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Payments for Ecosystem Services in Colombia: discourses, design and motivation crowding

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Thesis submitted for the degree of Doctor of Philosophy

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Para Simon

Preface

This thesis is the result of three years and a half of continuous learning and creation involving the topic of Payments for Ecosystem Services (PES) in Colombia. The starting point of this dissertation dates back to 2015, when Esteve and María Alejandra, my academic supervisors, met over a PES workshop in Barcelona. Thanks to this encounter, and out of the interest of gaining a deeper understanding of land-use and conservation policies in a multi-disciplinary environment, I officially began my Ph.D. in Environmental Sciences and Technology at ICTA in January 2016 with a three-year Ph.D. grant from Universidad de los Andes in Bogotá. This grant was for training future faculty members and was offered to young researchers that demonstrated the aptitudes and interest to pursue an academic career.

During this Ph.D. process many opportunities arose for collaboration with conservation practitioners in Colombia, and thanks to these encounters, the thesis took shape and consolidated given my interests in PES conceptualization and practice. This thesis is, to some extent, and adaptive process. For example, during the second year of my Ph.D. the national PES law was issued, and PES practice was dynamized as a response to it. In this context, Chapter Three on PES discourses arose from the interest of trying to understand what PES meant in Colombia after the issuing of a highly ambitious PES Law. Similarly, the selection of Cundinamarca's PES scheme (Chapter Four) was then based on the fact that it is one of the first pilot schemes included within the law. Chapters Five and Six took place as part of a larger project with a non-profit fund for conservation, Patrimonio Natural, that had an interest in designing an incentives system for conservation in the Amazon Piedmont, a key Colombian ecotone. Thanks to the funding sources provided by Patrimonio Natural and all the local knowledge and support provided, I conducted the forest conservation experiment and a motivations survey in that study area with the twofold purpose of providing insights for a new incentive-based scheme for conservation and analysing the effects of different types of payments on pro-environmental motivations.

In what follows, I list the main outcomes of this dissertation in terms of the resulting academic publications, my presentations at academic conferences and seminars, and research dissemination activities.

The following chapters of this dissertation have been **published:**

Chapter Five: Moros, L., Vélez, M. A., & Corbera, E. (2019). Payments for Ecosystem Services and Motivational Crowding in Colombia's Amazon Piedmont. *Ecological Economics*, *156*, 468–488. https://doi.org/https://doi.org/10.1016/j.ecolecon.2017.11.032

Chapter Six: Rueda, X., Vélez, M. A., Moros, L., & Rodríguez, L. A. (2019). Beyond proximate and distal causes of land-use change: Linking Individual Motivations to Deforestation in Rural Contexts. *Ecology and Society*, *24*(1), 1–14.

The following material has been **accepted** for publication (July 2019):

Chapter Three: Moros, L., Corbera, E. Vélez, M. A., & Flechas, D. (2019). Pragmatic conservation: Discourses of payments for ecosystem services in Colombia. Accepted after two rounds of revisions in *Geoforum.*

The following material **will be submitted** for publication after the Ph.D. defence:

Chapter Four: What drives institutional change? An analysis of environmental targeting in a publicly-funded PES scheme.

Presentations at academic conferences and seminars:

Chapter Five has been presented at the International Sustainable Development Research Society (ISDRS) Conference (Bogotá, June 2017), at the International Association for the study of the Commons (IASC) conference (Utrecht, July 2017), the Behavioural and Experimental Economics Seminar (BEBES) (Bogotá, February 2017) and the Ecological Economics Seminar (EES)- UAB (Barcelona, October 2016)

Chapter Three has been presented at the Latin American Studies Association (LASA) Conference (Barcelona, May 2018), at the Environment for Development (EfD) Policy Day (Bogotá, November 2018) and at the International Association for the study of the Commons (IASC) conference (Lima, July 2019).

Seminars, workshops, and research dissemination activities organized during the Ph.D.:

PES Colombia Policy Day (Bogotá, November 2018) funded by the Environment for Development (EfD) initiative. More information: http://efdinitiative.org/news/archive/international-researcher-esteve-corbera-icta-universitat-autonoma-de-barcelona-visits

Youtube: PES workshop for Afro-Colombian leaders in the Pacific (Buenaventura, February 2019) funded by Fundación Autónoma Solidaria (FAS). More information: https://bit.ly/2Qt63NB

Podcast : PES in Colombia. Centro de los Objetivos del Desarrollo Sostenible para América Latina y el Caribe (February 2019): https://bit.ly/2KtdSTQ

Policy memo: Recomendaciones para el diseño e implementación de incentivos para la conservación en paisajes agrícolas. Foro Nacional Ambiental (August, 2017): https://bit.ly/2s60UQ7

My academic supervisors have been Esteve Corbera Elizalde and María Alejandra Vélez. In Chapters Three, Four, and Five, I led the development of research ideas, design of research methods, collection and analysis of data, and the elaboration, writing, and editing process. My co-authors supported me across all stages of the research design and the ensuing process until publication. In Chapter Six, I contributed to data collection, and article data analysis and writing.

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I am very grateful to Alexander Pfaff and Ximena Rueda for their constant support, for their generosity with their time and all the reflections shared in these years. I thank Juliana Unda, Santiago Caicedo and Juan Sebastian Rodríguez for being the best field mates. I also thank Tiziana Laudato for her excellent work proofreading and copyediting this manuscript.

This thesis is very much indebted to the friends who constantly supported me and forced me to take a break every now and again: to Lili and Didier in Barcelona, thank you for welcoming me into your home and letting me become your *inquilina*. To the friends who made me laugh and supported me when I needed it most: Isabela, Marianna, María José, Juana, Adriana, Laura and Juan, Diego and Robert-Jan.

These four years would not have been possible without the loving support of my parents, Jorge and Beatriz. I thank you deeply for all your unconditional love and support. This thesis exists because of you. I also thank Simon, my Simo, for adapting to all the trips and changes over these years. This thesis is for you who heard me speak so often about the famous "payments for environmental services".

And Peter, we met when I was just accepted on the doctoral programme. You went with me to Barcelona to be with me when I was just starting this PhD. You have accompanied me during these 4 years, as a driver, to almost all my fieldwork (Buenaventura, Cali, Caquetá, and Cundinamarca). Your company and Mathias', your bad jokes, your good food, and unconditional love and support made this doctorate a lot gentler as I was constantly reminded of what is really important. I could not have done it without your care (and patience).

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Estos cuatro años no serían posibles sin el apoyo amoroso de mis padres, Jorge y Beatriz. Les agradezco profundamente todo su amor y apoyo incondicional. Esta tesis existe gracias a ustedes. También agradezco a Simon, mi Simo, por adaptarse de la mejor forma a todos los viajes y cambios que hubo en estos años. Esta tesis es para ti que tanto me has oído hablar de los famosos “pagos por servicios ambientales”.

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Summary

Payments for ecosystem services (PES) have been promoted since the 1990s by global institutions, conservation NGOs, and both national and regional governments to incentivise landowners to maintain biodiversity and forest cover, as well as to restore or enhance the provision of ecosystem services. PES has permeated the environmental global policy agenda because it promises a direct conservation approach that simultaneously tackles environmental protection and poverty reduction. Latin America dominates PES implementation, with the Costa Rican (1998) and Mexican (2003) national programmes being two of the largest schemes in the world, followed by China's Sloping Land Conversion programme. Despite the growing popularity of PES, it remains a contested and dynamic concept that raises many concerns including the monetisation of ecosystem functions, trade-offs between environmental effectiveness and equity considerations, and potential risks of motivation crowding, meaning that PES can, over time, diminish pro-environmental motivations.

Using a multi-disciplinary and mixed methods approach, this dissertation contributes to these debates by investigating how PES has been conceptualised and implemented in Colombia, a late-comer in the PES agenda which stands-out globally for both its high level of biodiversity and its rates of deforestation. This thesis makes two main contributions to PES literature: first, theoretically it shows the importance of identifying points of convergence across PES discourses to facilitate PES implementation according to local needs and realities. It also highlights the important role of motivations in the effectiveness of conservation policies aiming at behavioural changes. Second, methodologically, it advances Q-methodology by developing a systematic and replicable protocol to capture, define and prioritise PES statements from social media. It also proposes that motivations and behaviours should be analysed separately and not assumed as interchangeable.

Chapter One. Introduction

1.1. Research background

Global biodiversity loss and increasing rates of deforestation and ecosystem degradation are severely threating collective well-being on the planet (IPBES, 2019). Consequently, ecosystem services critical for human survival, such as crop pollination and regulation of water flow, are also rapidly deteriorating. In response, and particularly since the 1990s, Payments for Ecosystem Services (PES) have been promoted by global institutions, conservation NGOs and both national and regional governments to incentivise landowners to maintain biodiversity and forest cover, as well as to restore or enhance the provision of ecosystem services. To date, there are more than 550 PES initiatives of different focuses and scales of implementation worldwide (Salzman, Bennett, Carroll, Goldstein, & Jenkins, 2018). Despite such growing traction and popularity, various concerns continue to affect PES acceptance in policy and academic circles. These include, for example, the PES attempt to monetise and exchange ecosystem functions, their limited environmental effectiveness or ability to reduce poverty or inequality, and their potential risks for motivation crowding out, meaning that payments can, over time, diminish people's pre-existing motivations to protect their environment.

This thesis contributes to PES research and the above debates over PES outcomes by investigating how PES has been conceptualised and implemented in Colombia, a late-comer in the PES agenda which stands-out globally both for its high level of biodiversity and deforestation rates. Specifically, the thesis sheds light on the discourses that underpin PES policy and practice, the evolving design and outcomes of a public-led PES regional initiative, and the importance of motivations in understanding PES effects and land-use

decisions more broadly. In doing so, the dissertation follows a multi-method approach which includes Q-methodology, economic field experiments, surveys, and interviews with potential PES beneficiaries and implementers, policy makers, and academics from different regions of Colombia.

The thesis makes four main contributions. First, it demonstrates the existence of three PES discourses in the country, each based on different assumptions about the causes of deforestation, the related approaches that PES should adopt, the relationship between incentives and motivation crowding, and the effectiveness of PES compared to other policy instruments. The three discourses tend to be supportive of PES as an instrument to correct the inherent asymmetry in conservation costs and benefits. However, there is general disconformity with the far-stretched ambition of Colombia's PES legal and policy frameworks, which expect PES initiatives to tackle illicit cropping and promote peace in areas where guerrilla-related activities have been prominent until recently.

Second, the dissertation explores the interactions between targeting and environmental additionality criteria, and participants' motivation crowding through an analysis of the first sub-regional publicly-funded PES scheme in Colombia. The research demonstrates that in the quest for greater environmental additionality, the PES initiative excluded some early participants from the latest phase of project implementation and altered their pro-environmental motivations. It also shows that a passive adaptive management approach has characterised the scheme to date, with implementation changing as an outcome of experience rather than as a deliberate experimentation or learning.

Third, the dissertation explores the effects of motivation crowding through a forest conservation game in Colombia's Amazon Piedmont, developing a framed field

experiment and a survey to test the impact of individual, collective, and crop-price premium economic incentives on conservation behaviour. It is shown that all types of PES, except for the crop-price premium payment, increase conservation behaviour in the experiment. However, not all types of payments affect motivations equally: collective payments enhance social motivations to protect forests and the crop-price premium reduce intrinsic and guilt/regret related motivations.

Finally, the dissertation investigates the relationship between pro-environmental motivations and self-reported deforestation in a tropical deforestation frontier. Findings show that, when controlling for the structural and household drivers identified in the deforestation literature, intrinsic motivations positively correlate with less self-reported deforestation. This suggests that motivations can explain variation in land-use decisions and should thus be centrally considered when designing, implementing, and evaluating conservation policies aiming to halt deforestation, such as PES.

Taken together, these findings advance PES research in two important ways. Theoretically, the dissertation shows the importance of identifying points of convergence across PES discourses to facilitate PES implementation according to local needs and realities. It also highlights the important role of motivations in the effectiveness of conservation policies aiming at behavioural changes. Methodologically, the dissertation advances Q-methodology by developing a systematic and replicable protocol to capture, define and prioritise PES statements from social media. It also proposes that motivations and behaviours should be analysed separately and not assumed as interchangeable. Overall, the research demonstrates that PES is not only a contested concept that requires problematisation by relevant stakeholders but also that the role of motivations across PES design, implementation, and evaluation stages should not be overlooked.

1.2. Research objectives and questions

This thesis is organized in four different research questions that taken together aim to contribute to PES conceptualization and implementation debates at three analytical levels: discursive, institutional, and individual. The discursive level of analysis locates the focus of the research on the ideas or conceptualizations and shared beliefs about PES. The second analytical level focuses on institutional change in PES practices as its unit of analysis. And the individual level of analysis situates its analysis on the individual and the decision-making process.

Table 1.1 presents the research questions guiding this dissertation and their corresponding level of analysis.

Chapter No. and Question	**Level of analysis**
Ch. 3 - How is PES conceptualized in Colombia?	Discursive
Ch. 4 -What drives institutional change in PES?	Institutional
Ch. 5 -What is the relationship between types of PES and motivation crowding?	Individual
Ch. 6 -What is the relationship between deforestation and pro-environmental motivations?	Individual

Question 1: *How is PES conceptualized in Colombia?*

This question is addressed in Chapter Three and it is answered through the implementation of Q-methodology in four different sites in Colombia. This method allows for the systematic study of perceptions using a structured protocol based on the ranking of opinion statements. Findings show the existence of three PES discourses among relevant actors involved in the design, implementation, and debate over PES in

Colombia. These discourses vary in their degree of support they lend to PES as a policy tool, in the relative importance given to environmental vs. social or development-related objectives, the likely role of payments in altering pro-environmental motivations, and the effectiveness of PES compared to other policy options. Overall, the discourses identified suggest a high level of acceptance of PES which might ease its expansion and upscaling in the country over time.

Question 2: *What drives institutional change in PES?*

This question is answered in Chapter Four by analysing the evolution of the first-publicly funded PES scheme in Colombia "Yo Protejo, agua para todos" (YPAT). This chapter identifies the main driving factors of changes in the design of YPAT and how these changes have raised equity and motivation-crowding concerns among participants who were removed from the programme. Based on semi-structured interviews with relevant programme stakeholders and survey data from former participants, I identify three driving factors of design changes over time, namely: the learning derived from experience in the earlier phases of the programme; the entrance of a new experienced stakeholder who introduced a discursive shift within the scheme; and changes in the national environmental regulation. Results suggest that the programme became increasingly sensitive to equity considerations over time and that unexpectedly, exclusion from the programme did not negatively affect pro-environmental motivations among removed participants.

Question 3: *What is the relationship between types of PES and motivation crowding?*

This question is addressed in Chapter Five on the basis of an economic experiment and a motivations survey implemented among farmers dwelling in an active agricultural frontier in south-west Colombia, where PES schemes are expected to be implemented in the near future. This chapter examines how different types of PES (e.g., individual, collective and premium-price) affect conservation behaviour and pro-environmental motivations. Findings show that payments affect conservation behaviours and motivations in different directions, thus highlighting the need to analytically separate these two aspects. Results also provide evidence to demonstrate that PES effectiveness is highly sensitive to its design.

Question 4 *What is the relationship between deforestation and pro-environmental motivations?*

This question is answered in Chapter Six on the basis of quantitative data on motivations and self-reported deforestation behaviour for a sub-sample of farmers that participated in the economic experiment in Chapter Five. In this chapter, we used a logistic regression model to assess the role of different biophysical, household and motivations variables in explaining deforestation behaviour. Results show that controlling for structural (e.g., altitude, distance to main roads, slope) and the household (e.g., income, education, economic activity) variables widely identified in the land use literature, intrinsic motivations are positively correlated with less self-reported deforestation. This finding provides further empirical support to the argument that motivations play a crucial role in conservation and land-use policies that target behavioural change such as Payments for Ecosystem Services. Further, this chapter highlights the importance of understanding the role of motivations as drivers of land-use change particularly in areas with low state

presence and low enforcement capacity in which deforestation and ES degradation is highly likely to occur.

This dissertation adopts a multi-disciplinary and multi-sited case study approach in Colombia (See Section 2.7) with the objective of capturing regional nuances in PES conceptualization and implementation across the country. Colombia stands out globally both for its high level of bio-cultural diversity and its increasing deforestation rates. Despite its critical role in the provision of ecosystem services of global importance, more than 500,000 hectares of forest were cleared in Colombia between 2017 and 2018 and this trend is expected to increase in the following years. Unlike other countries in Latin America, Colombia does not have a national PES programme but several dispersed initiatives that vary in their intended scale and funding sources, and that operate from different logics. The field work for this dissertation was conducted in different parts of Colombia and the choice of methods and particular case studies is justified and explained in Chapter Two.

1.3. Dissertation outline

This thesis is organized into seven chapters. Chapter Two presents the research context, as well as the key concepts, theories and methodological approaches used in the dissertation. Chapters Three to Six are empirical chapters, and Chapter Seven concludes the dissertation by summarising its main findings, limitations and highlighting possibilities for future research.

Chapter Two. Theoretical and methodological foundations

This chapter presents the theoretical foundations of the thesis and an overview of the research methods applied including a justification for the selection of Colombia as the country case study guiding this dissertation. This thesis enriches PES debates and scholarship by investigating how PES has been conceptualised and implemented in Colombia. It draws from different concepts and theories from the social and environmental sciences and from various methodologies that are presented below and further elaborated in each empirical chapter. The methods and research tools are closely related to the researcher's conception of reality, and the methods simultaneously define and limit what can be said about a phenomenon. The research questions determine the appropriate research method and there is no a-priori single best method for every research question. Building on my multidisciplinary background, four different research methods are used in this thesis: Q-methodology (Chapter Three), semi-structured interviews (Chapter Four), survey questionnaires (Chapters Four, Five and Six), and economic experiments (Chapter Five).

In what follows, I first present an account of PES emergence and main debates over PES conceptualization and implementation. I then justify the use of a case-study approach and my focus on Colombia, and the adoption of a multi-sited research design approach. Next, I define and describe the research methods employed and further developed in my empirical chapters, and the last section presents my reflections on research ethics, positionality and the potential limitations of the methods employed in the dissertation.

2.1. PES emergence, typologies and practice

The concept of PES is closely linked to that of Ecosystem Services (ES). The Millennium Ecosystem Assessment defines ES as the benefits people obtain from ecosystems. Ecosystems are a "dynamic complex of plant, animal, and microorganism communities and the non-living environment, interacting as a functional unit" (MEA, 2003: 49). Services derived from ecosystems include provisioning services (e.g., food and water), regulating services (e.g., flood and soil control), cultural services (e.g., spiritual and recreational services), and supporting services (e.g., nutrient cycling). The concept of ES served to shed light on the interdependence between humans and nature (Gómez-Baggethun, de Groot, Lomas, & Montes, 2010). As such, the concept had a pedagogical purpose that aimed to raise public awareness about biodiversity conservation. However, to some, this purpose vanished over time as ES became increasingly related to markets and the commodification of nature (Peterson, 2010, Noorgard, 2010). The concept of PES is closely linked to ES because PES is an example of the articulation of ES into markets (Gómez-Baggethun et al., 2010).

PES emerged in the late 1990s to tackle the sub-provision of ecosystem services through direct incentives to conservation and restoration. PES was first proposed as a direct approach to conservation in opposition to other "more indirect" policy tools such as command and control regulations (e.g., protected areas), environmental taxes and subsidies, integrated conservation and development projects (ICDP's), and land acquisition for conservation (Engel, Pagiola, & Wunder, 2008; Wunder, 2005). Wunder's seminal definition considers PES a market-based instrument that relies on (1) a voluntary transaction, where (2) a well-defined ES (3) is bought by an ES buyer (4) from an ES provider (5), if and only if the ES provider secures ES provision (Wunder, 2005).

PES can be grouped into three broad typologies depending on its funding source: user-financed, government-financed, and compliance PES (Salzman et al., 2018). Under user-financed PES schemes direct users or beneficiaries of ES agree to compensate ES providers for activities that maintain or enhance ES provision. Users include citizens, NGOs, private companies, and actors that get a direct benefit from ES delivery. Publicly-financed schemes rely on governments as buyers of the ES. The buyer, under this type of PES scheme, does not directly benefit from ES provision. Publicly funded PES is the most frequent PES type in Latin America and Europe and North America accounting for 65% and 70% of total PES schemes respectively (Ezzine-de-Blas, Wunder, Ruiz-Pérez, & Moreno-Sanchez, 2016). Compliance PES refers, in turn, to PES-like schemes in which "parties facing regulatory obligations compensate other parties for activities that maintain or enhance comparable ecosystem services or goods in exchange for a standardized credit or offset that satisfies their mitigation requirements" (Salzman et al., 2018:136). Carbon and biodiversity offsets and cap-and-trade emissions trading schemes, in which private companies and governments gain access to buy carbon credits, fall into this category of PES.

To date, there are 16 PES review studies that describe and document lessons from PES practice and implementation at national, regional and global scales (Börner et al., 2017; Wunder, Brouwer, Engel, Muradian, et al., 2018). Overall, these studies highlight the importance of implementation contexts and specific institutional arrangements in determining PES environmental and social outcomes. Property rights issues (e.g., tenure insecurity or tenure conflicts), lack of technical knowledge on ES for schemes design (e.g., obstacles in measuring and monitoring ES), the important role of implementing agencies (e.g., the role of intermediaries), high pre-programme compliance rates, and self-selection bias in the schemes (i.e. the voluntary nature of PES potentially leads to the

enrolment of those who were going to provide ES regardless of payments) have been highlighted as the main factors limiting the potential of PES to become an effective and equitable conservation and land-use management tool (Ezzine-de-Blas, Wunder, et al., 2016; Jack & Jayachandran, 2019).

