcD in a joint reflection process aimed at devising potential alternatives to change the regional environmentally and socially detrimental processes.

The design of our simulation game builds on key inputs from the above partnership. We have drawn upon the analysis of territorial dynamics (the historical evolution of social relations, land use patterns, technical-economic practices, etc.) from two Agrarian Diagnosis studies in the same area (Lindtner, 2014; Vérant, 2013)⁵, with added data from interviews and focus groups with CcD staff and local farmers. These provided important insights into the main local social and land use change dynamics. We were able to trace current deforestation back to the early 1990s when farmer families, originating from cattle-ranching regions in other parts of the country, started migrating to the Indio-Maíz Reserve where they appropriated large forest plots which were gradually transformed into agricultural areas and pastures. Via this history we identified evolving farming systems as well as the main motivations and institutional factors underpinning a continuous shift towards cattle production. The most important determinants were identified as access to non-family labour and financial capital, the existence of cultural stereotypes of desirable 'moral landscapes' (Setten, 2004) and desired social identities shaped by traditional ideas of progress and development as the conquest of the 'savage and unproductive' forest becoming cattle farms as the endpoint (Van Hecken et al., 2017). While this cattle-based development pathway might seem unstoppable, our earlier research showed that over the past decade an increasing number of farmers have been trying to diversify their production by cultivating alternative crops such as cocoa as an attractive 'green' alternative. This interest has been triggered by an expanding export market and by support from

⁵ These diagnoses use landscape transect assessments, participant observations and semi-structured open interviews to identify agrarian change dynamics (changes in land use, production systems and farm types) and to construct technical-economic models for each farm type in the area.

environmental NGOs, such as CcD. However, since initial investments in financial capital and labour for establishing and maintaining cocoa are relatively high, uptake and production in the study area has been relatively slow (Merlet et al., 2015; Vérant, 2013).

In 2006 *Conservación con Desarrollo* launched a PES programme in three rural communities of the Indio-Maíz' buffer zone comprising a total of 249 households. In the initial phase CcD paid 13 farmer households for protecting parts of the forests remaining on their farms. After a self-assessment in 2010 concluded that the programme lacked a long-term vision, a modified second five-year phase was initiated; farmers were also required to design sustainable farm management plans – e.g. based on agroforestry, ecotourism, or the production of cacao – and to use the payments for implementation. A second assessment in 2015-16 indicated that the anticipated adoption of sustainable practices failed to generate the expected alternative incomes, and that some participants used the payments to invest in cattle-related activities thus undermining the long-term objectives. This second assessment also questioned the logic of the programme and its apparent inability to trigger increased cooperation. This motivated the NGO to rather target groups of farmers through collective payments and contracts. Within this context CcD expressed an interest in new participatory tools and approaches that would enable a deeper understanding of how farmers' decision-making is a product of the historical, socio-cultural and economic context of the locale, and that would permit cooperation in the creation, testing and discussion of new (or hitherto marginalised) alternative practices.

4.2. Rules of the PES simulation game in the Nicaraguan agricultural frontier

Based on analysis of the territorial dynamics and of the type of development and conservation interventions to be 'tested', we simulated the dynamics of newly-arrived farmers at the agricultural frontier. These immigrant farmers usually appropriate similar amounts of land but, depending on their individual history, there can be substantial differences in terms of available financial capital for further investments. At the outset of the game all participants were allotted an equal amount of land (10 hectares

of forested land, 4 hectares for staple crops⁶ and 3 hectares of cleared land covered with pasture), and an equal 350 labour days. However, participants started with different amounts of financial capital (30,000 to 50,000 Nicaraguan Córdobas (NIO)⁷), roughly representing poor, middle, and richer farmers.

In each turn, participants first hand in the money and labour corresponding to their basic subsistence needs and to the maintenance of current land uses. Participants then decided which (combination of) investment(s) to undertake in their farms. Available options were:

1. **Invest in cattle.** Participants could buy one cow per hectare of available pasture. Upon reaching at least 4 hectares of cattle pasture, their production system was upgraded from a basic breeding system to a specialised cattle-fattening system, implying a substantially higher financial return per animal.
2. **Clear forests.** Participants could cut down a maximum of 2 hectares of forest per year⁸ using slash-and-burn techniques. This decision meant that during the next two turns participants received returns corresponding to the temporary cultivation of staple crops on this area. After two turns these areas automatically turned into pasture.
3. **Plant cocoa.** Participants could opt for converting pasture into cocoa plantations.