PES has now been promoted by global institutions, international NGOs, and governments, national, regional, and locally on most continents. Up until 2018, there were more than 550 active PES programmes around the world with an estimate of $30-50 billion USD in transactions (Salzman et al., 2018). Since its emergence, PES has received substantial attention, mainly because of its promises of both tackling environmental degradation and generating alternative sources of income to vulnerable communities in particular in the global south (Muradian et al., 2013; Muradian, Corbera, Pascual, Kosoy, & May, 2010).

2.2. PES additionality and targeting

Environmental additionality is a key concern among PES practitioners and policy advocates. Additionality, in the context of PES, relates to the extent to which the environmental outcome with PES was better compared to an outcome in the absence of PES (Engel, 2016). Measuring additionality in PES requires "estimating realistic baselines on what would have happened in the absence of PES" (Engel, 2016:154) using impact evaluation techniques. To date, evidence in this regard is still limited and there are only18 impact evaluation studies on PES, including one Randomized Control Trial (RCT) in Uganda.

This evidence suggests an overall moderate positive impact of PES on slowing deforestation rates and maintaining sustainable land-use management practices. (Alix-Garcia, Sims, Orozco-Olvera, & Costica, 2018; Börner et al., 2017; Jayachandran et al., 2017). This impact is, however, comparable to that of other conservation policies such as protected areas (Börner et al., 2017). The effects of PES vary depending on its scale, and sub-national and local schemes exhibit more significant positive impacts than national programmes (Börner et al., 2017).

PES environmental additionality is very sensitive to its design and implementation. The literature has documented more than 18 design characteristics on which a scheme can be built (Engel, 2016). Although it is difficult to establish PES key predictors of success, the literature agrees on three characteristics that predict PES success in terms of environmental additionality: (1) environmental targeting, (2) differential payments, and (3) enforced monitoring (Ezzine-de-Blas, Wunder, et al., 2016; Wunder, Brouwer, Engel, Ezzine-de-Blas, et al., 2018).

In particular, Environmental Targeting (ET) implies selecting participants based on criteria of high ecosystem services (ES) density, high-threat areas, and/or ES provision costs. ET is a cost-effective design feature because not all areas matter equally for conservation and budget constraints impede the enrolment of all potential ES suppliers (Engel, 2016; Wunder et al., 2018; Wünscher, Engel, & Wunder, 2008). Hence, the benefits of targeting are larger the higher the self-selection risk and when "potential programme participants exhibit large variability in the outcome (e.g., threat of non-compliance, environmental benefits, or opportunity costs)" (Börner et al., 2017: 362). However, in practice, very few PES schemes incorporate targeting into their selection criteria because of alleged implementing costs (e.g., costs of spatial data on ES), equity

reasons (e.g., to avoid excluding very poor populations) or political dynamics in the case of publicly-funded PES (e.g., electoral motivations) (Wunder et al., 2018).

Additionality gains from targeting can also imply trade-offs with equity and well-being effects (Börner et al., 2017). Equity in the context of PES refers to the involvement of vulnerable ES providers in its (1) design, (2) implementation, and (3) the distribution of outcomes across project participants (Calvet-Mir, Corbera, Martin, Fisher, & Gross-Camp, 2015; Corbera, Kosoy, & Martínez Tuna, 2007). Schemes that focus solely on environmental efficiency and overlook equity considerations carry the risk of being perceived as not legitimate or credible across both enrolled participants and non-participants; two main aspects that have been identified as key predictors of PES success (Börner et al., 2017; Gross-Camp, Martin, Shawn, Kebede, & Munyarukaza, 2012).

In Chapter Four, I contribute to the debate on environmental targeting in PES by analysing the evolution of a PES scheme that underwent several design changes over time, including a renewed environmental targeting approach. These changes implied the exclusion of hundreds of early participants raising equity and motivation-crowding concerns. In particular, my analysis identifies three driving factors of design changes and explores the effects that these adjustments might have had on excluded participants. The analytical strategy followed in Chapter Four, which focuses on excluded participants, represents an innovative approach to understand PES unintended outcomes.

2.3. PES as a contested concept with uneven practical outcomes

In spite of PES dissemination in the global environmental policy agenda, with an increasing uptake as a means to promote forest conservation in tropical and sub-tropical countries, PES remains a contested concept. Wunder's 2005 seminal definition has been criticised by many and adjusted to fit local interests, demands and pre-existing institutions (e.g., Kolinjivadi & Hecken, 2017; Shapiro-Garza, 2013), or to respond to practitioners' and academics' criticisms of it being too narrow, too market-oriented, or too hard to implement in the field (see Wunder, 2015 and Sattler & Matzdorf, 2013 for reviews of PES definitions). Moreover, Wunder himself identifies more than nine different PES definitions in a recent review (Wunder 2015). In fact, very few PES schemes around the world adhere to Wunder's canonical PES definition (2005), with PES involving upstream water providers and downstream urban beneficiaries, with such schemes perhaps being the most closely related to such a definition (e.g., Borda et al., 2010). Regardless of how much PES adheres to or differs from this definition, it is evident that the way in which relevant actors conceptualise PES will affect their design, implementation, and outcomes (see Chapter Three for further discussion of this issue).

PES is not only a contested concept; its emergence and implementation has also raised several concerns among PES scholars and practitioners. It has been argued that PES can erode social capital between participants and non-participants in the same community (Lee & Mahanty, 2009); that PES represents a form of neoliberal conservation (Fletcher & Buscher, 2017; Hecken et al., 2017) and an ultimate step towards the commodification of nature (Kosoy & Corbera, 2010); that PES could be co-opted by powerful actors to gain control over natural resources (Jean Carlo Rodríguez-de-Francisco, Budds, & Boelens, 2013); that PES can crowd out pro-environmental motivations (Ezzine-de-blas,

Corbera, & Lapeyre, 2019); and that PES may raise equity concerns due to the risk of elite capture and the uneven distribution of benefits (Muradian et al., 2010; Pascual, Muradian, Rodríguez, & Duraiappah, 2010; Sommerville, Jones, Rahajaharison, & Milner-Gulland, 2010). The extent to which many of these criticisms becomes tangible will depend on PES conceptualisation, design and implementation.

2.4. PES discourses and conceptualizations

Discourses, in the broader sense, are a "shared way of apprehending the world", which construct meanings and relationships, "helping to define common sense and legitimate knowledge" (Dryzek, 2005:9). Discourses have different characteristics: they exist and are not true or false; they are historical constructs, and not objective givens; they are very stable and do not change overnight; and they are heterogeneous and not the product of a single author or single source (Hajer, 2006).

Environmental discourses frame the understanding and conception of environmental problems (e.g., deforestation, climate change) and related solutions (e.g., PES, REDD+). Literature on environmental discourses has focused on identifying global discourses (Appelstrand et al., 2010; Arts & Buizer, 2009; Dryzek, 2005), and understanding their impact on environmental governance and practice (Leipold, 2014). PES discourses are a sub-set of environmental discourses that reflect how environmental problems are framed or perceived and the role of incentives to tackle such problems. PES discourses underpin the design and implementation of PES schemes. Identifying PES discourses is important in revealing the assumptions behind practices that might be favouring particular interests or dominant positions.

PES discourses, just like any other sub-set of discourses, are likely to be pluralistic and two analytical fields can be generally distinguished in current scholarship. The first group of studies has analysed PES discourses, and its underlying assumptions, as part of a broader market-oriented discourse in conservation thinking and practice (e.g., Blanchard et al., 2016; Fisher & Brown, 2014; Sandbrook et al., 2013). The second group has analysed them in a country-specific implementation context (de Koning et al., 2011; Fletcher & Breitling, 2012; Hecken & Bastiaensen, 2010; McAfee & Shapiro, 2010). In general, both fields of study have shown that PES, and incentive-based conservation initiatives more generally, are usually appropriated by relevant local actors to fit their interests and demands, and that a pro-market thinking prevails among conservation professionals and scholars.

In Chapter Three, I contribute to these debates by identifying the key constitutive assumptions about PES discourses (as the first group of studies) at country level (the second group). Chapter Three maps out, for the first time, PES discourses in Colombia and advances the research frontier in environmental discourse analysis by revealing the premises and beliefs that underlie the present debates and implementation of PES in Colombia.

2.5. Self-determination theory and motivation crowding

The Self-determination theory (SDT) is a theory of human motivation developed by Richard Ryan and Edward Deci (2000). SDT proposes that human motivation should be understood as a continuum between two extremes: intrinsic motivation and a-motivation. A person is *intrinsically motivated* to perform a task when such task is inherently interesting or enjoyable, while a person is *a-motivated* when she lacks an intention to act. In between, there are four types of *extrinsic* motivations (i.e. external regulation,

introjection, identification and integration) that refer to doing something driven by external reasons (e.g., fear of punishment, avoiding the feeling of guilt or regret) or doing something because it leads to a separable outcome (e.g., money, reputation). These extrinsic motivations vary in their degree of *autonomy* (the individual's experience of choice) and *internalization* of external regulations by the individual's values and attitudes.

SDT theory posits that the process of moving away from or towards intrinsic motivation is determined by the interaction between the external incentives introduced and three psychological moderators (autonomy, feelings of competence, and relatedness). Any incentive, including PES, that undermines an individual's autonomy, perceived confidence in reaching a goal, or her sense of belongingness to a community or social group is expected to crowd-out motivations, moving the individual towards the *a-motivation* extreme, driven for example by feelings of control aversion or frustration. In contrast, any incentive that supports or reinforces these psychological mechanisms is expected to do the opposite or crowd-in motivations (Ezzine-de-Blas et al., 2019; Rode et al., 2015).

Environmental science and policy is increasingly interested in understanding whether conservation initiatives that use direct economic incentives to promote pro-environmental behaviours can unwillingly result in a motivation crowding out (MCO) effect. MCO refers to the reduction of intrinsic forms of motivations as a result of the introduction of an external incentive like PES. Motivation crowding in (MCI) in contrast refers to the reinforcement of pre-existing intrinsic motivations to conduct a task when an incentive is given to do so.

A review of eighteen articles in environmental policy instruments shows that motivational crowding out (MCO) is more frequently reported than motivational crowding in (MCI) (Rode et al., 2015). In the context of PES, a review of seven experimental economics and quasi-experimental studies measuring MCO shows that the majority of the studies report that there is no evidence of the motivation crowding effect in either direction, and second, among those studies that report an effect, MCO is more frequently reported than MCI (Moros, Vélez, & Corbera, 2019). Further, a recent special issue on behavioural and motivational responses to economic incentives for conservation compiles seven articles that show that motivation crowding in and motivation crowding out can co-exist and that these effects are contingent upon PES design, and on the participants' personal and interpersonal contexts (Ezzine-de-blas et al., 2019).

In Chapters Four, Five and Six, I contribute to gain a deeper and better understanding of the relationship between PES and pro-environmental motivations in several ways. From a methodological standpoint, I designed a new, simple, and comprehensive instrument to measure pro-environmental motivations that can be easily replicated in other PES implementation contexts (see Section 2.9). I applied this instrument in the context of an active deforestation frontier and found that motivations explain differences in deforestation behaviours (Chapter Six). Further, I made use of this instrument to explore the potential relationship between different types of payments and motivation crowding and concluded that collective PES might reinforce (crowd-in) social-related types of motivations (Chapter Five).

2.6. Case study and multi-sited research

A case study approach is characterized by an in-depth exploration of the subject of study in its context (Newing, 2011). As one type of observational research, namely, the type of research that involves observation rather than intervention, a case study design involves "detailed data collection about a single case or situation" (Newing, 2011:46). Case studies provide rich and in-depth information about a particular situation and when conducted with rigour can provide information beyond the actual case that is studied (Hodkinson & Hodkinson, 2001). A case study approach can be used to accomplish several objectives: from generating and testing theories to describing unique, unexpected or unusual situations, or establishing the mechanisms behind causal relationships (Eisenhardt, 1989; Hodkinson & Hodkinson, 2001). The main criterion for case study selection is the relevance of the case for the research objective. The researcher can opt for an average case of a specific phenomenon (typical case study), or for an extreme case where a phenomenon is only seen under specific or extreme circumstances (outlier case study) (Mills, Durepos, & Wiebe, 2010).

In this dissertation, I selected Colombia as a case study country of focus for personal and academic interests. On the one hand, I aimed to contribute to the understanding and practice of PES in the country in which I was born. On the other, Colombia has at least three special features that make it a relevant case study: first, it is the second most biodiverse country in the world after Brazil, and along with Mexico, has the highest increase in rates of deforestation in Latin America (Armenteras, Espelta, Rodríguez, & Retana, 2017). Second, environmental policy in Colombia is decentralized which means that unlike other countries like Costa Rica, Ecuador or México, Colombia does not have a national PES programme but rather several dispersed initiatives. Notwithstanding, Colombia has developed a PES law (Law No. 870, 2017) that is aimed at providing the

legal framework for publicly-funded PES initiatives across the country. Third, Colombia's PES law has one particularity which is linked to the historic context of the country: the law was issued as part of a group of laws that contribute to territorial peace-building in a post-conflict context, following the 2016 Peace Accord with the FARC guerrilla after five decades of armed conflict. The PES law notes that every publicly-funded PES must target conflict-ridden municipalities or areas where illicit crops are grown (Law No. 870, 2017, chapter II, Art. 8). These characteristics make Colombia both a typical and an extreme case study The country shares many features with other countries in the tropics with similar patterns of deforestation and has several PES schemes under implementation, but it is unique in terms of the historical moment in which the national PES legislation has come into existence and the particular linkage of the latter and some of the already ongoing PES initiatives with peace-building efforts.

The fact that the Colombian PES experience is decentralized makes it more relevant to conduct multi-sited research, since it becomes possible to capture regional specificities. In Chapter Three, I identify the discourses underlying the implementation of PES in Colombia from a discourse analysis relating to four Colombian cities. These cities were selected based on their relevance and convenience for identifying different understandings of PES by relevant actors spread throughout the country. Bogotá is the capital city of Colombia and hosts the national government, several national and international operating PES agencies, and representatives of civil society groups and ethnic organizations. Cali is located in south-west Colombia and is a hub of PES initiatives with more than seven active programmes. Medellín is the second main city in Colombia and hosts the largest PES scheme in the country: Banco2. And Buenaventura is located in the pacific coast and is the geographical node that connects afro-Colombian communities across the Colombian pacific region. The PES discourses identified in

Colombia provide evidence that contributes to understanding the permeation of PES thinking in global environmental policy and practice.

The selection of Cundinamarca's sub-national PES scheme for Chapter Four was based on its policy relevance: the "Yo protejo, agua para todos" (YPAT) programme is the first publicly-funded PES scheme in Colombia, financed through regional government budgets. This scheme underwent several design changes since its emergence in 2015 and therefore provided a relevant case study to document what drives institutional changes in PES. Additionally, Cundinamarca's biophysical characteristics were another factor that made this an interesting case to analyse. Cundinamarca is a highly deforested department[1]: only 0.1% of its total surface is still covered by forests (IDEAM, 2018), and it is home to the largest Paramo ecosystem in the world, Sumapaz, which is critical for the provision of water to over 7 million people in the neighbouring Department of Bogotá. Single-crop potato farming in the highlands, extensive cattle ranching, and high-altitude mining have resulted in increasing threats for water provision in the department. The analysis of YPAT provide insights for the future design and implementation of this and other publicly-funded PES programmes where reforestation and ecological connectivity are crucial, either in Colombia or beyond.

El Caraño, located within the Amazon piedmont, is the case study for Chapters Five and Six, and it offers a completely opposite perspective compared to Cundinamarca. This territory is part of the Amazon foothills in Caquetá, a region that links the Andes with the Amazon basin, a key biodiversity ecotone and an area with a high risk and rates of deforestation (IDEAM, 2018). Seventy-four per cent of the territory of the villages that

[1] A department is an administrative and political sub-national organizing unit. Colombia is made up of thirty-two departments which in turn are made up of several municipalities. Each department has its own Governor (*Gobernador*) who acts as the maximum authority within its jurisdiction and is elected by popular vote.

were part of this study is still forested with primary forests (Vélez et al., 2016). Because of its crucial role in armed conflict, Caquetá is an epicentre for post-conflict interventions aimed at territorial peacebuilding and the implementation of productive projects to substitute illegal coca crops plantations. Hence, it is expected for many PES programmes to start operating in this area. The lessons of this case study are relevant for colonization frontiers in the Latin American tropics, where deforestation is mainly driven by agriculture and cattle ranching and where PES alone might not be sufficient to tackle the pervasive threats to forest conservation.

Table 2.1. Summary of data collection methods and sample size

Chapter No. and Question	**Main data collection method**	**Participants**
Ch. 3 – How is PES conceptualized in Colombia?	Q-methodology	41 interviews with relevant actors involved in Colombia's PES debates and implemented schemes (Bogotá, Medellín, Cali, Buenaventura)
Ch. 4 - What drives institutional change in PES?	Semi-structured interviews and survey	14 interviews with actors directly or indirectly involved in the YPAT programme and 203 surveys to former and non-participants of YPAT in Cundinamarca
Ch. 5 What is the relationship between types of PES and motivation crowding?	Economic experiment and survey	257 farmers on an agricultural frontier in the Amazon Piedmont
Ch. 6 What is the relationship between deforestation and pro-environmental motivations?	Survey	64 farmers on an agricultural frontier in the Amazon Piedmont

2.7. Q-methodology for the study of PES discourses

Chapter Three of this thesis identifies the PES discourses that underlie PES implementation in Colombia. Q-methodology was first proposed by (Stephenson, 1935) a British physicist-psychologist, as a method for the systematic study of human subjectivities; i.e., how people conceive and communicate their points of view, opinions or perceptions. Q-methodology was initially used in psychology, then in political science (Brown, 1980), and later in other fields including environmental sciences and management (Zabala, Sandbrook, & Mukherjee, 2018). Q-methodology has been increasingly used in conservation research and environmental studies for different purposes: to ascertain management options, to reflect upon the values underpinning conservation practice and research, to appraise current or prospective policy acceptability and to mediate conflicts by revealing opposing views in precise terms, in order to facilitate stakeholders' dialogue (for a review see Zabala et al., 2018).

I choose Q-methodology to explore PES discourses, a sub-set of environmental discourses, in Colombia because the method combines the qualitative and quantitative paradigms of research: it assumes that reality is socially-constructed but that subjectivities "can be submitted to analysis to reveal their structural features through statistical analysis" (Brown, 2018:3). Q-methodology also overcomes one common shortcoming of qualitative discourse analysis: the confirmatory bias or taking from the data information that confirms previous beliefs or hypotheses (Leipold, 2014; Widdowson, 1998).

Q-methodology involves several steps. First, one should define the *q-concourse;* i.e., the set of statements that capture the complexity of the topic being studied. Most commonly, these statements are selected based on interviews to relevant stakeholders. However, as shown in Chapter Three, this dissertation develops a new approach to the selection of

such statements which combines an algorithm with a literature review. The algorithm underpins an automated web-search process that captured any mention about PES within social media accounts of relevant stakeholders in Colombia and we complemented this search with a content review of the 100 most cited papers on PES, published until March 2018.

Second, the Q-concourse needs to be reduced by removing redundant statements, in order to reach a manageable Q-set, i.e., the statements to be organised by the participants (Watts & Stenner, 2005). In order to do so, I developed a 4-step procedure. First, each of the 154 statements captured from social media accounts was categorised into one of eight broad categories by employing a multiple coding procedure (Flick 2007) in which three people, independently and without communicating with each other, coded each statement from the q-concourse into pre-defined codes. Second, the lead author alone proceeded to categorise each of the 79 statements from the literature review, in order to reach a balanced final Q-set. Third, and once we had all the statements distributed across the eight categories, we selected those which were more intelligible whilst making sure that each category mentioned above would be represented in the final Q-set. Finally, I piloted the Q-set with 18 graduate students from the environmental economics class taught by one of the supervisors at Universidad de Los Andes (Colombia).

In Q-methodology studies, the selection of participants does not need to be large or representative of a wider population (Brown, 1980). Therefore, in this research, I followed a purposive heterogeneity sampling (a sub-set of purposive sampling), to include all possible opinions and views on PES in Colombia regardless of their proportionality in a wider population (Trochim & Donnelly, 2008). I also used the

snowball technique, a type of sampling in which existing participants recommend future subjects among their acquaintances that meet pre-defined criteria (ibid).

Before asking participants to rank the statements as noted above, an informed consent form was read out loud to guarantee the voluntary participation of subjects and that they understood the purpose of this study. This step of q-sorting is conceived as a "mini-experiment" in which statements work as stimuli to elicit participants' opinions and points of view (Brown, 1980: 195). The resulting q-sort from each participant is then analysed using Principal Component Analysis (PCA) and varimax rotations to identify natural clusters of Q-sorts that are similar or dissimilar to one another (see Chapter Three for further details).

2.8. Semi-structured interviews to assess PES institutional changes

In Chapter Four, I document the underlying logic of changes in eligibility criteria, type of payment, and programme implementing agencies of the YPAT PES programme. To discover such logic, I developed a semi-structured interview, as well as a survey applied across participants (see next section).

Interviews are one of the most commonly used methods in social research since its emergence in the XIX century (Lewis-Beck et al. 2004). Interviews require a conversation between the interviewer and the respondent and interviews are highly recommended to understand respondents' subjective views or to gain expert knowledge on a particular topic (Flick, von Kardoff, & Steinke, 2004). Interviews are part of the qualitative paradigm of research and assume that reality is socially constructed through the interaction between the researcher and respondent (Mason,1996). There are different

types of interviews that vary in terms of the amount of control the researcher exercises over participants responses (Bernard, 2006). The semi-structured interview uses an interview guide, which is a written list of topics that needs to be covered more or less in order. As such, this type of interview is ideal for "high-level bureaucrats or elite members of a community who are accustomed to efficient use of their time" (Bernard, 2006: 212) because its use demonstrates that the researcher is fully in control of the situation but leaves enough room to follow up on new and unexpected topics (Bernard, 2006).

I designed a semi-structured interview to gain insights into the drivers of YPAT programme and the changes to the programme over time. The interview guide had three blocks of questions each one relating to a particular dimension of the programme based on Corbera et al., (2008): the reasons for the creation of the programme, the actors that shaped its final design, and a preliminary evaluation of the scheme's performance (See Chapter Four for details). The interview took about one hour and an informed consent form, which contained the projects' objective and the data use policy, was read out loud to guarantee that participants had all necessary information to voluntarily participate in the interview. Participants were selected using a combination of purposive and snowball sampling, actively looking for relevant actors who were involved in the programme's creation and implementation. Interviews were recorded and transcribed, not literally but according to the different dimensions of programme design and implementation. Transcriptions served as a basis for re-constructing the programme's history, which is one of the contributions of this chapter.

2.9. Surveys to analyse pro-environmental motivations

Chapter Four, Five, and Six rely totally or partially on the administration of a survey to address the corresponding research questions. Surveys are perhaps the most common data collection method in the quantitative paradigm of research (Bryman, 2008). Surveys, in contrast to interviews, sacrifice richness in detail to gain efficiency in variations in data (Robson, 1993). Surveys need to be standardized to reduce researchers' bias and help in the inference process. The questions asked through surveys must attempt to capture the underlying construct that they are trying to measure. If these conditions are met, it is possible to look for correlations between variables and also test causal hypotheses.

For Chapters Four, Five and Six, I first piloted 24 items or statements that conceptually capture five different types of motivations for forest protection based on Self-Determination Theory (SDT): intrinsic, guilt, social, extrinsic motivations, and lack of motivation (see Chapter One, Section 1.4). The survey was anchored to forest protection and not to other pro-environmental behaviour because this is a good proxy of broader ecosystem services provision. To determine the validity of the construct and to reduce the dimensionality of the data, I used factor analysis. Construct validity refers to the extent to which the research instrument does actually measure what it is supposed to measure, in this case motivations to protect forests. Factor analysis is a statistical method that describes the variability between observed and correlated variables in terms of a smaller number of unobserved variables, or *factors.* The factor analysis of the 24 items revealed that nine items had a factor loading of above 0.55 as suggested by Hair et al. (2009) and were thus included in the final survey (Table 2.2).

The final survey used a four-point Likert scale to capture variations in the motivations to protect forests. The scale was symmetrical, ranging from 1 (totally disagree) to 4 (totally agree), and did not have a central point with the aim of forcing respondents to go in one

direction or another and eliminate the risk of neutral responses (Lozano, García-Cueto, & Muñiz, 2008). The Likert scale is perhaps one of the most commonly used scales in research (Bernard, 2006) and it is used to measure unidimensional constructs or concepts (Trochim & Donnelly, 2008). Finally, the surveys also captured socio-demographic information on gender, income, education level and the economic activities of the participant, as well as information related to forest management at either individual or collective level (See Chapter Five for details).

It is important to point out that the motivations survey was adjusted over time as a result of its first application in 2016 (See Table 2.2). In particular, the statement: "I see myself as someone who does not clear forests" was not included in Chapter Four because it was correlated[2] to the other intrinsic statement: "I like to avoid clearing forests" and the latter better captured the intrinsic motives behind forest preservation. Second, the wording for the intrinsic statement "I like to avoid clearing forests" was later changed to "I enjoy taking care of forests" because it was proven to be easier to understand while preserving its original meaning. Third, a new dimension of pro-environmental motivation was added to the set of questions for Chapter Four: "I feel proud of myself when I take care of forests". This dimension was not included in the first versions of the survey but it is crucial to understand whether pleasant feelings that arise from a positive self-evaluation (Lewis, Takai-Kawakami, Kawakami, & Sullivan, 2010) are important for forest preservation. Fourth, the a-motivation item that was initially included in the set of motivations questions was not asked for Chapters Four and Five because participants were not understanding the statements related to this dimension. In Chapter Six, I decided to explore this dimension further and found a positive correlation between lacking

[2] Correlation coefficient =0.26 (p-value=0.0000) for Chapter Five, and 0.36 (p-value= 0.0027) for Chapter Six.

motivation to preserve the forest and self-reported deforestation (See Chapter Seven for more details). These adjustments over time are not completely ideal from a methodological standpoint because they limit the number of comparisons that can be made across survey versions. However, testing out different versions of the survey allowed me to reach a satisfactory and robust set of statements that can be replicated in further studies.

Table 2.2: Description of the survey of motivations and the corresponding statements

Motivation type	**Survey statements**	**Included in Chapter #**
Intrinsic	"I enjoy taking care of forests"	4,5,6
	"I see myself as someone who does not clear forests"	5,6
Guilt or regret	"I would feel guilty if I were to clear forests"	4,5,6
	"I would regret it if I were to clear forests"	4,5,6
Pride	"I feel proud of myself for taking care of forests"	4
Social	"I would be criticized by my neighbours, if I were to clear forests"	4,5,6
	"Significant others would be upset if I were to clear forests"	4,5,6
Extrinsic-payments	"I would take care of forests only if I am paid to do so"	4,5,6
Extrinsic-fines	"I do not cut down the forests because I am afraid of being fined by environmental authorities"	4,5,6
A-motivation	"I do not see what I can get out of protecting forests. There is no point in doing so."	6

2.10. Economic experiments to test different types of payments in motivations

Chapter Six of this dissertation explores the relationship between different types of PES and motivation crowding using an economic experiment and the motivations survey explained above. Economic experiments are an established research method that "uses controlled human experiments to answer research and policy questions" (Croson, 2002). Economic experiments aim to reveal social behaviours and preferences and test the effects of different conditions on behaviour. Individuals participate in decision making exercises under a protocol or rules of the game and they are paid in cash for their decisions in order for them to realistically account for the costs for these decisions. Participant earnings depend on their decisions and are not just for participating, which is critical for theory testing (Croson, 2005; Friedman & Sunder, 1994).

Ideally, in methodological terms, I would have had to pursue a Randomized Control Trial (RCT) to test the effects of different types of payments on participants' motivations and behaviours. RCTs are a policy evaluation method that randomly assigns participants to treatment and control groups. Given this random assignment, the effect of the treatment is calculated by observing the differences in outcome variables between the two groups (Heckman & Smith, 1995). RCTs are considered to be the gold standard to establish causality in policy evaluation because they reduce selection bias and they require fewer assumptions than other methods.

However, conducting an RCT was not possible because it requires close work with PES operators and for the researchers' and operators' agendas to be coordinated in time. RCTs also raise ethical concerns because randomization of the treatment implies "denying some people access to a well-established intervention, even if its effectiveness is unproven" (Sefton et al., 2002: 59). This issue is more relevant in the public health sector and less

crucial when testing the effect of conditional subsidies or payments such as PES. In the health sector an RCT would imply denying the control group a medical treatment or immunization (Banerjee, Duflo, Glennerster, & Kothari, 2010). To this criticism, some argue that it is even more unethical to not test the effectiveness of a programme because there may be cases in which an intervention is not only ineffective but also harmful (Haynes, Service, Goldacre, & David, 2012). In the case of conditional cash transfers and PES, this concern becomes less crucial because the treatment (the payment) is not directly related to saving lives. However, it is also true that, in some contexts of extreme or acute poverty, denying payments to some over others can also be ethically controversial, as well as politically and socially unacceptable.

Given the challenges exposed above, and the risks entailed in developing an RCT, I considered an economic experiment the best approach to exploring motivation crowding given time and operational constraints. Economic experiments can establish causality, test general theories, establish empirical regularities, and inform the design of policies, incentives or regulations (Harrison, List, Harrisson, & List, 2004). Lab-in-the-field framed field experiments (FFE), or experiments with subjects for whom the dilemma that is being recreated is relevant for their daily lives, and which incorporate some form of context about the problem recreated, are the option that maximizes both internal and external validity (Harrison et al., 2004). External validity here, refers to the extent to which the results of the study would hold for other contexts and participants. Internal validity is a relevant criterion for studies trying to establish causal relationships. Internal validity refers to the extent to which observed changes can be attributed to the intervention implemented by the researcher (Trochim & Donnelly, 2008).

The forest conservation FFE presented in Chapter Six recreates a situation in which there is tension between agriculture and conservation, as is often the case in many agricultural

frontiers around the world. In the experiment, water is provided only if the group accomplishes a specific environmental objective (threshold). The threshold aims to simulate real-life situations in which the provision of an ecosystem service (water in our case) is conditional on collective performance (conservation of the forest). Also, the payment to farmers is made only if the group complies with the threshold, a rule that simulates the conditionality feature of PES. The forest conservation experiment is structured in two stages: the baseline stage (rounds 1-5) and the payment stage (rounds 6-10). The difference between the two stages lies in the introduction of a conservation payment in the second stage. Chapter Five introduces three types of PES: individual, collective and a price-premium, and one treatment allows participants to vote on their preferred type of payment (See Chapter Five for details).

2.11. Research ethics, positionality and limitations

This research was conducted in compliance with ethics guidelines at *Universidad de los Andes* (UdeA) and *Universitat Autònoma de Barcelona* (UAB). Overall, these guidelines included considerations over participants' well-being, anonymity, and data storage to minimize psychological, physical and moral risks. Additionally, I adopted the Belmont's Report ethical principles and guidelines for research involving human subjects, namely: respect, beneficence, and justice (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). *Respect* for participants involves treating people as autonomous agents and that people with diminished autonomy should be especially protected. *Beneficence* refers to the rules of (1) do no harm, and (2) maximize benefits and minimize possible harm. *Justice*, in turn, refers to considerations about who receives the benefits of the research and who gets the burdens.

With these principles in mind, an informed consent (Appendixes 5,6 and 10) was read out loud prior to conducting any research method to ensure that individuals were voluntarily participating in the research, acknowledging the relevant risks and benefits. Although this research does not involve the disclosure of sensitive information, all responses were anonymously recorded and stored on my computer with exclusive access to protect participants' identity and confidentiality. Along these lines, in Chapters Three and Four, I explicitly avoided mentioning the participants' names and positions to maintain anonymity. The informed consent included an explanation of the general objective of this thesis, the funding sources, the time it would take to finish the task, the use of the information, the rationale behind the incentives (for the economic experiment) and a contact number for further questions (Appendixes 5,6,10). All quantitative data is available for verification (following the replicability principle in quantitative research) in Mendeley online repository.

I disseminated the results of this dissertation in two events targeting research actors: a policy day in Bogotá to which more than 80 PES practitioners and academics attended (funded through Environment for Development Initiative) and a workshop in Buenaventura targeting the Afro-Colombian community leaders from the country's Pacific region (funded through a small grant given by the UAB's *Fundació Autònoma Solidaria*).

I acknowledge that my "positionality" as a researcher is likely to have influenced my access to participants and the data collection process in general. Positionality refers to the extent to which the observable characteristics of the researcher (e.g., gender, race, class) might influence the data collection and interpretation process (Johnston, Gregory, Pratt, & Watts, 2000). The debate about positionality is directly related to how the researcher is positioned in relation to power and how a politics of position can help transform

unequitable or discriminatory debates (Johnston et al., 2000). As this dissertation involves people who differ in their educational level, wealth, and economic and political power, my position as a Ph.D. candidate, institutionally affiliated to both UdeA and UAB, facilitated access to both high-level interviewees for Chapters Four and Five, and landowners and farmers who participated in surveys and economic experiments for Chapters Six and Seven. My position as a Ph.D. candidate from a foreign university and being affiliated to one of Colombia's most prestigious universities, certainly opened doors to high level participants. All the data gathering was conducted in Spanish; therefore, no language bias is expected to be present in this research. Further, one key aspect to highlight is that research in Colombia is highly limited by security concerns, meaning that I had to obviously consider public order and overall field work conditions (e.g., accessibility) for the selection of study sites. As a woman researcher, I was always accompanied by a research assistant or a co-researcher to mitigate personal risks.

Another relevant issue to reflect on is that of expectations. In my own field work experience, I have usually observed that research participants expect benefits that go well beyond the scope of the research project or the researcher capacity (e.g., bringing possible money or development projects in the future). When this was the case, I opted to avoid raising any false hopes and to be very honest and realistic about my role and capacities as a Ph.D. researcher.

While offering a mixed methods approach to contribute to PES debates in terms of conceptualization and implementation, this thesis has potential limitations regarding the validity of its findings. The quality assessment of any piece of research (either qualitative or quantitative) is generally measured in terms its validity (Bryman, Becker, & Sempik, 2008; Flick, 2009). There are several types of validity, but the three most important types of research design validity are: context validity (to what extent the situation under which

the research is carried out represents real life), internal validity (the extent to which the research design allows to draw conclusions with a high level of theoretical rigour), and external validity (to what extent can the findings be generalized from the larger population) (Newing, 2011).

The findings of this thesis cannot, of course, be easily generalized or transposed to wider populations or applied to every other context. Assessing the external validity of a framed field experiment, for example, requires a comparison of the experimental results to self-reported or observed behaviours in real settings. Still, the findings drawn from areas with high potential for restoration (Cundinamarca) and with a pronounced need for conservation (Caquetá) might provide learnings for other settings facing similar threats. Further, the methods applied in this dissertation, and in particular the Q-method, the motivations survey, and the forest conservation game can be replicated to provide empirical evidence in other PES contexts. In the discussion section of each empirical chapter and in the Conclusions of this dissertation (Chapter Seven), I elaborate on future research avenues that take into account the limitations of each of the methods applied in this thesis.

Chapter Three. Pragmatic Conservation: discourses of Payments for Ecosystem Services in Colombia

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Abstract

Payments for Ecosystem Services (PES) schemes incentivise landowners to maintain, restore or enhance ecosystem services. Currently, there are more than 550 active PES programmes worldwide, expected to support conservation efforts and, ideally, to also reduce rural poverty. In this article we explore the discourses that underpin PES debates and practice in Colombia, a late-comer to the PES agenda in Latin-America. Informed by interviews with PES actors and Q-methodology (n=41), we identify three PES discourses: conservation conduit, contextual conservation, and inconvenient conservation. The narratives diverge in their framing of deforestation processes; their most preferred PES design features; the likely role of payments in changing people's motivations to conserve biodiversity over time; and the potential effectiveness of PES, specifically when the latter aim to contribute to peace-building efforts and reducing illicit crop cultivation. The conservation conduit and contextual discourse are by far the most popular, while the inconvenient conservation narrative is only endorsed by academic actors. This suggests the existence of a broad community which believes PES are a pragmatic conservation strategy and who supports PES because payments can correct the often-uneven distribution of conservation costs and benefits. This overall positive engagement with PES, we argue, may facilitate the increase and upscaling of PES initiatives throughout the country, provided that funding and other supporting social conditions are met.

Keywords: Payments for Ecosystem Services, Q-methodology, discourses, Colombia

3.1. PES as a contested concept

Payments for Ecosystem Services (PES) schemes incentivise landowners to maintain, restore, or enhance ecosystem services (ES). As an increasingly popular environmental policy tool, there are now more than 550 active programmes worldwide that represent USD 36 billion in annual transactions (Salzman et al., 2018). Latin America dominates PES implementation, with the Costa Rican and Mexican national programmes being two of the largest schemes in the world, followed by China's Sloping Land Conversion programme. PES were popularised as they are assumed to have more effective potential than other conservation tools, such as community conservation areas, and they represent an alternative source of income for vulnerable communities in the global South (R Muradian et al., 2013; Pagiola, Arcenas, & Platais, 2005).

In spite of the growing popularity of PES across conservation policy and practice circles, it remains a contested and dynamic concept. In practice, very few PES schemes adhere to Wunder, (2005) canonical PES definition, with PES involving upstream water providers and downstream urban beneficiaries being perhaps those schemes more closely related to such a definition (e.g., Borda et al., 2010). Regardless of how much PES adhere to or differ from this definition, it is evident that the way in which implementing actors conceptualise PES will affect their design and outcomes. For example, funding and implementing agencies more concerned about the environmental additionality of PES schemes than about poverty-related issues might target payments to highly biodiverse ecosystems and disregard the socio-economic conditions of the beneficiary populations. In contrast, if these agencies are interested in reducing poverty, the degree of marginalisation of the beneficiary populations might be a more important criterion for payment targeting than the deforestation risk of nearby ecosystems. In fact, when PES have been conceptualised as a strategy for the recognition of environmental stewardship,

environmental additionality has not been a critical design issue or evaluation criterion (Swallow, Kallesoe, Iftikhar, Noordwijk, & Bracer, 2009). Therefore, trade-offs between design features and the quest for particular objectives in PES implementation reflect how specific paradigms or discourses about deforestation, environmental degradation, poverty, or the role of incentives in motivating specific human behaviours are understood and thus mainstreamed in such implementation.

There has been a call in academia for a deeper understanding of PES conceptualisations, contexts, and power dynamics (van Hecken, Bastiaensen & Windey, 2015; Vatn, 2009 Büscher, 2012; van Hecken & Bastiaensen, 2010; McAfee & Shapiro, 2010). In this article, we respond to such call and contribute to PES debates by disseminating the discursive assumptions and beliefs that underlie contemporary and future PES discussions and programmes in Colombia which, despite the uniqueness of the country, can be found in other similar countries where both the agricultural and urban frontiers are advancing over less altered and more biodiverse ecosystems. Colombia is a late-comer to PES regulation and rather under-researched in terms of PES policy and practice, when compared to other Latin American countries (Muñoz-Piña, Guevara, Torres, & Braña, 2008; Pagiola, 2008). Furthermore, Colombia's environmental policy is decentralised, and therefore PES schemes are or will be led by sub-national authorities operating in different regions. Additionally, PES law in Colombia was issued in the context of the Peace Agreements between the government and the FARC guerrilla, therefore in principle PES are mandated to further peace-building and social justice missions. These characteristics make it even more relevant to understand PES discourses in Colombia after decades of dispersed experiences and advancements in regulations.

Below, we begin with a brief review of the literature on environmental and PES discourses. In Section 3, we present Colombia's PES context and we introduce Q-methodology as our main analytical approach. We highlight two methodological innovations carried out: a web-search algorithm to extract statements from social media, and an additional factor analysis to evaluate the balance of the final set of statements. In Section 4, we distil the three PES discourses identified: PES as conservation conduit, PES as contextual conservation, and PES as inconvenient conservation. These discourses vary in their degree of support of PES as a policy instrument and on the priority assigned to environmental *versus* development goals. The discourses also diverge in terms of which policy mechanisms are envisaged for tackling environmental degradation and deforestation. In Section 5, we discuss the findings and conclude the article, arguing that, in contrast with other studies, the little opposition to PES observed in the discourses might reflect the country's historical momentum; and it might also contribute to ease the further implementation of PES across the country, provided funding opportunities and conducive institutional developments are realised.

3.2. Examining PES discourses

Discourses are a "shared way of apprehending the world", which construct meanings and relationships, "helping to define common sense and legitimate knowledge" (Dryzek, 2005:9). Discourses influence views and realities; which discourses have more influence on reality depends on the power they embody. Dominant discourses are those that comply with two conditions: (1) they are used by many people (discourse structuration) and (2) they solidify or materialize into programs, institutions and organizational practices (discourse institutionalization) (Hajer, 2006). For example, Garrett Hardin's *Tragedy of the commons* (Hardin, 1968) was and still is, in some contexts, a dominant discourse that resulted in a trend of privatisation and nationalisation while ignoring community-based

natural resource management (Agrawal & Gibson, 1999). Plurality in discourses is difficult to discern because sometimes different voices are forced to use the vocabulary of the dominant discourse (Adger, Benjaminsen, Brown, & Svarstad, 2001). Discourses have different characteristics: they exist and are not true or false; they are historical constructs, and not objective givens; they are very stable and do not change overnight; and they are heterogeneous and not the product of a single author or single source (Hajer, 2006). Dominant discourses can change over time as the product of influential actors, groups or coalitions, for example, scientific communities, who can reframe a particular situation (Appelstrand et al., 2010). For instance, The Intergovernmental Panel on Climate Change (IPCC) is an epistemic community, or a network of knowledge-based experts, that has shaped our understanding of climate change and reinforced particular ideas and discourses of its causes and consequences (Corbera, Calvet-mir, Hughes, & Paterson, 2015).

Environmental discourses frame the understanding and conception of environmental problems (e.g., deforestation, climate change) and related solutions (e.g., PES, REDD+). Literature on environmental discourses has focused on identifying global discourses (Appelstrand et al., 2010; Arts & Buizer, 2009; Dryzek, 2005), and understanding their impact on environmental governance and practice (Leipold, 2014). For example, Adger et al. (2001) identify two global environmental discourses that prevail around the issues of desertification, deforestation, climate change and biodiversity use: the global environmental management (GEM) discourse and the populist discourse. The GEM discourse represents a technocratic worldview under which slash and burn farmers are the main cause of the destruction of forests and are depicted as "villains". As such, external solutions like financial payments for the conservation of forests and the adoption of soil conservation practices are encouraged under the GEM discourse. For example, the

Global Environmental Facility is an institution that advocates this discourse. Under the populist discourse, small farmers are presented as "victims" who are pushed to deforest by economic marginalization and trends of commodity consumption (ibid: 687). Solutions to deforestation under the populist discourse come in the form of community-based conservation approaches to forest management. These two discourses are, of course, reductionist perspectives on environmental problems; they do not help *per se* in comprehensively tackling the pervasive environmental problems faced by humanity but make visible the distance between policy-making discourses and resource users' realities (Adger et al., 2001).