These decisions have different labour needs and financial costs and returns, which are reflected in the game's input-output matrix (Table 2)⁹.

Table 2: Input-output matrix: PES simulation game in the Nicaraguan agricultural frontier

⁶ Staple crops are fixed at 4ha for all players during the whole game. Staple crops do not result in annual financial returns but are used to cover households' basic food needs.

⁷ 1 US \$ = 30 NIO (January 2017).

⁸ In this region cutting trees is a labour-intensive manual activity. This limits the area of forest that can be transformed into agricultural land to about 2 ha/year (Van Hecken et al., 2017).

⁹ These financial costs and returns correspond to actual values. Within these parameters the optimal economic strategy to follow is to specialise in cattle production. However, there are many constraints that hamper the implementation of such a strategy (e.g. labour constraints, limited access to capital). A more detailed discussion of these 'optimal' strategies is beyond the scope of this article, but can be found in Van Hecken et al. (2017).

		Cleared forest (per ha)	Cocoa (per ha)	Cattle (< 4 cows) (per cow)	Specialised cattle (≥ 4 cows) (per cow)
Initial single investment	NIO*	2,000	16,000	3,200	NA
	labour days	70	100	1	NA
Maintenance (yearly)	NIO	0	0	320	1,100
	labour days	0	40	5	15
Income (yearly)	NIO	10,000**	8,000	2,500	13,000

*NIO: Nicaraguan Córdoba (1 US \$ = 30 NIO as of January 2017)

** The income from cleared forest only applies during two turns (corresponding to staple crops being temporarily cultivated on this cleared area). After two turns this area automatically transforms into pasture, generating zero income.

Source: Authors' own elaboration; calculations based on Lindtner (2014) and Vérant (2013).

Two types of events were included in the PES simulation game. The first was a collective PES intervention, in line with CcD's current real-life initiative. On a voluntary basis interested farmer households were asked to sign a collective contract which stipulated that the signees were committing to, as a group, protect all remaining forest patches on their farms for a period of at least 3 turns. The contract also prohibited further expansion of cattle production within participating farms. As compensation, participating farmers were offered a 50% financial subsidy and 50% labour support for establishing cocoa on their farms. Participating farmers were also offered assistance to improve production and commercialisation of cocoa and staple crops, resulting in a 10 to 20% income increase for these crops. If any of the signees breached the contract at any point, benefits to all participating farmers would immediately cease.

Two turns after the collective PES contract was introduced, three types of shocks were randomly simulated: i) the unexpected death of a family member, resulting in the permanent loss of 75 labour days per annum; ii) a crop disease, causing a 50% income decrease for cocoa and staple crops during that turn;

and iii) an inheritance process, resulting in the permanent loss of half of the participant's current farm area. Per participant these shocks were attributed by rolling a dice.

Picture 2: PES simulation game played with farmers involved in the PES intervention of *Conservación con Desarrollo* in Indio-Maíz, Nicaragua

Source: Authors

5. Reflecting on ES interventions through the use of the game

From February 2016 to February 2017 we worked together with *Conservación con Desarrollo*'s staff on the design of the game and have played it on five occasions (see Picture 2). Each game lasted about four hours, including a debriefing session of about one hour. A total of 30 participants took part in the games at an average of six participants per game: 10 practitioners, 10 researchers from different institutes and 10 farmers living in CcD's intervention area. Sessions with practitioners and researchers were mainly aimed at providing a temporary virtual environment to experience and better understand some of the

main constraints farmers experience when making livelihood choices (Section 5.1). Sessions with farmers were mainly aimed at an improved understanding of social relations and farmers' perceptions, motivations and decision-making in the context of land use change dynamics and project interventions (Sections 5.2 and 5.3). As such, within the broader action-research agenda we conceived of these games as new entry points for thinking about existing and alternative intervention policies. It is important to emphasise that up until now our work in this regard has mainly been focused on piloting and testing the game dynamics¹⁰. Therefore the discussion below offers a summary of only some of the many experiences this game might offer.

5.1. Experiencing and discussing farmers' constraints

The PES simulation game has proven to be a useful tool for researchers and practitioners to experience some of the many constraints and incentives that farmers face when making decisions. It allowed participants to take up the role of farmer households and feel first-hand how individual production decisions in the Nicaraguan agricultural frontier are constrained by the broader historical dynamics and processes in which farmers are embedded. By simulating the contextual dynamics in the study area all games played illustrated how investments in cattle quickly appeared to be the obvious option, encouraging most participants to pursue a cattle-based development pathway. Without exception all participants in all games we played decided at some point – but to different extents – to cut forest and increase pasture for cattle production. Interestingly this production strategy was not only dominant in sessions played by farmers but also in sessions with researchers or practitioners who initially often fiercely defended and argued for a 'pro-environmental' game strategy. For instance, in a game played with CcD staff one of the practitioners in the debriefing session said that he felt stressed and uncomfortable about being forced to take decisions that in real life he was, in fact, fighting against. Experiencing this stress

¹⁰ This also explains the relatively high proportion of researchers and practitioners as participants.

helped the participant to view differently the assumed relevance and applicability of his NGO's conservation strategies. It made him realise why farmers usually stick to proven strategies in their own specific context, and that farmers' weak performance in environmental projects is influenced by many more prominent concerns beyond mere (un)willingness to contribute to the collective 'good' (Participant's comment, 30 September 2016): the concerns are mainly the result of historic rules and norms and socially-instituted ideas and habits around what seems to work in a specific context (Van Hecken et al., 2017). Another participant, who in real life was a practitioner promoting cocoa projects, explained how she was convinced that her initial game strategy of investing in cocoa would provide clear evidence of the potential benefits of a livelihood centred on this crop. However, the outcomes of such a strategy proved to be rather disappointing: it quickly led to financial problems, difficulties in covering basic food needs, and ultimately even a need to invest in cattle to be able to survive. During the debriefing session she explained that the experience made her realise how she and her colleagues might all too often gloss over the many daily constraints that farmers face when participating in a project that imposes a particular outside logic (Participant's comment, 30 September 2016).

While these observations might seem straightforward considering the context and the constraints imposed by the game, playing clearly offered a new interactive platform to personally experience and openly and critically discuss different lived experiences and perspectives on longstanding project assumptions and routines (e.g. uncertainty of project policies in case of unpredictable shocks, the often inflexible technocratic models imposed by projects, the perceived disrespectful behaviour of some project officials). These reflections also sparked broader discussions about often simplistic assumptions NGO staff hold regarding farmers' weak motivation or reluctant participation in different types of 'well-intended' projects, and how this mutual misunderstanding often leads to frustration and distrust on both sides. The presence of practitioners as co-facilitators during the games played with farmer participants, for example, enabled the practitioners to enter into a constructive dialogue with them on how farmers' resistance to

certain externally-promoted activities/practices is often motivated by distrust due to previous experiences with 'questionable' interventions. This stimulated the NGO staff to start thinking more seriously about experimenting with alternative participatory methods and tools with empathy as a more central focus when approaching farmers in future projects. The discussions led to consensus among participants that being empathic was one of the most important characteristics a field practitioner should possess or further develop, even more so than their technical knowledge. The explicit recognition and discussion of these seemingly obvious issues was seen as a crucial but hitherto mostly neglected first step in constructing more meaningful and effective collaborative policies.