PES discourses are a subset of environmental discourses. They reflect shared conceptions about what drives observed changes in ecosystem services flows and their constitutive ecosystems (or land-use change and biodiversity loss more generally), how best to support the conservation and enhanced provision of specific ecosystem services, and specifically which potential payments can have –if any– in doing so. As a result, PES discourses are likely to be pluralistic and two analytical camps can be distinguished in current scholarship. A number of studies have analysed PES discourses as part of a broader market-oriented discourse in conservation thinking and practice, while others have analysed them in a country-specific implementation context.

The first group of studies suggest that discourses on markets and ecosystem services among conservation professionals can be grouped into four broad categories: the enthusiasts, the pragmatics, the realists, and the sceptics (Blanchard et al., 2016; Fisher & Brown, 2014; Sandbrook et al., 2013). Each discourse is founded upon different assumptions on the role of markets in conservation, their potential to benefit local people, and the underlying causes of deforestation or environmental damage, among other

aspects. The enthusiast's discourse gives priority to market arguments for conservation over moral or ethical reasons (Fisher & Brown, 2014), where markets are seen to provide a new large and sustainable source of funding for conservation (Blanchard et al., 2016; Sandbrook et al., 2013). The pragmatic's discourse combines instrumental and intrinsic arguments for the conservation of nature (Sandbrook et al., 2010), and it suggests that PES schemes, for example, are not necessarily ideologically motivated but "worth trying where other approaches have failed" (Waylen et al., 2018:27). The realists' discourse emphasises the role of MBIs on creating incentives for local people and providing livelihood opportunities for the rural poor (Blanchard et al., 2016), whilst the sceptics' discourse is grounded on ideological concerns about markets for conservation and the lack of empirical evidence regarding their actual effectiveness (Blanchard et al., 2016; Sandbrook et al., 2013). This discourse considers that "putting a price on nature detracts from other values, and (…) that conservation organisations should not promote economic valuation or the commodification of nature" (Sandbrook et al., 2013:238).

The second group of studies focus on PES adoption and implementation at the country level. For instance, Fletcher and Breitling (2012) explore how PES implementation in Costa Rica, mainly driven by the State as the buyer, deviated from its initial market-based conceptualisation with minimal involvement of the government. In Mexico, the initial conceptualisation of PES based on economic principles and a strong focus on environmental objectives shifted towards poverty alleviation, in response to the opposition of state representatives and rural social movements (McAfee & Shapiro, 2010). In Nicaragua, van Hecken et al. (2015) tracked the evolution of PES-thinking and found that the majority of PES projects continue to be driven by market-based discourses, despite the Sandinista's more critical public stance on market-driven approaches to conservation. In Ecuador, the national PES programme Socio Bosque incorporated

elements from the discourses of rights of nature and *buen vivir* (a criticism to conventional ideas of economic development) into its conceptualisation and design (de Koning et al., 2011). In Vietnam, the PES national scheme does not follow the orthodox neoliberal conservation approach characterised by "patterns of privatization, retreat of the State and decentralization of management, and commodification of nature" (McElwee, 2012: 413). Instead, the programme reflects the dominant role of the State in PES design and implementation, which also characterises other environmental policy domains in Vietnam. McAfee and Shapiro (2010) demonstrate the existence of four PES discourses in Mexico that range from those that conceive PES as a necessary, purely market-oriented instrument (the conservation efficiency discourse), to those that reject PES on the premise that they represent a complete affirmation of the commodification of nature (the anti-PES discourse). In the middle there is the pro-market pro-poor discourse which de-politicises nature-society relations and considers poverty alleviation to be a benefit of greener capitalism, and the compensation for ecosystem services discourse, which considers that rural communities must be rewarded and recognised for their stewardship efforts.

Our research identifies the key assumptions underlying PES discourses (the first group of studies) at a country level (the second group). By doing so, we expect to advance the understanding of PES discourses, and market-oriented conservation discourses more broadly whilst recognizing the specific context in which discourses take place.

3.3. Analysing PES discourses in Colombia through Q-methodology

3.3.1 Country overview

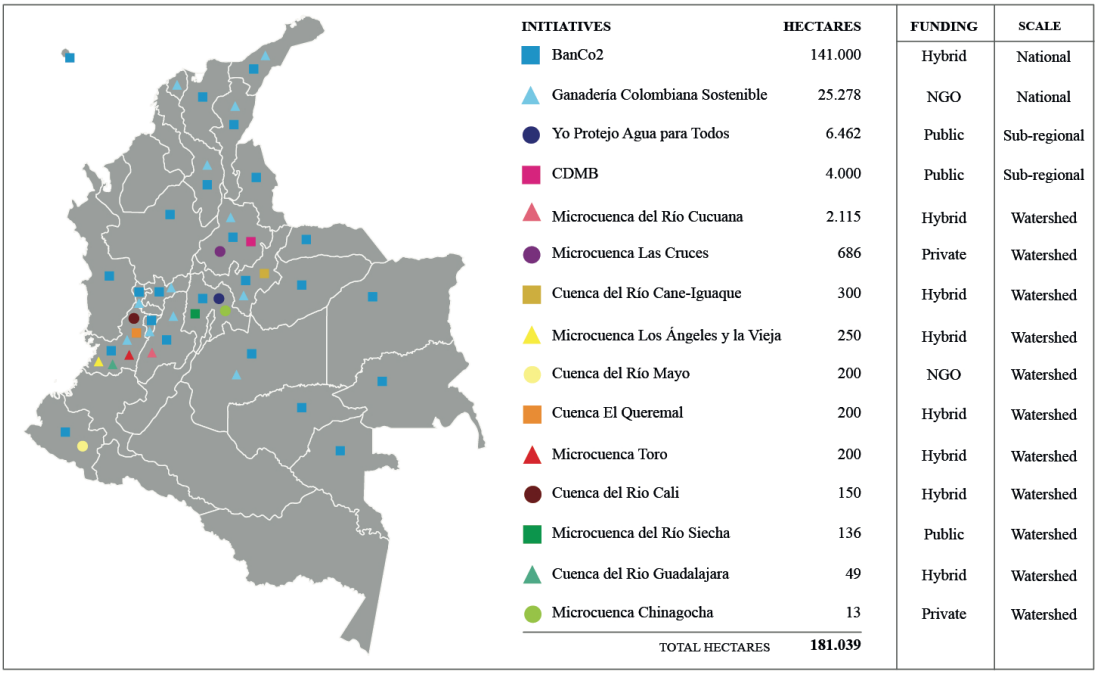
Colombia stands out for its high biodiversity in addition to its high deforestation rates: it is the second most biodiverse country in the world after Brazil, and along with Mexico, has the highest increase in rates of deforestation in Latin America (Armenteras et al., 2017). In Colombia, deforestation increased by 23% between 2016 and 2017, with 219,973 hectares of forest cleared during this period (IDEAM, 2018). Deforestation rates vary across regions and are often explained by a combination of factors that are found elsewhere in the American tropics: low population density, extreme poverty, low income, and the presence of an illicit economy (Armenteras, Cabrera, Rodríguez, & Retana, 2013).

Although many PES programmes have been implemented in Colombia since 2002, as a response to deforestation and ecosystem services degradation, the country is a late-comer to PES regulation in Latin America. The national PES law (Law No. 870, 2017) and the national PES policy document (Departamento Nacional de Planeación -DNP, 2017) were issued in 2017. Taken together, these two documents establish the framework for PES implementation and differ in their scope and nature. The law does not establish a national PES programme but instead lists the requirements for the design and implementation of all publicly-funded programmes, whereas the policy document presents the guidelines for PES implementation across the country, including the roles national and sub-national governments play in that regard.

The fact that PES implementation in Colombia will not be dominated by a single national programme managed by a public institution (such as FONAFIFO in Costa Rica or CONAFOR in Mexico) makes it, on one hand, more diverse, but on the other, harder to compare and establish its overall effectiveness.

Currently, Colombia hosts more than 15 PES programmes covering around 181.000 hectares across the country, with the exception of the Amazon basin where none have been developed (Ministerio de Ambiente y Desarrollo Sostenible, 2018b). Eight of these programmes are hybrid and funded through private-public partnerships, four are publicly funded, and three are funded through donations from private firms or corporate social responsibility initiatives (Figure 1). Most of these PES programmes were launched before the issuing of the national law and thus have not followed the standard implementation requirements which it proposed. They differ in their geographical scale (e.g., national, sub-national, watershed level), design features (e.g., selection criteria for participants, payment amounts, payment mode, and contract length to mention a few), and parameters of success (e.g., number of enrolled hectares, permanence of behavioural changes). For example, the PES programme known as BanCo2 has wide national coverage (141.000 hectares spread across several of the country's departments), is funded through private firms' and citizens' donations and public funds, and pays monthly (USD 100-250 per hectare). Conversely, the PES programme Yo Protejo, Agua Para Todos has a limited sub-national scope (6,000 hectares spread across one single department), is publicly-funded, and pays annually (USD 96-192 per hectare). The national government's goal is to encourage current and new PES implementers to target and enrol at least 1,000,000 hectares by 2030 (0.87% of the country's area).

While private and hybrid schemes in Colombia have the flexibility to establish their own design features, any publicly-funded PES must target conflict-ridden municipalities or areas where illicit crops are grown, since this is mandated by the PES Law (Law No. 870, 2017, chapter II, Art. 8). The rationale behind such mandate is that the law was issued in the context of the Peace Agreements with the FARC guerrilla and it thus had to align with the peace-building process and serve social justice concerns. The law encourages the participation of informal landowners in PES schemes, and among these those who are poorest. Under any public scheme, payments must range between USD106 and USD159 per hectare per year for forest conservation, and USD53 and USD105 per hectare per year for forest restoration. Payments for conservation are higher than those for restoration "to prevent perverse incentives towards a path of deforestation followed by restoration to get the payment" (Rojas, 2018 personal communication). These values are considerably lower than those in Costa Rica but slightly higher than those in Mexico (Muñoz-Piña et al., 2008; Porras et al., 2013). Publicly-funded PES payments in Colombia are set at a very low payment range, which suggests that they are not aimed at covering the opportunity cost of alternative land-use activities, but rather as a complementary income source of income for participating families. The relative effect of such payments on participants' total income will depend on the opportunity costs and underlying governance system of the targeted lands, which obviously vary across the country. BanCo2, for example, is the country's PES initiative with greater impact on participant households' income, since participants receive up to one minimum monthly wage salary (USD 250/month) for conservation related activities.



INITIATIVES	HECTARES	FUNDING	SCALE
BanCo2	141.000	Hybrid	National
Ganadería Colombiana Sostenible	25.278	NGO	National
Yo Protejo Agua para Todos	6.462	Public	Sub-regional
CDMB	4.000	Public	Sub-regional
Microcuenca del Río Cucuana	2.115	Hybrid	Watershed
Microcuenca Las Cruces	686	Private	Watershed
Cuenca del Río Cane-Iguaque	300	Hybrid	Watershed
Microcuenca Los Ángeles y la Vieja	250	Hybrid	Watershed
Cuenca del Río Mayo	200	NGO	Watershed
Cuenca El Queremal	200	Hybrid	Watershed
Microcuenca Toro	200	Hybrid	Watershed
Cuenca del Río Cali	150	Hybrid	Watershed
Microcuenca del Río Siecha	136	Public	Watershed
Cuenca del Río Guadalajara	49	Hybrid	Watershed
Microcuenca Chinagocha	13	Private	Watershed
TOTAL HECTARES	**181.039**		

Source: Own elaboration based on PES official government data (2019)

Figure 1 shows most of the PES initiatives being implemented in Colombia, organised by number of hectares enrolled. Each coloured shape represents a different PES programme. BanCo2 is the largest scheme both in number of hectares and in number of administrative departments (25 of 32). Some geographical regions concentrate several initiatives, such as Valle del Cauca, on the left, which has 7 different PES programmes. The present study acknowledges that other programmes exist, but the mapping here is based on official government data.

3.3.1 Q-methodology: The Q-concourse and the Q-set

Q-methodology has been increasingly used in conservation research and environmental studies for different purposes: to ascertain management options, to critically reflect upon the values underpinning conservation practice and research, to appraise current or prospective policy acceptability and to mediate conflicts by making visible opposing views in precise terms and facilitating dialogue among stakeholders (for a review of these studies see Zabala et al., 2018).

Q-methodology allows for the systematic study of human subjectivities, that is, "how people conceive and communicate their point of view" (Zabala, 2014:164), assuming that only a limited number of distinct viewpoints on a certain topic exist (Brown, 1980). Q-methodology presents statements to participants to elicit their views on a particular topic and the method assists with the understanding of opinions. Q-methodology compares individuals' ranking of opinion statements to identify the underlying structure behind subjective positions (Fisher & Brown, 2014). One of Q-methodology's strengths is that it combines qualitative and quantitative data techniques and analysis (Zabala et al., 2018). It also mitigates one common limitation of discourse analysis: researchers' confirmatory bias, namely, taking from the data information that confirms previous beliefs or hypotheses (Leipold, 2014; Widdowson, 1998). Q-methodology does not require a large set of statements to produce valid results (Watts & Stenner, 2005). All that is required are enough subjects with distinct viewpoints to establish the existence of a discourse or perspective (Brown, 1980: 192).

Q-methodology requires, as a first step, that the Q-concourse or the set of statements that capture the complexity of the topic being studied are defined. In the context of this research, we understand a statement as a clear expression of PES purpose or intentionality; for example, "PES make marginalised communities visible", or "PES are expected to reduce climate change vulnerability". To identify these statements, we followed two novel procedures: 1) we developed a web-search algorithm, or automated search process, with the support of a computer engineering student, to capture every possible mention of PES on the Facebook and Twitter accounts of Colombia's PES actors; and 2) we reviewed the 100 top-cited PES papers found in the scientific repository Scopus.

The web-search algorithm captured complete sentences containing the following key words in Spanish: *pagos por servicios ambientales* (payments for environmental services), *pagos por servicios ecosistémicos* (payments for ecosystem services) and *incentivos a la conservación* (incentives for conservation) on the official Twitter and Facebook accounts of 105 actors relevant to the discussion, design or implementation of PES in Colombia. These three concepts are used interchangeably among Spanish native speakers in reference to PES. The actors were identified based on the local knowledge of two of the authors of this article and they represented all the stakeholders with social media accounts involved in PES debates, policy, and practice in Colombia. However, we acknowledge that actors without a social media account or whose accounts were not active or did not exist during the period of study might be missing. The time span of the search goes back to the date of creation of the account until March 2018. The search yielded a total of 629 captures (260 on Facebook and 369 on Twitter). 176 of the 260 (67.6%) Facebook statements and 299 of the 369 (81%) Twitter statements were manually deleted because they contained public forum invitations, public announcements, were reposted, or did not mention a clear expression of PES purpose. The web-search algorithm thus identified a total of 154 statements related to PES design and/or practice.

The statements automatically collected were, in general, positive about PES. Hence, the algorithm-led web search was complemented with a content review of the most cited 100 articles about PES according to Scopus, in order to achieve a more balanced sample of PES views. The search terms were “payments for ecosystem services” OR “payments for environmental services” in the abstract, title or key words of the article. After reading the abstracts of articles, we excluded 50 from further analysis because these did not mention a clear purpose, objective or conceptualisation of PES. They were in most cases articles

that modelled ecosystem services flows, reviewed other articles, or introduced special issues. An in-depth reading of the 50 selected articles by the lead author permitted to identify 79 statements that referred explicitly to PES objectives.

Overall our Q-concourse encompassed 233 statements: 154 from the web-search algorithm and 79 from the literature. We subsequently reduced it to a manageable Q-set, i.e. the statements to be organised by the participants (Watts & Stenner, 2005), by removing redundant statements. In existing literature, some studies use matrices derived from pre-existing theories on the topic of interest to reduce the Q-concourse, others simply select the statements that seem more pertinent or relevant according to the issue at hand (Exel, 2005), while most fall somewhere in between (Eden et al., 2005).

For this article, we developed a 4-step procedure to reduce the Q-concourse. First, each of the 154 statements captured from social media accounts was related to one of eight broad categories we exclusively created as a heuristic tool to reduce the Q-concourse: (1) rural development and wellbeing, (2) global and local provision of public goods, (3) social (in)justice and equity, (4) conservation actors, (5) post-conflict in Colombia, (6) policy interplays, (7) markets and ecosystems, and (8) society and nature relationships. These categories were developed based on our knowledge of PES debates and experience in PES pilot projects. The lead author and two research assistants from the Universidad de los Andes undertook the task of classifying statements independently and without communication. The assistant's payment varied depending on the level of coincidence between the three coders in the classification of each statement.[3] When there was no

[3] The payment aims to ensure inter-coder reliability (Flick, 2007). The latter refers to the extent "to which two or more independent coders agree on the coding of the content of interest with an application of the same coding scheme" (Lavrakas, 2008:344).

agreement between coders for a given statement, a discussion was held, and a decision made regarding which category the statement belonged to.

Second, the lead author alone proceeded to categorise each of the 79 statements from the literature review, in order to reach a balanced final Q-set (Figure 2).[4] Third, and once we had all the statements distributed across the eight categories, we selected those which were more intelligible whilst making sure that each category mentioned above would be represented in the final Q-set. This was not completely possible given the higher number of statements in the global public goods and social (in)justice and equity categories, which in turn reflected the fact that both public and academic debates about PES had addressed issues related to these categories notably more than others. The final Q-set included 36 statements, which fell within the range of other Q-methodology studies. The Q-set reflected the bias within the PES debate, with 7 statements coming from the global public goods and social (in)justice and equity categories and between 3 and 4 statements from the others. As for data origin, 17 came from the web-search algorithm and 19 from the literature (see Figure 2 and Appendix 1). Finally, we piloted the Q-set with 18 graduate students from the environmental economics class taught by one of the authors at Universidad de Los Andes (Colombia) and, as a result, some minor wording adjustments in a few statements were made to improve participants' understanding.

[4] Please note that this process did not follow the same multiple-coders procedure developed in the first step. This second step was conducted to complement the original set of statements and was carried out after performing the web-search algorithm and performing step 1 above.

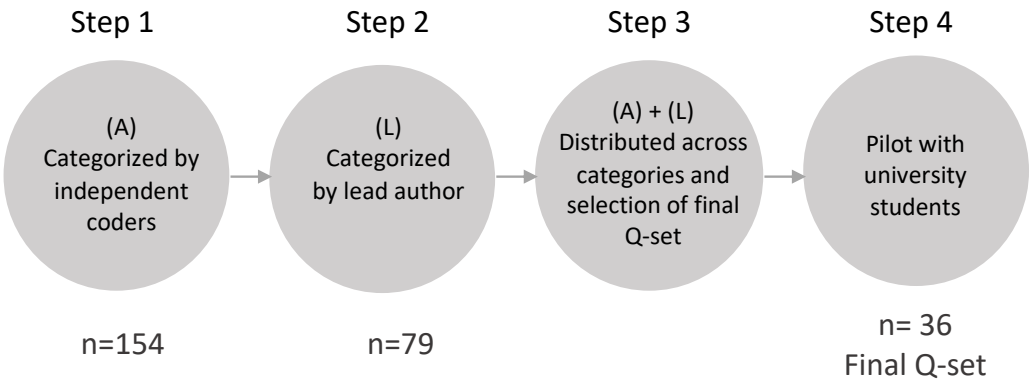


Figure 2: Overview of the Q-concourse reduction process. The first step of reduction consisted in categorizing the algorithm-based statements (A) into the eight broad categories created to this purpose. This process was conducted by three coders. Second, the literature-based statements (A) were categorised by the lead author of this article. Third, the (A) + (L) statements were distributed across the eight categories, and we selected those which were more intelligible to compose the final Q-set. Finally, we pilot tested the final Q-set with university students in Bogotá.

The Q-sorting

The study targeted 41 people involved in the discussion, design or implementation of PES in Colombia. A combination of purposive and snowball sampling was used for participant selection and a diversity of viewpoints and backgrounds was actively sought. Participants were selected based on their knowledge and experience with PES schemes in Colombia. The final sample includes representatives of national and international NGOs, development agencies, ethnic and peasant communities, central and regional environmental authorities, research institutes and universities, independent consultants and public service companies. The sample size falls within the range of other studies in conservation research (typically ranging between 26 to 46 people according to Zabala et

al., 2018). Participants were asked to rank each of the 36 statements along a continuum from strongly agree to strongly disagree using a Q-grid that follows a flattened normal distribution to encourage participants to prioritise statements (Appendix 2).

The interviews were conducted in Spanish and face-to-face by the lead author following a Q-sorting script aimed at providing consistency across Q-sortings. Each Q-sorting took around one hour, and Q-sorts were conducted in the cities of Bogotá, Cali, Buenaventura, and Medellín from April 11th to June 25th, 2018. After a brief explanation of the project and the method, participants were asked to read through all the statements on the cards and, while reading, to divide the cards into three piles: disagree, neutral, and agree. Next, respondents were asked to order the statement cards in the Q-grid supported by the rough order of the piles. Where participants had questions on the meaning or interpretation of a statement, the lead author provided a brief and limited explanation, in effort to not interfere in the process and avoid researcher bias. The lead author conducted post-sorting interviews to understand the participants' interpretation of the statements, in particular, for those placed at the extreme ends of the continuum.