5.2. Social relations, power differences, and environmental governance

Playing the PES simulation game also offered new entry points for discussing sensitive issues related to power differences in local communities, which, in turn, offered important inputs for thinking about the design of more equitable and effective ES governance interventions. This proved to be particularly relevant to our research as social relations in the Nicaraguan agricultural frontier are characterised by persistent vertical patron-client relations, one of the structural social underpinnings driving the dominant cattle-based development pathway (Van Hecken et al., 2017). In these network constellations large-scale cattle ranchers ('patrons') usually secure access to both cheap labour and additional pasture by contracting neighbouring 'client' farmers or by engaging them in share-breeding systems¹¹. Despite the unfavourable or even exploitative conditions these informal agreements usually entail for poorer farmers, the latter tend to accept them. One of the main reasons is that these unequal arrangements reach far beyond the cattle-related exchanges. They are considered as important coping strategies for poorer farmers to deal with unexpected shocks or emergencies (e.g. sudden illness of a family member or a bad

¹¹ In a share-breeding system, a large cattle rancher leases some of its animals to smaller farmers. The latter feed and take care of the animals on their farm and, in turn, are entitled to keep a portion of the generated products (milk and/or calves).

harvest), offering the opportunity to call upon patrons for e.g. short-term loans. While these social relations (and their social and environmental impacts) have been studied to some extent in the Nicaraguan context (Broegaard, 2005; Merlet et al., 2015), there is often an unwillingness by farmers to openly discuss them.

Playing the game with farmers has proven to be useful in assessing why these vertical, authoritative relations are so persistent and difficult to challenge. The game dynamics exposed two important characteristics of these relations. The first one is the apparently general perception among farmers that these relationships are overall ‘helpful’ and ‘supportive’ for both the patrons and the clients. Negotiations between richer participants, who had succeeded in establishing a cattle farm in the game, and poorer ‘clients’ struggling to cover their basic food needs were almost exclusively framed in terms of ‘help’, ‘support’, and ‘favours’: helping poor farmers with a loan, or conversely supporting cattle ranchers by selling them labour. The second characteristic is that patron-client relations are based on mutual trust. For example, when poorer participants urgently needed money, they would always prefer to borrow it from their ‘richer’ neighbours instead of turning to banks, for which they expressed a profound distrust¹². In the debriefing sessions we urged participants to collectively reflect on these observed dynamics and corresponding discourses by referring back to particular events that had occurred during the game. This led to lively discussions on the unequal conditions imposed by powerful cattle ranchers, and deeper reflections on how the observed dynamics resemble real-life situations in their communities. These knowledge encounters proved to be crucial inputs for *CcD* as they allowed them to gain additional insights into the deeper social patterns and power relations underlying cattle-driven deforestation in the region. While these reflections have yet to translate into new intervention strategies, it is clear that the PES

¹² In most games participants assumed that the facilitators, who also managed the money transactions in the game, could be considered as a bank.

simulation game is an useful platform allowing for clear visualisation and acknowledgement of the deeper structural patterns, which could lead to ultimately challenging them.

5.3. Value frameworks and targeting in interventions

Playing the PES simulation game has shed additional light on our previous finding that farmers in the region generally perceive forests as a dormant reserve of future productive land (Van Hecken et al., 2017). From this perspective forests are largely considered as a short-term obstacle to development, only becoming economically valuable after being converted into agricultural plots. The game also uncovered further insights into this general farmer perception of forests, as well as in relation to the (P)ES interventions proposed in the game. Table 3 provides a rough illustrative typology of game participants, by considering three qualitative criteria: i) the pace of deforestation in the participant's farm; ii) the willingness to participate in the proposed PES project; and iii) the match between the proposed project rules and the participant's dominant production strategy.

Table 3. Typology of game participants in relation to proposed PES project

Criteria Group Type	Deforestation pace	Willingness to participate in PES project	Match between project rules and production strategies
Poor farmers	Low	High	High
Diversified farmers	Intermediate	Intermediate	Low
Specialised cattle ranchers	High	Low	Low

Source: Authors' own elaboration.