The Q-analysis

The R package "qmethod" developed by Zabala (2014) was used to analyse Q-sorts and reduce responses into a few main groups of perspectives or discourses (named factors in Q-analysis). Principal Component analysis (PCA) and varimax rotations were used to identify clusters of Q-sorts that are similar or dissimilar to one another. Brown's standard requirement (1980: 222) was followed to determine the number of factors and only those factors with i) eigenvalues (variances of the principal components) greater than 1.00, ii) factors that had at least two Q-sorts, and iii) factors that had the greatest amount of

variability explained were selected. Choosing factors is always a trade-off between the lesser number of factors for simplicity purposes and the greatest percentage of variation explained. We tested the model with three, four and five factors. In the five-factor solution, the fifth factors had an eigenvalue greater than one (1.618) but only one Q-sort loaded onto this factor. As for the four-factor solution, even though the three criteria were met, the gain in explanatory variance was marginal (only 4%). In turn, the first three factors represented almost the 60% of the total explanatory variance, a percentage consistent with other Q-studies (e.g.,Albizua & Zografos, 2014; Zabala et al., 2017). Specifically, the first two factors represented almost 50% of the explanatory variance and the third represented 9%. The fourth factor sunk to 4%. This analysis drove us to decide for the three factors solution, since it was the simplest model with the greatest explanatory variance.

Each respondent was then associated to a factor via a Q-factor loading which indicated the relation between each respondent and a factor (known as 'flagging' in Q-methodology). Factor loadings are interpreted similarly to correlation coefficients (Zabala, 2018). Four respondents were not flagged into any factor because they had relatively high loadings in all three factors meaning that they moved across discourses or shared features from more than one PES discourse (Appendix 3). Next, the responses from flagged participants were used to define the content of each discourse. For each statement, the weighted or normalised mean response was calculated (known as 'z-scores' in Q-methodology), resulting in an idealised Q-sort for each discourse. The idealised Q-sort represents "how a hypothetical respondent with 100% loading on that factor would have ordered all the statements of the Q-set" (Exel, 2005:9). To identify differences and similarities between factors, the z-scores for each statement were compared across factors. When this comparison was statistically significant, it meant that

the statement was considered a distinguishing statement, i.e. only relevant and distinctively positioned in the correspondent discourse. If it was not statistically significant, the statement was considered a consensus statement, positioned similarly across factors and thus shared by all discourses.

Further, we performed an additional analysis that is not reported in any previous Q-study: we graphed the factor analysis of statements (Appendix 4). This analysis allowed us to rule-out the common method bias, that is, the case in which the results are driven by the research instrument rather than by the constructs they represent (Campbell & Fiske, 1959). The fact that the graph in Appendix 4 shows that statements project in different directions demonstrate that such statements are balanced and capture different dimensions of PES discourses. We think that such reflected plurality of PES views can be attributed to the combination of the web-search algorithm and the literature review, which enhanced the probability of having a more comprehensive Q-set.

3.4. Results

3.4.1. Identifying and mapping out PES discourses in Colombia

Three PES discourses were identified: conservation conduit, contextual conservation, and inconvenient conservation. Instead of using manual rotation suggested by Brown (1980: 229), when mapping out identified discourses we used the hierarchical clustering method to find an optimal spatial solution. This procedure brings information into a two-dimensional plane to provide the researcher a better analytical perspective (Rokach & Maimon, 2005). Clusters, in this case, are similar to factors, grouped by geometrical distances. To name the dimensions or axes of the factor map we followed an inductive approach according to the underlying structure of discourses as proposed by Brown

(1980:247). The factor map in Figure 3 indicates the location of each participant, into each cluster, based on their geometrical distance with other participants.[5]

As shown in Figure 3, the three discourses identified vary in being either supportive or critical with PES (X axis) and in being either mostly concerned with social or environmental outcomes (Y axis). For example, the figure shows that the conservation conduit discourse falls in the supporters (X axis) and social objectives (Y axis) quadrant. This means that this discourse considers income generation for vulnerable communities the main objective of PES and also supports PES as a conservation tool for different reasons, for example, as it might be more cost-effective than protected areas. The contextual conservation discourse is mostly focused on the environmental objectives of PES (e.g., additionality in forest cover, water quantity and quality, etc.) and it is slightly more critical with PES than discourse 1, since a higher number of actors belonging to this discourse appear in the "critics" area of Figure 3. Finally, the inconvenient conservation discourse is deeply critical, fundamentally grounded on the belief that PES deepens the commodification of nature.

In the following section, we interpret three discourses using the idealised scores of representing statements in parenthesis (Statement#-idealised score). The idealised score represents how the ideal respondent would sort the statements. Distinguishing statements are marked with an asterisk for $P<0.05$ and two asterisks for $P<0.01$. Table 3.1 presents the 36 statements with idealised scores for each of the three discourses and Table 3.2 presents a summary of the discourses.

[5] The mathematical algorithm supporting the clustering is based on k-means. The procedure computes first the hierarchical clustering and cut the tree into k clusters. Secondly, computes the centre of each cluster and thirdly, compute k-means by using the set of cluster centres (identified in step 2) as the initial cluster centres. The use of this method is innovative in Q-studies and resulted in a highly useful procedure for analytical purposes meeting the same purposes and rigor of the rotation.

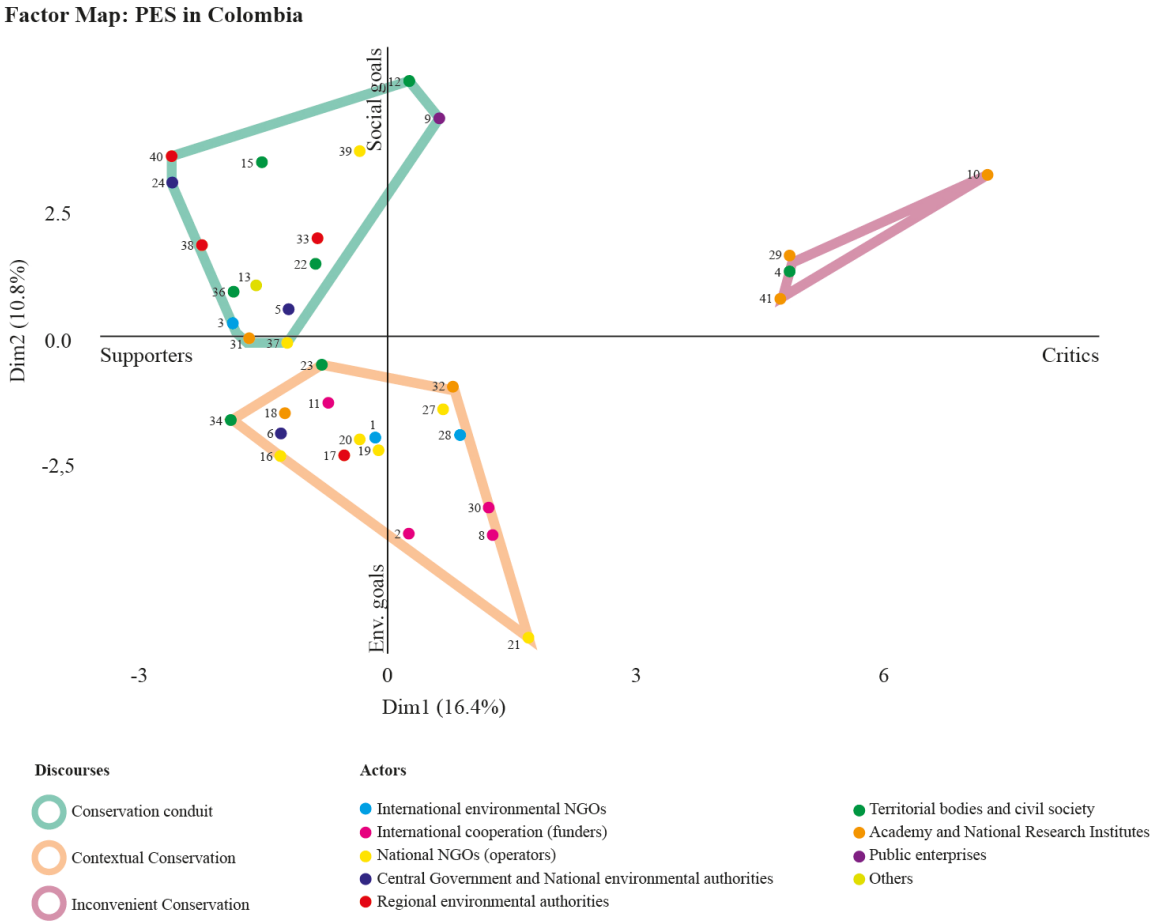


Figure 3. Factor map of PES discourses in Colombia: Each dot represents a flagged participant, and dots nearest to each other make up a factor based on their geometrical distance. PES as conservation conduit is presented in green, PES as contextual conservation in yellow and PES as inconvenient conservation in pink. The X axis represents the PES approach of each discourse (supporters vs. critics). The Y axis represents the PES scope of each discourse (social vs. environmental goals). Each number refers to an actor who represents an organization. This figure includes only flagged participants and participants that loaded to the same factor both in the flagging process and the hierarchical cluster analysis.

Statement	Z-score F1	Factor-score F1	Z-score F2	Factor-score F2	Z-score F3	Factor-score F3
1. "PES contribute to comply with international conservation agreements, such as those adopted by the UNFCCC-COP21"	0.17	0	0.56	1	0.47	1
2. “PES are a tool for the recognition of cultural services provided by indigenous communities"	-0.12	-1	-0.36	-1	-1.91	-3**
3. "PES are an instrument for aligning the interests of landowners/holders and society in general"	0.07	0	0.74	1**	0.08	0
4. "PES surrender the management of ecosystem services to a market model focused on efficiency"	-0.89	-2**	-0.07	0**	1.23	2**
5. "PES are a tool for the conservation of endangered species"	0.1	0	0.1	0	-0.97	-2**
6. "PES are an effective policy instrument because they engage different actors in a broad and inclusive manner"	0.23	0**	-0.39	-1**	-1.55	-3**
7. "PES are an instrument that crowd-out the intrinsic motivations for conservation"	-1.4	-3**	-0.54	-2**	1.38	3**
8. "PES are an instrument that, in seeking to reduce poverty, is limited in its conservation objectives"	-0.81	-2**	-0.12	0	0.27	1
9. *"PES are a mechanism for the reduction of illicit crops"*	-0.45	-1	-0.73	-2	-0.69	-2
10. "PES are a tool for the fight against deforestation and protect strategic ecosystems"	1.3	3	0.93	2	1.02	2
11. "PES are an alternative to command and control instruments that displace peasants from their lands"	-0.63	-1	-0.65	-2	-1.92	-4**
12. "PES create new sources of funding for the protection of ecosystem services"	0.52	1**	1.07	2	1.49	3
13. "PES are a conservation tool that disparages the rights and intrinsic value of nature"	-1.48	-3	-1.58	-3	0.62	2**
14. "PES are an instrument for the commodification of ecosystem functions and goods that have traditionally been public goods"	-1.11	-2	-1.2	-2	1.38	2**
15. "PES are a land-use planning tool"	-0.61	-1	1.87	4**	-0.56	-1
16. "PES are a tool for the construction of territories in peace"	0.62	1*	-0.15	0	-0.2	0
17. “PES are a simpler tool for decision makers as they simplify the impact evaluation "	-0.38	-1*	-1.25	-2**	0.05	0*
18. "PES reconfigure the relationships between human beings and their environment, promoting a relationship that hinges on the exploitation of nature"	-1.06	-2	-1.25	-3	0.53	1**
19. "PES are an effective tool for conservation because they distribute their benefits in a way that is perceived as fair at a local level"	0.75	1**	-0.22	-1	-0.53	-1

Statement (continuation)	Z-score F1	Factor-score F1	Z-score F2	Factor-score F2	Z-score F3	Factor-score F3
20. "PES are a tool for contributing to adaptation to climate change"	0.27	1	0.8	1*	-0.12	0
21."PES contribute to improving the quality and quantity of water"	0.27	1	1.27	3**	-0.14	0
22."PES allow rural communities who care for forests to receive a decent income"	1.52	4**	-0.53	-1	-0.25	-1
23. "PES are a tool for involving peasants in the conservation of natural resources and strategic ecosystems"	1.51	3	1.29	3	0.67	2*
24. "PES recognize the conservation work of peasant, indigenous and Afro-Colombian communities in areas of ecosystemic importance"	1.06	2	0.9	2	-0.26	-1**
25. "PES engage citizens and private companies in conservation"	1	2	0.9	2	0.21	1*
26. *"PES contribute to Integral Agrarian Rural Development, according to the provisions of the Havana agreements"*	-0.24	-1	-0.3	-1	-0.2	0
27. *"PES are an instrument that implicitly recognizes the unequal distribution of the costs and benefits of conservation and therefore transfers resources to those who assume such costs"*	1.16	2	1.06	2	1.58	3
28. "PES take advantage of market forces to achieve more efficient environmental results"	0.03	0	0.54	1	0.4	1
29. "PES are an instrument for rewarding the restoration of ecosystem services"	0.78	1**	0.3	1**	-0.81	-2**
30. "PES are a more cost-effective instrument for conservation compared to command and control instruments"	0.94	2**	0.01	0**	-0.78	-2**
31. "PES are a tool for motivating productive practices consistent with conservation"	0.82	2**	1.74	3**	-0.4	-1**
32. "PES are a tool for depriving poor peasants of their lands"	-2.23	-4	-2.28	-4	-1.58	-3*
33. "PES are bribes paid to the guardians of the territory, contributing to the handover of control of natural resources to more powerful actors"	-2.06	-3	-2.03	-3	-0.9	-2**
34. "PES aim to make it more profitable for rural communities to protect forests than to deplete them"	1.35	3**	-0.36	-1	0.33	1
35. "PES are an instrument of neoliberal policy that introduces market criteria to the management of environmental public goods"	-1.19	-2**	-0.22**	0	2.33	4**
36. *"PES contribute to the reduction of greenhouse gas emissions"*	0.18	0	0.14	1	-0.25	-1

Table 3.1: statements with idealised scores for each discourse. Distinguishing statements are marked with asterisks: (*) denotes significance at 5%, and (**) at 1%. Consensus statements in italics. Source of the statement in brackets (A) for web searching algorithm and (L) for literature.

3.4.2. PES as conservation conduit

This discourse is associated with Factor 1, and it is shared by 15 out of 41 participants, including four representatives of local environmental authorities, two representatives of indigenous and departmental territorial bodies, one representative of Afro-Colombian communities and one of peasant organisations, representatives of two environmental NGOs (one local, one international), one environmental research institute, one representative of a water fund, one water supply and sewerage company, one representative of a water users' association, one scholar from a private university, one leading expert from the IPBES platform, and one central government representative.

This discourse conceives PES as a new income stream that can simultaneously foster economic development and conservation among rural vulnerable communities (S22: +4**). It emphasizes the social objectives of PES, such as the improvement of PES participants' economic status. It is grounded on the belief that "as long as there are poor economic conditions, conservation will never be a priority" (Q-sorter #40). As such, PES should make forest conservation more profitable than deforestation activities (S34: +3**), as rural communities face "a lack of economic opportunities which are the major threat for forests" (Q-sorter #38). Advocates of this discourse also believe that PES can become a mechanism to motivate agricultural eco-friendly practices (S31: +2**) and sustain that the environmental and social objectives of PES should not be regarded as opposite goals (S8: -2**).

Advocates of the conservation conduit discourse support PES for different reasons: they think PES are more cost-efficient than other conservation measures (S30: +2**), they can distribute their benefits in a locally perceived equitable manner (S19: +1**), and they

represent a new source of conservation funding (S12: +1*). This discourse strongly disagrees with those who think that PES can result in social or environmental dispossession (S32: -4), in elite capture (S33: -3), or that payments can undermine nature's intrinsic value over time (S13: -3).

3.4.3. PES as contextual conservation

This discourse is associated with Factor 2, and it is shared by 16 out of 41 participants: eight representatives of national and international NGO operating agencies, two independent consultants, two international non-governmental environmental conservation organisations, two environmental authorities at departmental and national level, one representative of a departmental territorial body, and one representative of Afro-Colombian communities in the country's western Pacific region.

PES in this discourse is understood as a land-use planning tool (S15: +4**) that has two environmental objectives: promoting agricultural eco-friendly practices (S31: +3**)– similar to the previous discourse– and improving water quality and quantity (S21: +3**). The discursive emphasis is placed on the environmental objectives of PES, specifically on environmental additionality (Y axis). Its advocates tend to believe that "the problems of deforestation and environmental degradation arise from poor land use planning and law enforcement" (Q-sorter #16). Within this discourse "PES are a complement to other state policies for land-use management and conservation" (Q-sorter #21), and as such, PES are not regarded as a policy panacea. In fact, the advocates of this discourse acknowledge that the scope and impact of PES are very sensitive to their design and the (local) institutional context. Hence, they do not necessarily consider PES a more cost-

effective instrument than other conservation policy options (S30: 0**), and they do not think that PES will crowd-out intrinsic pro-environmental motivations (S7: -1**).

Finally, the advocates of this discourse do not care if PES fit into the neoliberal conservation paradigm or not (S35: 0*), or if PES forces ecosystem services provision into a market model (S4: 0**). Rather, they are concerned with PES role and contribution to conservation and sustainable land use management as part of a broader portfolio of land-use management policies and tools, regardless of their governance nature, i.e. more or less state- or market-driven.

3.4.4. PES as inconvenient conservation

This discourse is associated with Factor 3 and is represented by only 4 out of 41 respondents; all of them scholars from private and public universities in Bogotá. PES as inconvenient conservation is underpinned by a criticism of PES, which are conceived as a neoliberal tool for conservation (S35: +4**). This discourse argues that PES contribute to the further commodification of nature (the transformation of nature into a tradable object) (S14: +2**), which will over time undermine intrinsic pro-environmental motivations (S7: +3**). PES are thus regarded as a policy instrument that might reconfigure nature-human interactions by promoting an extractive relationship (S18: +1**) which disregards nature's rights and intrinsic value (S13: +2**). However, the advocates of this discourse do not necessarily PES as a platform for land dispossession (S32:-3**), or for an increased control of natural resources by third parties (S33: -2**).

Advocates of this discourse acknowledge that PES have contributed to engage rural communities in conservation efforts (S23: +2**), but warn that such engagement has been

built on and might result in unfair processes and outcomes, respectively. For example, it is argued that "there is great [power] asymmetry among the social actors that are involved in [PES] schemes" (Q-sorter 41), which might jeopardise PES ability involve the most marginalised actors in a broad and inclusive manner (S6: -3**). The four academics who adhere to this discourse challenge the belief that PES can become a way to recognize the cultural services provided by Colombia's indigenous communities (S2: -3**), and they suggest that "we are asking a lot more of PES than they are capable of" (Q-sorter #29). Furthermore, they think that PES might not be effective in conserving key threatened species (S5: -2**), or restoring ecosystems (S29: -2**).

In contrast with discourses 1 and 2, the PES as inconvenient conservation narrative does not conceive PES as a more cost-effective policy option than traditional command and control measures (S30: -2**), such as land purchases (LP). According to an advocate of this discourse, "there is some evidence that land purchases might be more cost-effective, at least, in the short term than PES" (Q-sorter #41). However, the discourse also acknowledges that LP require of a strong institutional framework. This includes legitimate and enforceable property rights and property transaction rules, which might not exist in some countries across the global South, particularly in those where complex systems of both legal and customary tenure co-exist.

Table 3.2 Summary of discourses

	Discourse 1 Conservation conduit	Discourse 2 Contextual conservation	Discourse 3 Inconvenient conservation
No. of participants	17	16	4
Distinctive view	PES connect people, economic development and conservation through the generation of new income sources for vulnerable communities	PES complement other state policies like land-use management and conservation	PES represent a neoliberal and anthropocentric form of conservation
Mechanisms to stop environmental degradation	Improving economic conditions of vulnerable communities	Land-use planning and law enforcement	Establishing a new contract with nature
Conservation and development objectives exclusive?	No, but prioritizes development goals	Perhaps, but prioritizes environmental additionality	YES
PES more cost effective?	YES	NO, per se	NO
Negative effects of PES?	NONE	NONE	Plenty
PES and Motivations	Reinforces motivations Crowding in	Do not negatively affect	Negatively affect Crowding out
Actors represented	Local territorial bodies and environmental authorities	National and international NGOs and PES operating agencies	Academics
% of explained variance	27.6	23.7	7.7
Eigenvalues	11.3	9.7	3.2
Composite Reliability	0.986	0.985	0.941

3.5. PES discourses in Colombia and beyond

This article is the first attempt to map out PES discourses in Colombia. It advances the research frontier in environmental discourse analysis by making visible the assumptions and beliefs that underlie the present debates and implementation of PES in Colombia. The results demonstrate that there are two discourses that are supportive of PES and another that is more critical. Each of these discourses reflect different assumptions about forest loss and degradation, the required solutions, and the role PES should play in this context[6].

The conservation conduit discourse considers PES to be an environmental policy tool that contributes to tackle deforestation by improving the economic conditions of marginalised communities. This discourse is represented mainly by local environmental authorities and representatives of indigenous, Afro-Colombian and peasant organisations. The fact that the indigenous, Afro-Colombian and peasant leaders who participated in our study endorsed this discourse, and support rather than criticise PES on the grounds of the possible additional income that might represent, contrasts with other studies where similar social actors often stand against incentive-based conservation (de Koning et al., 2011). We are not suggesting, however, that such support to PES is shared by other ethnic minority and peasant leaders across the country, since our sample did not reach the great diversity of indigenous and rural collectives existing in Colombia. For example, the Afro-Colombian community of the Yurumanguí river in Valle del Cauca initially refused to

[6] We checked to which coding category belongs the distinguishing statements for each discourse. We found that discourse's 1 and 3 distinguishing statements are part of "markets and ecosystems" category and discourse 2 is part of "policy interplays". This ex-post check suggests that our interpretation of the discourses is coherent since discourses 1 and 3 put an emphasis on markets and ecosystems –but for opposing reasons- while discourse 2 is clearly linked to the integration of different types of conservation and land-use management policies.

participate in the implementation of REDD+ activities led by the NGO Bio-REDD (Consejo Comunitario del Río Yurumanguí, Personal Communication, November 28th 2018).

The conservation conduit discourse, with its underlying assumptions, is perhaps the most commonly reported discourse in the literature. This discourse emphasises the role of PES, and more broadly of market-based conservation tools, in providing new resources for conservation, which is an aspect that is prioritised in the *enthusiast*'s and *realist*'s discourses identified by Blanchard et al., (2016) and Sandbrook et al., (2013). The discourse also resonates with the *populist* discourse identified by Adger and colleagues (2000), which portrays small farmers as victims of economic marginalisation, and with McAfee and Shapiro's (2010) *compensation for ecosystem services* discourse that considers development and environment objectives as complementary and inseparable.

The second most popular discourse found in our study is the contextual conservation discourse. This discourse considers PES as a land-use planning tool and a complement to command-and-control policies. International and national NGOs and PES implementing actors align with this view. Deforestation, under this discourse, is the result of poor law enforcement and unsustainable land-use planning, an aspect shared by the *pragmatist* discourse identified by Fisher et al.(2014). The contextual conservation discourse also prioritises environmental over societal or poverty reduction goals, to be considered a positive side effect of PES rather than an explicit goal, and in doing so the discourse resonates with the PES *conservation-efficiency* discourse identified by McAfee and Shapiro (2010) in Mexico. Seemingly, the discourse's emphasis on top-down land-use planning, and of PES being part of such endeavour, resonate with Adger et al.'s (ibid.) *technocratic* discourse.

Academics are the only social actor embracing the third and only critical discourse in our sample, PES as inconvenient conservation. This discourse considers PES a policy tool at the service of a neoliberal conservation agenda (Fletcher & Buscher, 2017). It shares elements with the *sceptical* discourse (Blanchard et al., 2016; J. A. Fisher & Brown, 2014) which proposes that moral and ethical arguments should be prioritised over instrumental or economic reasons, in order to avoid crowding out pro-environmental motivations. However, the basis for the critical stance of the inconvenient conservation discourse in Colombia are neither the lack of positive evidence in terms of environmental outcomes, as in the *evidence-oriented sceptics*' discourse (Blanchard et al. 2016), nor the risks PES may entail in terms of land dispossession or resource enclosure, as in the *anti-PES* discourse (McAfee, 1999). The fact that this critical discourse is only endorsed by academics reflects that this collective is more acquainted with conceptual debates and emerging evidence from international PES implementation outcomes than it seems to be with PES implementation in the country, which remains generally under-researched. Despite having made an effort to identify additional and critical actors who would like to participate in our study, we acknowledge that other actors in Colombia might also adhere to this critical discourse, among the above-mentioned indigenous and rural collectives but also elsewhere.

Besides identifying PES discourses in Colombia, and highlighting their main commonalities and differences, this article can foster further social collaboration and debate over PES in Colombia, since discourses serve to "sensitize scientists, practitioners and other stakeholders of different mechanisms, assumptions and trade-offs in environmental governance" (Zinngrebe, 2016: 6). For example, the results suggest that there is a low level of consensus across discourses because these only concur in four out of 36 statements. The first consensus statement relates to the role of PES in correcting the

inherent asymmetry in conservation costs and benefits (S27). This idea is the only one that ranked high and positively across the three discourses, which suggests that PES is considered a mechanism to account for the unequal distribution of conservation costs and benefits, a common concern in developing countries where the socio-economic gap between ES providers and beneficiaries is usually very high (Daw, Brown, Rosendo, Pomeroy, & Pomeroy, 2011). Although we do not have empirical data to support these claims, this shared belief might be implicitly assuming that (1) the low provision of ES is a market failure that can be corrected within the present social and economic structures, and (2) that the distributional dimension of social equity matters in PES (Pascual et al., 2014). This idea of PES as correcting the imbalances in conservation costs and benefits is particularly important in creating points of convergence between different discourses and might make PES operationalisation more flexible, sensitive to the contexts in which it is proposed and ultimately, perhaps, more effective.

The other two consensus statements relate directly to the post-conflict context of Colombia, with all discourses acknowledging that PES are *not* alternatives for reducing illicit crops (S9), and that PES are *not* contributing to rural development as emphasised in the Peace Accord with the FARC guerrilla (S26). Such shared beliefs on the limits of PES in a post-conflict context is a unique characteristic of the Colombian case, and a finding that is contrary to the PES law that explicitly links PES to coca cropping mitigation and peace-building efforts. We further suggest that such level of agreement over these statements across the three discourses reflects a general disconformity with the far-stretched ambition of Colombia's PES law to use payments for conservation as a means to tackle illicit cropping and promote peace. However, we are also aware that the PES law was strategically linked to post-conflict and peace-building efforts in order to guarantee itself a faster approval by Congress in the broader context of the Peace

Agreement, which in turn explains its ambitious mandate and therefore unlikely effectiveness in this regard in the future.

The fourth and final consensus statement is related to the potential of PES to reduce or mitigate greenhouse gas emissions (S36). The three discourses are neutral and rather indifferent in this regard perhaps because the role of PES in reducing greenhouse gases from land-use activities is limited due to their potential implementation scale, particularly when compared to REDD+ initiatives or carbon pricing schemes which are almost inexistent in Colombia. We acknowledge that the combined roll-out of several policy instruments to preserve forests and avoid deforestation should be pursued urgently in the coming years, in order to reduce the share of land-use change emissions in the country, which currently account for 36% of the country's total greenhouse gas emissions (IDEAM, PNUD, MADS, DNP, & Cancillería, 2018). In this context, PES schemes supporting forest conservation in collective ethnic territories, which encompass more than 50% of the country's forests, and initiatives restoring large areas of recently deforested and degraded lands are more likely to have a higher climate change mitigation impact than private small-scale initiatives, which currently dominate PES implementation throughout the country. BanCo2 is the only PES program that involves large collective territories, but its environmental effectiveness is still a matter of controversy among PES practitioners.

The increasing appeal of PES as a policy tool can be interpreted as a product of the "general disenchantment with the conventional command and control approach" (Rodriguez-de-Francisco & Boelens 2015: 495), as well as the emergence of an active PES epistemic community that promotes the tool based on the construction of 'success stories', not always based on empirical data (Büscher, 2012; van Hecken, Bastiaensen &

Huybrechs, 2015). This trend is visible not only in Colombia but is also found, for example, in the literature reporting the spread of pro-market thinking and pro-PES policy among US and UK-based conservation professionals (Blanchard et al., 2016).

From a methodological standpoint, we have contributed to Q-methodology and discourse analysis more broadly in at least three ways: first, by developing a web-search algorithm to capture PES-related statements from social media; second, by proposing the factor map as a new way to characterise discourses and provide the researcher a better analytical and interpretative perspective; and, third, by proposing the PCA as a new analysis to ensure a balance across statements and rule-out the possibility of the common-method bias. In combining these three innovations, we have developed a more systematic protocol to capture, define and prioritise the statements that make up the Q-set. Notwithstanding, we are aware that the combination of the web-search algorithm and the literature review might have still be insufficient to capture all aspects that might be relevant for PES –or another topic– in a given country or social context, since the former is limited to information from the web and the latter to information written by scientists and, in our case, in English alone. Therefore, future researchers aiming to replicate the methodology presented in this article should complemented it with in-depth interviews that can help capturing context-specific discursive elements. They are also encouraged to undertake a careful curatorship of the statements gathered through the automated process, in order to avoid multiple interpretations and inconsistent coding due to long, double-barred statements or double-negations.

In conclusion, the three PES discourses in Colombia identified in this article reflect the relatively high level of acceptance of PES as a policy tool as of today. They are a snapshot of PES discussions in the country and the outcome of years of national policy debate and

early practice, which was characterised by limited social opposition. The rather small constituency that endorses the critical PES discourse suggests that PES initiatives are likely to grow in number and geographical coverage if funding and other institutional conditions are met, such as well-funded implementing organisations and enough communities and landowners willing to participate. In Colombia, PES are regarded today as a pragmatic conservation approach for which only time will tell if environmentally effective and socially transformative.

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Chapter Four. What drives institutional change? An analysis of environmental targeting in a publicly funded PES scheme

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Abstract (264 words)

Payments for Ecosystem or Environmental Services (PES) programmes have become a mainstream conservation approach over the last two decades. To guarantee their environmental performance, PES programmes have aimed at targeting ecosystems based on environmental criteria. Some research, however, has shown that such environmental targeting can negatively affect the outcomes of PES programmes, particularly if changes in selection criteria result in negative environmental behaviours and inequitable outcomes. In this article, we investigate the relationship between environmental targeting, equity and motivation crowding through an analysis of the first publicly-funded watershed conservation PES programme in Colombia, known as "*Yo protejo, agua para todos*" (YPAT). Informed by interviews with program actors and a motivations survey applied to removed participants, we document the evolution of the PES scheme, identify the key factors driving institutional changes, and explore how these changes might have affected the distribution of programme outcomes and former participants' motivations. The YPAT programme underwent three phases in which several changes were made to the design, including a renewed environmental targeting approach. This new approach led to the exclusion of hundreds of former participants, but unexpectedly this logic of exclusion did not affect the pro-environmental motivations of excluded participants. Changes in the programme rules were the result of three interrelated factors: the growing experience during the first phase of the programme; the involvement of a new experienced stakeholder; and changes in national environmental regulations which affected the programme's goals and scope. The analysis of YPAT highlights the importance of considering the implications that changing PES rules might entail for former and future participants in this and other PES schemes.

Keywords: payments for ecosystem services, targeting, motivation crowding, Colombia

4.1. Introduction

Payments for Ecosystem Services (PES) are an innovative and flexible tool for sustainable land-use management and conservation. Globally, there are more than 550 active PES cases mobilizing approximately USD 330 million per year (Salzman et al., 2018). The rationale behind PES is based on providing positive economic incentives conditional to the achievement of specific environmental outcomes (Engel et al., 2008). Due to the potential of PES to reduce poverty through the generation of alternative sources of income for rural communities (Pagiola et al., 2005), these have been widely promoted and implemented as a conservation incentive, mostly in Latin America, Asia, and Africa but there are also cases in Europe and North America (Ezzine-de-Blas, Wunder, et al., 2016).

PES schemes are very flexible in their design and there are more than 18 design characteristics on which a scheme can be built (Engel, 2016). However, PES effectiveness is highly sensitive to its design and implementation and, although it is difficult to establish key predictors of success, the literature reports that (1) environmental targeting, (2) differential payments, and (3) enforced monitoring are the three most important design features for successful PES; i.e., generating additional ES provision (S Wunder, Brouwer, Engel, Ezzine-de-Blas, et al., 2018). In particular, environmental targeting implies selecting participants based on criteria of high ecosystem services (ES) density, high-threat areas, and ES provision costs. Targeting is a cost-effective design feature because not all areas matter equally for conservation and budget constraints impede enrolling all potential ES suppliers (Engel, 2016; S Wunder, Brouwer, Engel, Muradian, et al., 2018; Wünscher et al., 2008). However, in practice, very few PES schemes incorporate targeting into their selection criteria because of alleged implementing costs (e.g., costs of

spatial data on ES), equity reasons (e.g., not excluding participants with lower incomes) or political dynamics in the case of publicly-funded PES (e.g., electoral motivations) (Wunder et al., 2018).

Environmental targeting involves selecting potential participants, and every selection implies some kind of exclusion. To increase the efficiency of PES schemes, targeting should be made ideally before the project starts (*pre-targeting*). The most frequent targeting strategy is to select areas based on ES density, which is based in turn on the potential provision of ES per area unit. In a recent article, Wunder et al. (2018) report that 50 percent of the cases revised in their study claim to target participants based on ES density. However, targeting can also occur during the implementation of the project to correct inefficient selection criteria or to test new design ideas, which is known as *re-targeting*. Re-targeting is quite common in social and environmental public policies and interventions (Porras et al., 2013; J. Robalino & Pfaff, 2013; Sánchez-Azofeifa, Pfaff, Robalino, & Boomhower, 2007) and although the adjustment of selection criteria is a recommended practice to improve PES implementation, *re-targeting* also opens up the possibility for former participants to no longer be part of the scheme, thus raising equity and motivation crowding concerns (Ezzine-de-blas et al., 2019).

This article explores the tensions between environmental re-targeting, equity, and participants' motivation crowding through an institutional analysis of the first sub-regional publicly-funded PES scheme in Colombia: "Yo protejo, agua para todos" (YPAT). Since its beginning in 2015, the programme has gone through three phases in which several design changes have been made including a renewed targeting strategy. These three phases correspond to a new budget allocation by the regional government

and were not strategically planned beforehand by the schemes' funding and implementing actors. Rather the programme was conceptually structured into these three phases after an ex-post analysis of its implementation.

Guided by the adaptive management framework -a structured approach to decision-making in natural resource management (Rist, Campbell, & Frost, 2012) that has been used to analyse, for example, the Mexican PES scheme (Sims et al., 2014)-, we analyse and reconstruct the institutional history of the YPAT programme to identify key factors driving institutional changes in this PES scheme. Based on interviews with relevant stakeholders and the review of official programme documents, we show that the YPAT scheme sophisticated its design features over time but in doing so left-out hundreds of participants from the first and second phase, thus potentially raising equity and motivational concerns among those excluded participants. Our analysis shows that a logic of passive adaptive management was present in the first phase of the programme in which changes within the programme were based on short-run outcomes rather than a deliberate pursue of experimentation or learning (Williams, 2011). Further, a shift towards an active adaptive management approach took place during the second and third phases characterized by the re-design of the programme in response to feedback from new key stakeholders.

The article is organized as follows. Section Two presents relevant literature concerning targeting in PES schemes, equity, and motivation crowding. Section Three presents the methodological approach, based on interviews with YPAT actors and a motivations survey administered to former programme participants. Section Four presents the results in terms of the evolution of the YPAT programme and the relationship between re-

targeting, equity and motivation crowding. The fifth section discusses the results in the light of existing literature and concludes with a summary of findings and future research.

4.2. Relevant literature

4.2.1. Environmental targeting and re-targeting in PES

As noted above, environmental targeting (ET) refers to the practice of selecting eligible PES participants based on some pre-defined considerations with the purpose of increasing additionality in conservation outcomes, i.e., what would have happened in the absence of PES (Engel, 2016). The logic of ET resides in the fact that not all areas matter equally for conservation, i.e., there is variability in environmental benefits or risks, and budget constraints impede enrolling all potential ES suppliers. Hence, ET is expected to enhance additionality in areas that exhibit large variability in potential environmental benefits, opportunity costs or risk of non-compliance (Börner et al., 2017). The most common ET approach is based on selecting areas with high ES provision and low ES provision costs, or areas with high threat of degradation or deforestation (Engel, 2016; S Wunder, Brouwer, Engel, Muradian, et al., 2018). Once geographical areas are prioritized in terms of the above-mentioned criteria, landowners or tenants are invited to participate. At this stage, who gets eligible to participate is not neutral to PES objectives and conceptualizations (van Hecken, Bastiaensen, & Huybrechs, 2015). PES discourses reflect shared conceptions on what drives changes in ecosystem services and the potential role payments can have in preserving or enhancing their provision (Adger et al., 2001; Dryzek, 2005; McAfee & Shapiro, 2010).

For example, if environmental additionality is conceptualized as the main PES objective and cost-efficiency is a priority, then, in principle, participants who are likely to conserve for intrinsic reasons should be excluded from the programme (Alpízar, Nordén, Pfaff, & Robalino, 2017b). In contrast, if income generation, recognition of forest stewardship, and compensation of opportunity costs for land-use restrictions are regarded as PES objectives, then any participant residing in an area of ecological importance should become eligible regardless of potential deforestation threats or pre-existing motivations to preserve ES (Gómez-Baggethun & Muradian, 2015; Moros, Corbera, Vélez, & Flechas, 2019).

In this article, we focus on *re-targeting* defined as the changes in the selection criteria of old and new participants. Re-targeting is a quite common practice in social and environmental public policies and interventions and it is usually the result of different drivers including: pressures from specific interest groups including donors and the general public (Sabatier, 1988), learning derived from programme evaluations or technical innovations (Sabatier & Jenkins-Smith, 1993), the involvement of new stakeholders in programme design and implementation (Gunderson, 2008), or changes in the environmental context or environmental regulations.

Re-targeting implies changes in the rules governing PES schemes and as such, it affects both performance and outcomes (Corbera et al., 2008). Several PES schemes in Latin America have gone through re-targeting processes for different reasons. For example, a partial evaluation of the Costa Rica national PES scheme showed that adverse self-selection led to the enrolment of participants with no threat of deforestation and low conservation opportunity costs (Robalino & Pfaff, 2013). Consequently, a large fraction

of payments went to those who would conserve forest regardless of payments; a feature that was later adjusted (Porras et al., 2013; Sánchez-Azofeifa et al., 2007). The Mexican PES programme was also subject to a re-targeting process. The programme was criticized by rural social movements for not including enough areas at high risk of deforestation and not reaching the most vulnerable communities (McAfee & Shapiro, 2010; Sims et al., 2014). In response, applications from smaller landowners were allowed and two ecological criteria were included in 2009 to increase environmental additionality: areas that had low rate of anthropogenic soil degradation and areas that contain high biomass density (Sims et al., 2014). The Socio-Páramo programme in Ecuador also shifted its area selection criteria from solely environmental criteria to explicitly incorporating poverty levels to define priority areas and taking into account land size to reduce strategic rent-seeking behaviour from large landholders (Bremer, Farley, & Lopez-Carr, 2014).

4.2.2. Equity in PES

Equity has been identified as a key element to incorporate in PES design and implementation, particularly when vulnerable participants or communities are involved in such schemes (Corbera et al., 2007; Pascual et al., 2014). In the context of PES, equity can comprise three elements: equity in access, equity in decision-making, and equity in outcome (Calvet-Mir et al., 2015; Corbera et al., 2007; Pascual et al., 2010). Equity in access refers to the extent to which disadvantaged farmers are able to participate in the schemes. Equity in decision-making is related to the extent to which disadvantaged groups are recognized and included in PES strategic management decisions. Finally, equity in outcomes refers to the distribution of project outcome across participants (Corbera et al., 2007).

PES can vary on the emphasis and relative importance given to these different dimensions of equity. For example, schemes that focus exclusively on environmental efficiency and overlook equity in access (e.g., enrolling only *de jure* landowners) carry the risk of being perceived as illegitimate or not credible among both enrolled participants and non-participants; two main aspects that have been identified as key predictors of PES success (Börner et al., 2017; Gross-Camp et al., 2012). Further, overlooking equity in outcomes (for example, if a flat-rate payment is given disregarding heterogeneous conservation opportunity costs or land size) can also result in reinforcing pre-existent inequalities among participating communities and landowners (Muradian et al. 2010; Pascual et al. 2010; Sommerville et al. 2010). Ignoring equity in decision making by excluding groups without economic or political power also risks reinforcing control over natural resources by the most powerful actors and rural communities' elites (J. C. Rodríguez-de-Francisco & Budds, 2015).

Additionality gains from targeting can also imply trade-offs with equity and well-being (Börner et al., 2017). Empirical evidence on the potential trade-offs between environmental additionality and equity is still scant. A review study of 29 biodiversity conservation schemes in the tropics and subtropics found that positive impacts on environmental effectiveness are generally more often reported than those associated to positive equity outcomes, and that trade-offs between equity and efficiency are rarely explored in a quantitative manner (Calvet-Mir et al. 2015). However, other evidence suggests that equity and effectiveness can be reconciled, for example through the implementation of redistributive PES (i.e. higher payments to poorer landholders)

without compromising environmental effectiveness (Vorlaufer, Ibanez, Juanda, & Wollni, 2017).

4.2.3. Motivation crowding in the context of PES

Although environmental targeting and re-targeting are a necessary step towards the improvement of PES implementation in terms of additionality and efficiency, adjusting selection criteria, or changing the rules governing PES schemes, also entails the risk of excluding early participants. This situation potentially raises motivation crowding concerns, which implies the alteration of existent motivations due to the introduction or removal of an incentive (R. Ryan & Deci, 2000). Motivation crowding is a common preoccupation in PES practice and scholarship (Moros, Vélez, et al., 2019; Sommerville et al., 2010; a Vatn, 2010; Vollan, 2008) and recent theoretical advances in the context of PES state that crowding out of intrinsic motivations is more likely to happen when payments are perceived as controlling or imposing; when they are designed in a non-participatory manner; when they do not recognize people's skills; or do not take into account the equity, and social or environmental preferences of participants. The opposite situation is expected to lead to crowding in (Ezzine-de-blas et al., 2019). Research on PES motivation crowding is increasing over time and to date the majority of studies in the context of PES report no evidence of motivation crowding out (Handberg & Angelsen, 2016; Kaczan, Swallow, & Adamowicz, 2016; Vollan, 2008). However, this evidence is not conclusive yet perhaps due to the difficulties in comparing dissimilar case-studies that are embedded in different institutional dynamics and contexts. In the context of this research, motivation crowding out might occur as a result of re-targeting if excluded participants feel frustrated or if they perceive exclusion as an unfair outcome.