'Poor farmers' were participants who typically started the game with little financial capital, and from early on struggled to cover their yearly basic food needs. From the outset these participants' capacity to invest in land use changes was very limited, resulting in less deforestation throughout the game. Unsurprisingly

these participants were the most willing to participate in the proposed PES project. During the debriefing sessions they explained that the project's requirement to leave forest undisturbed was not perceived as a significant production constraint in the short term. Furthermore, the labour and financial subsidies for cocoa production offered by the project were considered as an attractive opportunity to start financial accumulation. 'Diversified farmers' and 'specialised cattle ranchers', on the other hand, were participants who typically started the game with a cattle-based development strategy. However, due to disparate financial constraints, not all of them succeeded in sustaining this strategy throughout the game. While specialised cattle ranchers were those who were able to fairly quickly transform their areas into pasture and upgrade their cattle system, diversified farmers were those who experienced more constraints, leading to slower deforestation and eventual diversification into both cattle and cocoa production. To the specialised ranchers the proposed PES project was very unattractive as the commitment of conserving forest was much too costly compared to their very profitable livestock specialisation system. Diversified farmers were somewhat more willing to participate in the PES project but during the debriefing sessions they explained how they considered the proposed project rules to be quite unfavourable to their desired production strategy. One of the respondents said:

'In real life I would never participate in the proposed PES project. I just wouldn't be able to do so under the proposed conditions. I would only be able to participate if I would have already cleared enough forest in the previous years. It just doesn't make sense for us farmers who have barely started developing our farm. The contract would oblige us to leave all forests undisturbed and in turn would offer us cocoa subsidies. But what's the use of these subsidies if I don't even have enough available agricultural land for planting cocoa anyway?' (Participant comment, 30 September 2016).

The constructed typology in relation to the proposed project proved to be a very useful heuristic tool to collectively discuss the extent to which this particular proposal was acceptable, as well as illustrate when

existing interventions' characteristics were (in)compatible with farmers' motivations and (long-term) strategies. It opened a platform to collectively analyse the heterogeneous nature of communities and, hence, to discuss the need for more flexible and socially-sensitive targeted strategies, while taking into account potential equity trade-offs for different types of farmers. These discussions, in turn, were important inputs for the broader action-research on CcD's ES governance interventions. For example, the organisation was inspired to initiate a reflection process on determining *alternative values* for remaining forests. This represents an important paradigm shift for the organisation: whereas traditionally it always followed a 'don't-touch' or 'non-intervention' strategy for the remaining forests in the area, it now realises that in an agricultural frontier context such an approach may not be appropriate and might even be untenable. In order to encourage farmers to see forests as potentially valuable assets for their farm they should be allowed to integrate them into their production system by, for example, allowing different kinds of forest interventions such as shade-grown cocoa production, ecotourism, agroforestry or silvopastoral systems.

6. Conclusion

The PES simulation game we have presented in this article aims to create a virtual platform where different actors engaged in ES governance are able to experience alternative realities and are encouraged to collectively explore and discuss them. Through discussion of the pilot games we have played in the Nicaraguan agricultural frontier we demonstrated some of the game's potential in terms of stimulating joint reflections and knowledge co-creation. By enabling practitioners to experience how farmers' motivations and decision-making processes are largely embedded in broader socio-institutional structures, we have shown how the game offers novel entry points for open discussion of alternative perspectives on commonly made assumptions. The game has also helped to more openly explore and debate how ES governance is to a large degree shaped and influenced by different values, interests, and

power relations thus, for example, inspiring practitioners and researchers to think more carefully about the political dimensions and implications of different types of targeting strategies.

It is important to underline that we do not conceive the PES simulation game as an all-encompassing strategy to explore political and motivational dynamics in ES governance. The methodology has clear limitations and therefore needs to be used with care. One of the major limitations is that – ideally – the contextual design requires an in-depth understanding (and deliberative discussion) of real-life dynamics. In the absence of prior analyses of the study area, the construction of a meaningful and context-specific simulation platform will be a time-consuming process of contextual data collection and interpretation. This limits the meaningful use of the tool mostly to broader action-research processes which include a high level of stakeholder involvement and appropriation. This simulation game should be considered for use as part of a broader and iterative research process in which the co-creation of actionable knowledge starts before the contextual game design. As such, rather than offering a ready-made, predetermined design route, we recognise that there exists a multiplicity of ways to adapt the gaming platform we have presented in this article. In the spirit of action-research we encourage interested researchers and practitioners to further test and adapt the game in different contexts, and to share their additional insights with the broader research-practitioner community, for example through the virtual forum we have created on <https://pessimulationgame.wordpress.com/>.

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