4.3. Mixed methods approach to analyse institutional changes in YPAT

This study follows a mixed methods approach, including both qualitative and quantitative research techniques, to analyse the YPAT programme and provide insights on the relationship between re-targeting, equity and crowding effects. Mixed methods are used to cross-validate and/or complement results (Flick et al., 2004). The YPAT programme description relies on primary and secondary data. Between October 2017 and February 2019, the lead author conducted 14 semi-structured interviews with the key actors involved in the scheme, i.e., the programme's implementing agency (n=6), funders (n=2), field technicians(n=3), environmental authorities (n= 2) and independent consultants (n=1). A combination of purposive and snowball sampling was used to select interviewees and an informed consent containing the project description was read out loud prior to the start of the interview. The interviews lasted approximately one hour, and participants were asked to narrate the history of the programme and to place emphasis on the reasons why it was implemented, the actors who participated in its design and implementation, the underlying logic of changes in the programme over time, and a preliminary opinion regarding its performance (Table 4.1). Interviews were recorded and not transcribed literally but focusing on the structure described above. We also reviewed official reports, documents, and relevant regulations to complement or triangulate interview responses.

Table 4.1 Structure of the interview and guiding questions

Dimension	Questions
1. Creation of the programme	Why is PES proposed as a policy tool in Cundinamarca?
2. Actors involved and final design	Which actors shaped the rule-design process? (per programme phase) How are their interests represented in the final rules? How and why did design rules change over time? What were the selection criteria for participants? How was the "strategic area criteria" developed? Which was the rationale behind changing in-cash payment to in-kind? Why did CAEM (first stage implementer) not continue in the second stage? Why was Patrimonio Natural selected to be the implementer in the second stage? What was the logic behind reducing the number of participants between stages 1 and 2?
3. Preliminary evaluation	What is the end balance of the programme in terms of its environmental and social objectives? Why did participants fail to comply PES contracts? Why did participants voluntarily decide to not continue in the programme? How did the programme measure and monitor the provision of ES, and account for changes?

To explore the possible effects of re-targeting on motivations among excluded participants, we applied a motivations survey to 56 Phase 1 (P1) and 67 Phase 2 (P2) former participants and to 80 non-participants. We did not include Phase 3 (P3) participants because at the time of data collection applications for this phase were still being received. Our data set also contains panel data on motivations in two periods of time, 2017 and 2018, for a sub-sample of former participants (n=23 P1 and n=56 P2). The lead author administered the survey between June and September 2017 (first stage of data collection), and October 2018 and February 2019 (second stage of data collection), in Spanish, and with the support of trained research assistants (See Appendix 7 for full survey). The second stage of data collection was part of a larger project that includes other experimental measures not explored in this article. An informed consent containing the project description was read out loud prior to the start of the survey (Appendix 5).

Although we tried to reach as many former participants as possible, after several rounds of phone calls only 20% of total P1 and 47,8% of total P2 participants were available to respond in the second stage of data collection. Non-participants were selected from the participating districts following a convenience sampling approach.

The motivations survey followed the protocol described in Moros et al., (2019). This protocol contains eight questions based on the Self -Determination Theory (SDT) which proposes motivation as a continuum between two extremes: intrinsic motivations and lack of motivation (a-motivation): intrinsic motivations relate to the inherent pleasure of preserving forests; guilt-related motivations capture motivations related to the need for self-approval; duty-related motivations refer to motivations that emerge out of pride for "good behaviour"; social motivations relate to motivations that arise from the need for social approval or reputation; finally, extrinsic motivations are those that arise exclusively from external payments or fear of fines (Table 4.2). The survey used a four-point Likert scale to capture variations in the motivations to protect forests. The scale was symmetric, ranging from 1 (totally disagree) to 4 (totally agree), and did not have a central point in order to force respondents to go in one direction or another and eliminate the risk of neutral responses (Lozano et al., 2008).

Table 4.2 Description of motivation survey statements

Motivation	Description	Survey statements
Intrinsic	Captures inherent interest for forest conservation as well as self-endorsement of forest protection	1. "I enjoy taking care of forests"
Guilt, pride or regret	Captures motivations related to the need for self-approval	1 "I would feel guilty if I were to clear forests" 2. "I would regret it if I were to clear the forests" 3. "I feel proud of myself for taking care of forests"
Social	Includes motivations that arise from the need for social approval or reputation	1. "I would be criticized by my neighbours if I were to clear forests" 2. "Significant others would be upset if I were to clear forests"
External (Payments)	Includes motivations that arise from the need for social approval or reputation	"I would take care of forests only if I am paid to do so"
External (Fines)	Captures motivations that emerge exclusively from external payments	"I do not cut down the forests because I am afraid of being fined by environmental authorities"

4.4. Re-targeting, equity, and motivation crowding in YPAT

4.4.1. PES in Colombia and the YPAT programme[7]

Colombia hosts 15 PES initiatives across the country that cover up to 181,000 hectares (Ministerio de Ambiente y Desarrollo Sostenible, 2018b). PES schemes in the country are very diverse in their geographical scale (e.g., national, sub-national, watershed level), design features (e.g., selection criteria for participants, payment amounts, payment mode, and contract length to mention a few), and parameters of success (e.g., number of enrolled hectares, permanence of behavioural changes) (Moros, Corbera, et al., 2019). PES implementation is decentralized and Colombia does not have a national PES programme

[7] This section is based on interviews with relevant stakeholders. Quoted statements refer to interviewees' own words. For confidentiality considerations, we do not reveal the names nor the position of the interviewees.

like other countries in the region, such as Mexico, Costa Rica or Ecuador. Colombia is also a late-comer to PES regulation. By 2017, the country issued the first PES national law mandating that all publicly funded PES target conflict-ridden municipalities or areas where illicit crops are grown, and incorporate social justice considerations (Law No. 870, 2017, Chapter II, Art. 8).

Cundinamarca is an administrative department[8] located in central Colombia. Bogotá, Colombia's capital city, is located within this department. Cundinamarca is a highly-deforested region (only 0.1% of its total surface is still forested (IDEAM, 2018)) and hosts the largest Páramo ecosystem in the world, Sumapaz. This ecosystem is critical for the sustained provision of water to the approximately 8 million people living in Bogotá and the city's metropolitan area. Rapid urbanization, single-crop farming of potato in highlands, extensive cattle ranching, and mining have resulted in increasing threats for water in the department.

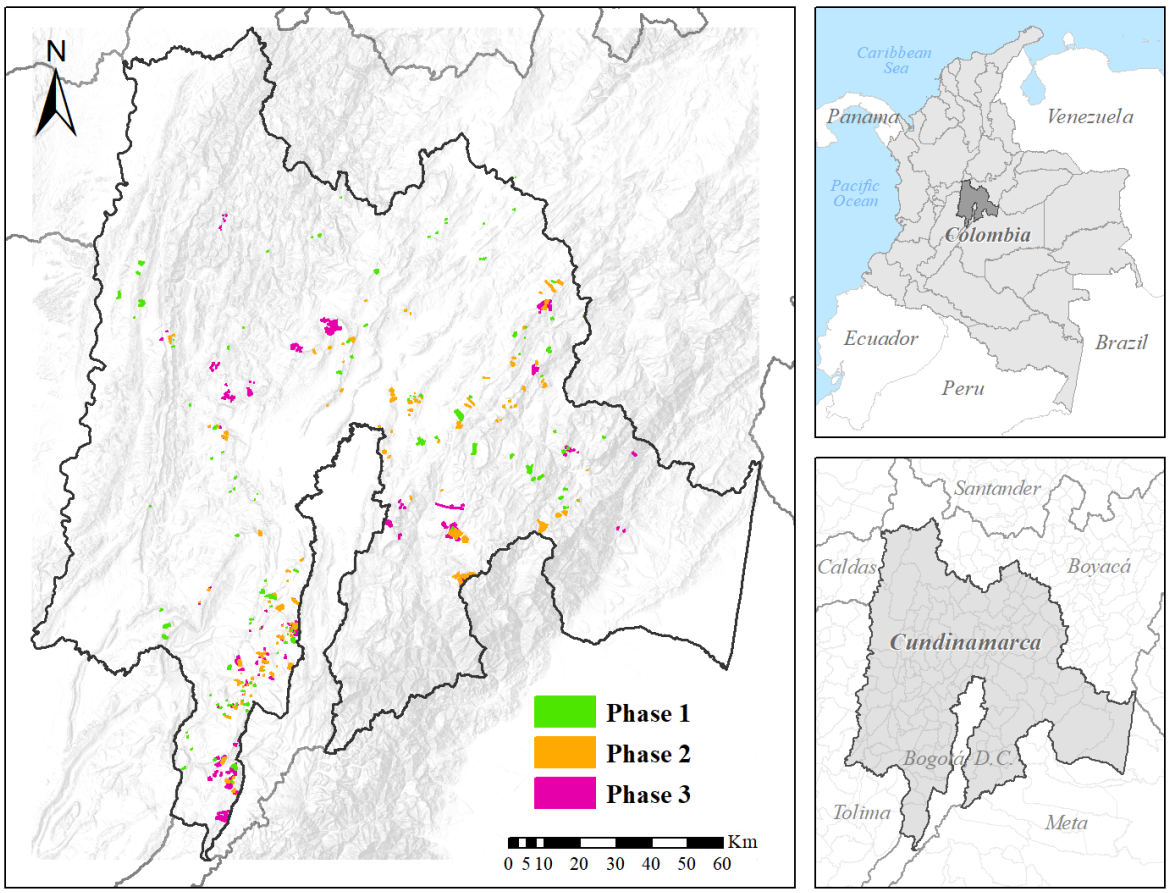
YPAT was launched in 2015 by the government of Cundinamarca, before the national government issued the PES national Law. The programme aims to annually enrol up to 6.000 hectares, as mandated by the regional development plan "Unidos podemos más, 2016-2020" (Gobernación de Cundinamarca, 2016: p. 77). It aims to preserve strategic areas within the department and is defined as (1) "an alternative to land purchases for conservation" and (2) "a proposal for tackling land-use conflicts in the territory such as deforestation, water shortages, and agricultural expansion".

[8] A department is an administrative and political sub-national organizing unit. Colombia is made up of thirty-two departments which in turn are made up by several municipalities. Each department has its own Governor (*Gobernador*) who acts as the maximum authority within its jurisdiction and is elected by popular vote.

Between 2011 and the present day, the government of Cundinamarca, through its Environmental Office, has purchased 35,986 hectares for conservation (Patrimonio Natural, 2016). However, these land purchases have not been an effective strategy for conservation due to high monitoring costs and because such purchases have not been able to "promote a conservation model that includes people living in those strategic areas". In this context, and since regional governments are required by law to invest 1% of their net income on PES schemes or land purchases (Ministerio de Ambiente y Desarrollo Sostenible, 2013, 2018a), the Environmental Office proposed the PES scheme as a "complementary action for conservation that keeps people in their territory".

As mentioned in the introduction, the YPAT programme has gone through three phases and several design changes have been implemented over time (see Table 4.3 and 4.4 for a summary of these changes). Each phase corresponds to a new budget allocation from the regional government to accomplish the objectives of the regional development plan. These phases were not *a-priori* established by the programme implementing actors but rather an outcome of an ex-post analysis of the scheme implementation. Figure 4 shows the distribution of participants in each phase. Green dots are participating plots in Phase 1. Yellow dots are plots in Phase 2, and purple dots plots in Phase 3. We can observe that plots in Phase 3 were more concentrated geographically than those in phases 1 and 2. In what follows, we describe and analyse each phase of the programme and the changes implemented.

Figure 4. distribution of participants per phase of the programme



Source: Authors based on data provided by Patrimonio Natural 2018.

4.4.2. Building trust through cash payments (2015-2016)

Phase 1 of the programme was operated by the Corporación Ambiental Empresarial (CAEM), a subsidiary of the department of Cundinamarca's Chamber of Commerce that had previous experience in ecosystem restoration and which had signed an 18-month collaboration contract with the regional government. Two regional environmental authorities (Corpoguavio and CAR) also participated in the programme providing support for municipal field visits. During this phase, the programme was named "Conservar sí paga" (Conservation pays-off). This phase is depicted by relevant stakeholders as a "learning process", a "pilot phase", or an "experimental stage". As such, instead of being guided by technical criteria, most decisions were based on their ease of implementation, time constraints in spending public resources, and to build trust among potential participants.

For example, during the first phase of the programme, a total of 277 participants received between USD 130-200 per year and hectare of forest, through a direct bank transfer. Cash payments were the easiest option to implement compared to in-kind payments that required the out-sourcing for purchases. Cash payments also served to "build trust among participants who were wary of the regional government". The payment amount per hectare was established following a sub-regional opportunity cost approach and participants received between two and three payments during the contract. Payments were partially conditioned to compliance with agreed activities in the plot, and field technicians visited the plots twice or three times during the contract to monitor compliance.

Enrolment in the programme followed a first-come first-served basis and selection criteria included only formal landowners (with land title), who had forest within their plots, and

who resided in "strategic ecological areas" (SEA) according to the regional environmental authorities. These areas were defined according to their importance for water provision (Corporación Autónoma Regional, 2013). According to the Cundinamarca Secretary of the Environment, almost 60% of the department's land is considered an SEA, which led to scattered applications to the programme throughout the region. Landowners who complied with the criteria were invited to enrol up to 100 hectares and the payment had two levels of differentiation depending on the number of hectares applied: the first 50 hectares received 100% of the payment, and the subsequent 50 hectares were paid 75% of the total payment (Ministerio de Ambiente y Desarrollo Sostenible, 2013). The enrolment process resulted in different contract lengths, ranging between 8 and 17 months. The majority of Phase 1 participants (58%) were enrolled into the programme for only 8 months, a rather short contract term compared to international standards that run for over 5 years (e.g., Mexico and Costa Rica).

Additionality was not a relevant element in this phase (Patrimonio Natural, 2016). The results of this phase were measured by the government of Cundinamarca in terms of hectares enrolled. Although the initial objective of 6,000 hectares under PES was accomplished with 6,465 hectares and 277 beneficiaries, the regional government proposed to change the implementing actor by the end of 2016. The regional government perceived that the scheme was not delivering environmental benefits and that the "enrol and pay" approach that CAEM had employed was resulting in a "perverse market logic towards conservation".

4.4.3. Improving participant targeting to enhance ecological benefits (2016-2017)

In Phase 2 (2016-2017), Patrimonio Natural (PN), a non-profit national fund for conservation[9], took up the programme's implementation with the support of two regional environmental authorities that where involved in Phase 1 (Corpoguavio and CAR). Following the suggestion by the Ministry of the Environment, PN was chosen because of its experience in managing incentive-based conservation initiatives in other regions of the country. With the arrival of PN, the underlying logic of the scheme changed from a logic of "enrol and pay" to one more concerned with ecological impacts in terms of water quantity and quality. This second phase is known as the "transition phase" among the interviewed actors. One of the first changes in the scheme was its name, whereby in 2016, the programme adopted the name "Yo protejo, agua para todos". This change was a strategic marketing decision to "gradually eliminate the salience of payments in Phase 1".

In this second phase, the payment mode also changed from 100% in cash to a mix of cash and in-kind payments per hectare of forest conserved. This change was driven by the need to "counteract possible perverse effects of cash payments under the assumption that they were not creating the type of conservation consciousness the programme intended". Due to time pressures in budget execution, however, it was decided to avoid an open call for new participants and renew instead, the existing conservation agreements for a maximum of eight months, but only with Phase 1 participants whose forests sit within the new eligible geographical areas defined by PN. As a result of this change in the targeting, based on ecological arguments, 137 former participants were removed from the

[9] Patrimonio Natural's board includes representatives from the Ministry of the Environment, other environmental public bodies, and private actors.

programme. Those who continued (140 people, representing 3,928 hectares) were required to implement activities in their standing forests, such as fencing-off water sources to impede the entrance of cattle, installing a billboard that publicizes the programme, and planting living fences to increase biodiversity, among others. Some of these activities had no clear connection to the improvement of water quality and quantity but were proposed as part of the farm environmental management plan agreed between participants and PN.

In this phase, conditionality was based on on-farm activities monitored by field technicians, and participants were also required to attend training workshops once a month conducted by the French National Forest Office (ONF in Spanish) through an alliance with PN. These training workshops were essential to communicate the new logic of the programme: "conservation as a shared responsibility". The objective of this transition phase was, as in the first phase of the programme, to gradually adjust eligibility criteria within the time constraints for budget execution. In this phase, measures of ES provision and improvement were inexistent partially given the lack of technical knowledge on PES and because "it would be hard to observe changes in ES provision during such a short contracting period".

4.4.4. Towards environmental additionality (2018-onwards)

Based on the learnings and failures from previous phases, Phase 3 continues the path set in Phase 2 and improves the participants' selection criteria to be more effective in resource allocation (Table 4.4). A discursive shift is visible during this phase, which stresses the importance of making the programmes' environmental outcomes more

tangible and durable. Consequently, 20 critical watersheds in 18 municipalities have been prioritized by PN to maximise the environmental objectives of the programme and in relation to this, 180 new landholders have been invited to participate. Only 26 participants from Phase 2 continue in Phase 3, as they were the only ones located within the new eligible areas, which in turn means that another 114 participants were excluded.

One main change in this phase has to do with the payment amount. Based on an opportunity cost (OC) established by the government of Cundinamarca, the programme now includes criteria for payment differentiation based on three variables: (1) existing legal land-use restrictions for the plots in the program (LU), (2) plot size (PS), and (3) socio-economic conditions of participants (SE) (Patrimonio Natural, 2019). The first criterion is incorporated with the idea that PES would work as a complement, and not as a substitute, for those who are obliged by law to conduct conservation activities on their plots because existing legal and land-use restrictions such as National and Regional Parks, National Forest Reserves or Civil Society Forest Reserves. The second and third criteria are incorporated to favour smaller plots and poorer participants based on equity considerations.

Equation 1 presents how the total payment amount is calculated:

$$Total\ payment\ amount = Opportunity\ Cost * (LU + PS + SE)$$

(LU) takes values of 10%, 40% and 70% depending on the existent legal land-use restriction of the plot. For example, plots located within National Parks obtain 10% of LU while plots located within a non-restricted area obtain 70%. (PS) and (SE) can take

values of 0%, 5%, 10% and 15% depending on the size of the plot and household income. Poorer and smaller households obtain 15% of PS and 15% of SE. Following Equation 1, payments per hectare range between 10% and 100% of the opportunity cost. This construction favours smaller and poorer plots that are located within SEAs but that are not obliged by law to carry on conservation activities.

In this phase participants are not required to attend training workshops and in fact, the alliance with ONF did not continue in this phase. In Phase 3, the ONF training workshop facilitator was hired directly by PN, which consolidated their staff in number and expertise. Technical assistance is a new crucial aspect of this phase. The underlying logic of such assistance is "to create installed capacity and facilitate the permanence of conservation behaviours after payments end". In this phase, the programme re-targets its operation to high density ecosystem services areas and high threat regions within pre-selected watersheds. Indexes of forest cover, water quality and vulnerability to climate change were included as selection criteria of potential participants (Patrimonio Natural, 2019). In this phase, PN is collecting baseline information of five ecological and social indicators at farm level, including water quality, forest cover, level of ecological connectivity, soil erosion rate and participants' appropriation of ecological knowledge (Patrimonio Natural, 2019).

Another change in this phase is that the PES coordinator at the Secretary for the Environment managed to guarantee funds for YPAT for the next 20 years, through an ordinance, independently of the political party and interests of the new administrations. This, in principle, should guarantee the financial sustainability of the programme in the

coming years and thus allow for more changes and improvements in payment amounts, targeting, and ecological requirements.

4.4.5 Re-targeting, additionality, and programme performance

PES impacts are usually measured in terms of their additionality, defined as the extent to which a given positive environmental outcome (e.g., increased forest cover or reduced deforestation) with PES is more significant than without PES (Engel, 2016). Additionality requires the estimation of baseline information of what would have been the scenario in the absence of payments. However, as noted above, additionality was not a key concern during the first two phases of the YPAT programme and the scheme lacked baseline information on forest cover and water provision. The indicators of programme performance and success were conceived in terms of the number of hectares and farmers enrolled.

When asked about programme performance and its environmental impacts, programme funders recognized that they were not proposing measures of additionality but that "at least they could say that the programme had avoided the deforestation of 6,000 hectares". While we cannot empirically test the effects of YPAT payments on additional forest cover or water provision in this article due to data limitations, we can explore how re-targeting has contributed to reducing deforestation, deforestation threats being considered as a key predictor of the environmental impact of PES (J. Robalino & Pfaff, 2013).

To investigate this relationship, we calculated the average distance to main roads, slope, and altitude for a sub-sample of participating plots across programme phases[10]. These biophysical characteristics have been proposed as deforestation proxies in land-use change literature (Geist & Lambin, 2001; Muñoz-Piña et al., 2008). Deforestation is more likely to occur in flatter plots, nearer to main roads and located in low altitudes because forest conversion to agriculture or cattle ranching is less costly both in terms of production and transport to markets (Geist & Lambin, 2002; Rueda, Vélez, Moros, & Rodríguez, 2019)

Based on official programme data, we found that YPAT plots are located at high altitudes (above 2,000 meters above sea level), are rather flat (slopes of less than 25 degrees) and they vary significantly in terms of their distance to nearest roads (from 400 meters to 5 kilometres). Disaggregating by phase and using a one-way analysis of variance test (ANOVA), we found that the implemented changes in eligibility criteria from Phase 1 to Phase 2 resulted in enrolling, on average, higher altitude (p-value=0.000) and slightly flatter plots (p-value=0.06). Additional re-targeting from Phase 2 to Phase 3 resulted in enrolling farther (p-value==0.0069), steeper (p-value=0.0068) but lower altitude plots (p-value=0.0009) (Table 4.3). These gross estimates suggest that re-targeting resulted in enrolling plots with potentially low to mid deforestation risk. Therefore, in a nutshell, the changes in re-targeting across Phase 1 and 2, and Phases 2 and 3, do not seem to have focussed on high opportunity cost lands. However, as the programme is increasingly

[10] Based on official programme shapefiles, we calculated the linear distance to main roads for a sub-sample of participating plots across phases. We also used a digital elevation model (DEM) to compute the altitude and the slope (with the Fleming and Hoffer (1979) algorithm). For those calculations, the *sf* (Pebesma, 2018) and *raster* (Hijmans & van Etten, 2012) packages in R Core Team (2019) were used.

aimed at conserving forests on the top of critical watersheds, (under the assumption that such forests will result in better water quality and water flow regulation), this re-targeting strategy seems to better align with the program's changing goals (more in terms of water provision, and less so in avoiding deforestation).

Table 4.3. Summary of design changes over time in YPAT. Source: Authors based on official programme data

Design characteristics	**Phase 1 2015-2016**	**Phase 2 2016-2017**	**Phase 3 2018-to date**
Municipalities	49	30	18
Participants	277	140	180
Excluded participants		137	114
Distance to nearest road in meters	1701,7 (1220)	1746,8 (1379,2)	2164,2 (1705.89)
Altitude in meters	2555,2 (629)	2873 (395,9)	2700 (612.1)
Slope in degrees	18.41 (7.13)	17.09 (6.09)	18.7 (6.37)
Number of Plots	341	177	257
Participants from previous phase		140	26
Hectares enrolled	6.465	3.928	7.791
Payment amount	USD 130-200/ ht./year Based on OC	USD 130-200/ ht./year Based on OC	USD 20-200ht./year Based on OC
Payment type	100% Cash	Mix of cash and in-kind	Mix of cash and technical assistance
Contract length	Short 8 to 17 months	Short 6 to 8 months	Short 11 to 16 months
Payment differentiation	No	No	Yes
Payment duration	Temporary	Temporary	Temporary
Type of conditionality	Partly ex-ante	Partly ex-ante	Partly ex- ante 30% of payment is upon signing of agreement
Degree of conditionality	Activity-based	Activity-based monitored via field visits	Activity-based and results based monitored via field visits
Training workshops?	NO	YES	YES

Table 4.4 Changes in selection criteria across phases. Source: own elaboration based on official programme data

	Phase 1 2015-2016	**Phase 2 2016-2017**	**Phase 3 2018-ongoing**
Within strategic ecological areas (SEAs)	YES	YES	YES
Formal land owners eligible	YES	YES	YES
Within an area of potential creation of ecological corridors	NO	YES	YES
Informal land owners eligible	NO	NO	YES
Index of water scarcity and poor water quality	NO	NO	YES
Percentage of forest cover	NO	NO	YES
Index of vulnerability to Climate Change	NO	NO	YES
Index of land-use conflict	NO	NO	YES
War-torn municipalities	NO	NO	YES

4.4.6 Re-targeting and equity

Changes in selection criteria across phases raise equity considerations related to who becomes eligible to participate (equity in access), how are communities and/or landowners included in decision-making (equity in decision-making), and how are outcomes distributed across participants (equity in outcomes). Additionally, as re-targeting implied the exclusion of more than 130 former participants from Phase 1 to Phase 2, this situation also raises concerns regarding who was excluded from future participation. In this section, we present to what extent the YPAT programme managers took into account equity considerations across the programme's three phases.

In phases 1 and 2, only formal landowners with land titles were eligible to participate. This criterion meant that the poorest informal landholders, which account for more than 48% in Cundinamarca (Unidad para la Planificación Rural Agrícola, 2017), were excluded from participating in the programme. In Phase 1, the programme incorporated payment differentiation: participants could enrol up to 100 hectares and the first 50 obtained 100% of the payment while the subsequent 50 hectares were paid 75% of the

total payment. The underlying logic of this differentiation was to be sensitive, at least to some extent, to the fact that large landholders could benefit extensively from the programme if payments were always proportional to the land enrolled. Based on official programme data, approximately 23 % of Phase 1 and Phase 2 participants enrolled areas larger than 50 hectares, while more than 50% of participants enrolled areas smaller than 10 hectares (Table 4.5). While this differentiated payment was limiting the benefits that large landholders can obtain (which is desirable from an equity in outcomes perspective), this arrangement was not taking into account the different socio-economic conditions not the heterogeneous opportunity costs of small landholders, thus potentially exacerbating pre-existent inequalities in the scheme operating area. In phase 3, however, the programme became more concerned with equity in outcomes and incorporated a new payment differentiation rule in which plots smaller than 5 hectares were eligible to obtain an additional 15% of total opportunity cost. The incorporation of this distributive type of payment does reflect an active quest for equity in outcomes while capping the benefits large landholders could receive from the programme.

Table 4.5 Size of area enrolled in hectares by phase. Source: based on official programme data

	Min	Max	Median	Mean	Standard deviation
Phase 1	0.3	157.9	10.9	23.67	29.3
Phase 2	0.8	100	16.7	29.33	30.71

Up to now, and across the three phases, strategic decision-making such as payment type and contract length was or remains conducted in a centralised manner and participants only have a say in proposing on-farm required activities.

As noted earlier, over time, YPAT became more concerned with its environmental impacts and gradually more sensitive to equity outcomes. Since the start of Phase 3, and in response to the PES national law, the programme has aimed to enhance equity in access by making vulnerable informal landholders from war-torn municipalities eligible for participation.

One key question regarding re-targeting and equity has to do with who was excluded from the programme. Re-targeting could be problematic in terms of equity if removed participants were poorer or more vulnerable than those who continued. Although we lacked information for all excluded participants (n=130 from Phase 1 to Phase 2) an analysis of a sub-sample of former Phase 1 (n= 56) and Phase 2 (n= 67) participants suggests that former P1 are similar in all socio-demographic variables to P2 except for the number of plots, with P2 participants reporting more land plots than P1 excluded participants (Table 4.6). Our analysis suggests then that P1 excluded participants were, on average, very similar to those that continued participating in Phase 2. Please note that at the time of data collection, applications for P3 were still open and therefore we cannot focus our analysis on those 114 participants who did not continue in Phase 3.

Table 4.6. Descriptive characteristics of former programme participants comparing Phase 1 to Phase 2 (Data for 2018) Note: Asterisks represent differences between groups, using Two-Sample Fligner-Policello Robust Rank Order[11] test for ordinal or interval data and Chi-squared test for categorical data *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis.

	A	**B**	**C**
	Phase 1 (1)	**Phase 2 (2)**	**P-value (1)vs.(2)**
Observations	56/277	67/140	
Characteristics of the plot			
Total number of plots	1.60	2.07	0.0144**
	(1.28)	(1.40)	
Size of main plot in hectares	43.07	28.28	0.5649
	(106.02)	(48.09)	
Characteristics of the participant			
# of people economically dependent	2.71	2.47	0.161
	(1.70)	(1.79)	
% of respondents living in the PES plot or other plot	50%	53.7%	0.36
Education level of the respondent (years)	5.21	5.55	0.26
	(3.12)	(3.15)	
Age of respondent (years)	59.08	56.85	0.21
	(10.3)	(14.3)	
Sex of respondent (% male)	64.29	71.64	0.24
Monthly Income in (US$)	690	566.7	0.46
	(981.6)	(685)	
Main income activity (%)			
Farmers	25%	22.4%	0.40
Cattle ranchers	19.6%	19.4%	0.49
Merchant	12.5%	0.29%	0.19
Employee	23.2%	22.39%	0.46
Wage labourer	0%	2.99%	0.389
Other (mostly retired)	19.6%	29.8%	0.16
Motivations 2018 *(scale 1-4)*			
Intrinsic			
I enjoy taking care of forests	3.85	3.86	0.566
	(0.35)	(0.42)	
I feel proud of myself for taking care of forests	3.91	3.92	0.79
	(0.34)	(0.31)	
Guilt or regret	3.88	3.73	0.10
	(0.31)	(0.51)	
I would feel guilty if I were to clear forests	3.84	3.70	0.19
	(0.49)	(0.62)	

[11] We used the two-sample Fligner-Policello Robust Rank Order test as an alternative to the Wilcoxon–Mann–Whitney test for non-normal populations with unequal variances. The null hypothesis considered in the Wilcoxon–Mann–Whitney test is that the two samples come from the same population (and thus have the same mean and variances). The Fligner-Policello Robust Rank Order test assumes neither normality, nor equal variances or equal distribution between groups (Feltovich 2003).

I would regret it if I were to clear forests	3.92	3.77	0.0729*
	(0.25)	(0.54)	
Social	3.5	3.12	0.0443**
	(0.572)	(0.92)	
I would be criticized by my neighbours if I were to clear forests	3.44	3.05	0.0225**
	(0.85)	(1.09)	
Significant others would be upset if I were to clear forests	3.55	3.19	0.0488**
	(0.89)	(1.01)	
External – payments			
I would take care of the forests only if I am paid to do so	1.21	1.50	0.009***
	(0.52)	(0.74)	
External – fines			
I do not cut down the forest because I am afraid of being fined by environmental authorities	1.69	1.67	0.694
	(1.007)	(1.07)	

4.4.7 Re-targeting and motivation crowding

This section now turns to explore changes in motivations among excluded participants. Our measure of motivation crowding in is any positive change in intrinsic, pride, guilt and social related motivations over time. In turn, any negative change in motivations over time is referred to as motivation crowding out (R. Ryan & Deci, 2000). Likewise, the reinforcement of extrinsic pro-environmental motivations (e.g., the weight given to payments for conservation or fear of fines as main driver for conservation) is interpreted as a negative effect of payments on such motivations. In this section, we compare panel data on motivations over two periods of time, 2017 and 2018, for a sub-sample of Phase 1 (P1, n=23) and Phase 2 (P2, n=53) participants.

Ideally, for an experimental-type of analysis, we should have gathered responses regarding motivations for a control group in 2017 to be able to compare participants to non-participants using panel data. However, due to budget and operational constraints

this was not possible for 2017 and we only have motivations data for a control group in 2018.

It is worth noting that at the time of the survey in 2017, P1 already knew they had been excluded from the programme, and P2 were about to be informed about their exclusion. In 2018, all surveyed former participants acknowledged they were excluded and that the programme had continued in other areas.

A Kurskall-wallis[12] test for differences shows that former (P2) report higher intrinsic motivations in 2018 compared to 2017 at a 5% level of significance. Likewise, (P1) report higher guilt-related motivations in 2018 compared to 2017 at a 5% level of significance (Table 4.7). Although we lacked baseline motivations data prior to participation in the scheme and we therefore cannot rule-out alternative explanations for this effect (e.g., the passing of time), this exploratory result suggests that some form of motivation crowding in among former participants might have occurred.

This result can be interpreted in different ways. First, it may be possible that the relatively short exposure to the programme (for P1:8-16 months, and for P2: 8-24 months) is preventing us from observing any type of motivation crowding out or the reinforcement of extrinsic motivations. Second, it could also be possible that design changes in the programme are driving these motivational shifts. For example, P2 were exposed to changes in the type of payment: from 100% in cash to a mix of in-kind and cash. In Phase

[12] A non-parametric test that can be used to compare the medians of an ordinal variable between two or more independent groups when data distribution is not symmetric. In our case, our variable of interest (motivations) is ordinal (takes values from 1 to 4 following a clear ordering in terms of agreement).

2, participants were also obliged to attend training workshops on the importance of biodiversity; water quality improvement; and, in general, on the crucial role of ecosystems in human well-being. That some types of motivations in Phase 1 are different from those in Phase 2 could be the outcome of these changes.

Table 4.7. Stability in motivations across time Note: Asterisks represent differences between groups, using Chi-squared test for categorical data *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis

	Phase 1 2017 (1)	**Phase 1 2018 (2)**	**P-value (1)vs. (2)**	**Phase 2 2017 (3)**	**Phase 2 2018 (4)**	**p-value (3) vs. (4)**
Observations	23	23		52	52	
Motivations						
Intrinsic						
I enjoy when I take care of the forest	3.69	3.78	0.93	3.67	3.86	0.028**
	(0.70)	(0.42)		(0.617)	(0.44)	
I feel proud when I take care of the forest	3.78	3.91	0.22	3.80	3.90	0.222
	(0.42)	(0.28)		(0.48)	(0.35)	
Guilt or regret	3.63	3.86	0.02**	3.65	3.74	0.397
	(0.49)	(0.69)		(0.63)	(0.49)	
I would feel guilty if I clear the forests	3.39	3.84	0.0489*	3.63	3.70	0.60
	(0.89)	(0.67)		(0.65)	(0.64)	
I would regret if I clear the forests	3.90	3.92	0.52	3.67	3.77	0.29
				(0.70)	(0.52)	
Social	3.36	3.54	0.365	3.13	3.14	0.840
	(0.69)	(0.60)		(0.86)	(0.90)	
I would be criticized by my neighbors if I clear the forests	3.17	3.52	0.172	3.07	3.05	0.8161
	(0.79)	(0.89)		(0.98)	(1.12)	
Significant others would be upset if I clear the forests	3.59	3.56	0.953	3.19	3.23	0.780
	(0.98)	(0.79)		(0.99)	(1.00)	
External – payments						
I would take care of the forests only if I am paid to do so	1.21	1.34	0.49	1.40	1.53	0268
	(0.51)	(0.71)		(0.74)	(0.80)	
External – fines						
I do not cut down the forest because of fear to fines	1.43	1.69	0.45	1.65	1.63	0.968
	(0.78)	(1.06)		(1.11)	(1.08)	

We also compared motivations responses across phases using the Kruskall-wallis test for differences, and we found that in 2017, P2 reported less socially-related motivations than P1. In 2018, P2 reported less socially-related motivations, less regret-related motivations and more extrinsic motivations related to payments to preserve forests than P1. These comparisons, although limited, also suggest that design changes made to the programme and time of exposure (contract length) might also affect motivations. Further, using the motivations survey conducted with the control group in 2018, we compared the socio-demographic characteristics and motivations responses between participants and non-participants. Using the Fligner-Policello robust rank-order test for ordinal or interval data and the chi-square test for categorical data shows that the two samples are not comparable in all socio-demographic characteristics. Participants are wealthier, more educated, and, in general, less economically dependent on on-farm activities than non-participants (Appendix 8). Taking into account these differences, we conducted a logistic model controlling for socio-demographic differences between the two samples to assess the extent to which participating in the YPAT programme has affected motivations and found no evidence of crowding out (Appendix 9).

4.5. YPAT as an adaptive management PES experiment

YPAT is a pioneer scheme in Colombia. The case is the first publicly-funded PES experiment at sub-national level. YPAT emerges in response to deforestation, water shortages and agricultural expansion in Cundinamarca and an overall disconformity in the regional government with land purchasing as a key conservation strategy. The institutional history of the programme demonstrates that several design and implementation adjustments occurred over time which included changes in the payment type, the entrance of a new programme implementing actor, and changes in eligibility

criteria (re-targeting). These changes resulted in the gradual sophistication of the scheme and an increased concern towards generating the basis for measuring and achieving environmental additionality in terms of water improvement.

Three factors explain the process of institutional change within YPAT: first, the growing experience during the first phase of the programme, which resulted in a refinement of its environmental goals and a change in the perception of who should be the most suitable providers of the desired ecosystem services; second, the involvement of PN, a new experienced stakeholder, which introduced both a discursive and practical shift within the programme; and third, changes in national environmental regulations which affected the scheme's goals. These three factors are identified in policy change literature as drivers of policy modifications (Gunderson, 2008; Kallis, Kiparsky, & Norgaard, 2009; Sabatier & Jenkins-Smith, 1993).

The involvement of PN in Phase 2 marks the shift from passive to active adaptive management and was critical in the mainstreaming of a new PES discourse at implementation level. This new discourse considers PES an integral environmental planning tool that should complement, and not substitute, other state policies for land-use management and conservation, such as traditional command-and-control instruments or capacity building interventions (Moros, Corbera, et al., 2019). This vision of PES has become more apparent during Phase 3, when payments have been set according to existing legal land-use restrictions on the lands allocated under the programme. For example, plots located within protected areas can now, in principle, participate in the programme but they will only obtain a fraction of the total potential payment, since forest conservation in these areas is, by law, compulsory. This change in Phase 3 reflects PN's willingness to promote PES within a policy mix approach that considers environmental

policy problems complex enough and impossible to resolve with a single policy instrument (Ezzine-de-Blas, Dutilly, Lara-Pulido, Le Velly, & Guevara-Sanginés, 2016).

The issuing of PES national law was an additional driving factor for changes in eligibility criteria. Upon the signature of the Peace Accord between the FARC guerrilla and the Colombian government, many laws that aimed at contributing to territorial peace-building were issued. Among these, the PES law mandated that PES should target conflict-ridden municipalities or areas where illicit crops are grown (Law No. 870, 2017, Chapter II, Art. 8). The inclusion of such criterion in YPAT's Phase 3 should thus not be seen as an active strategy from local PES promoters to bridge the potential gap between efficiency and equity considerations in PES practice, but rather as a response to a government mandate.

It is interesting to highlight that the institutional changes that took place within YPAT were not the result of pressures from the general public or enrolled participants (Sabatier, 1988). The programme has until now followed a top-down design approach and it is likely that, due to the geographical dispersion of Phase 1 and Phase 2 participants, the latter lacked the group identity and social capital required to push for changes that better fit their interests and demands. Further, it is also probable that third phase participants will have greater participation in decision-making for at least two reasons. First, the programme is actively seeking to create and extend a conservation discourse based on the concept of "shared responsibility", and on the idea that participating peasants are "water stewards". In our view, such an attempt by the YPAT implementing actor to create a sense of project ownership and identity among participants might lead the latter to demand greater participation, at least in strategic programme decisions. Second, YPAT has recently started implementing collective conservation agreements with communities

located in key selected watersheds. This factor could also further enhance the collective action capacity and decision-making power of participating communities.

The evidence presented in this article contributes to PES debates about environmental targeting (ET). YPAT re-targeted its selection criteria in Phase 3 to include areas with high ES provision using multi-dimensional socio-ecological criteria. These targeting criteria are fairly common around the globe: 50% of the cases reviewed by Wunder et al. (2018) follow multi-criteria ES targeting. However, this process of re-targeting followed a "logic of exclusion", through which more than 130 former participants were excluded from implementation, a situation which could potentially result in negative consequences in terms of distribution and participation. However, as our analysis has shown, the excluded participants are not necessarily less well-off than those who have remained in the programme, whilst the implementing actor is becoming more sensitive to equity in access (e.g., allowing landholders who lack property titles to enrol in the programme) and to equity in outcomes (e.g., limiting benefits to large landholders and those that are required by law to preserve ES). However, the programme was and is still characterized by low participation of landholders in strategic decision-making.

Exclusion due to re-targeting might also raise motivation crowding out concerns. The analysis of covering two periods of time, however, suggests that exclusion from the programme generates motivation crowding in, if anything. Removed participants from Phase 1 report higher guilt related motivations in 2018 than in 2017, and removed participants from Phase 2 report higher intrinsic motivations in 2018 than in 2017. This result indicates that instead of crowding out pro-environmental motivations, the participation and later exclusion from a PES programme might reinforce intrinsic

motivations to preserve the environment. This result is counterintuitive because we would have expected crowding out of intrinsic motivations as a consequence of frustration, increased perceptions of injustice (Alpízar et al., 2017b; Alpízar, Nordén, Pfaff, & Robalino, 2017a), or a decrease in social belonging brought about by no longer being part of YPAT.

Psychological literature has, in fact, identified that social exclusion, for instance, decreases pro-social behaviours (Twenge, Baumeister, Dewall, Ciarocco, & Bartels, 2007). However, we interpret this indication of crowding in as a result of contract length or time of exposure to the programme. Phase 1 participants were enrolled for a maximum of 16 months and Phase 2 participants for up to 24 months. It is likely that crowding out is not observable within this narrow time-frame; a hypothesis that is worth testing empirically in the future. Second, participants of Phase 2 were also obliged to attend training workshops about the crucial role of ecosystems in human well-being. The learning derived from the workshops may potentially explain the increase in intrinsic motivations among Phase 2 participants. Another feasible explanation to motivation crowding in is self-selection. It is possible, and in fact very frequent in PES programmes, that highly motivated individuals applied to and enrolled on the programme in its early phases. Therefore, what we might be observing is a reinforcement of intrinsic motivations among already motivated participants. An alternative explanation for this suggestive result is related to the level of dependency on payments. If payments do not represent a large share of household total income, then it is likely that they do not have a strong impact on participant's motivations (Handberg & Angelsen, 2019) . However, this explanations doesn't seem to be plausible in this case because, based on the available data

for a sub-sample of former participants (n= 33 P1 and n=66P2)[13], we found that the median share of payments over total monthly income is 25% for P1 and 37% for P2. If payments represent a large share of total income, then being excluded from the programme would represent a significant economic shock for the household that might result in changes in motivations. However, we might also expect an interaction between payment size and contract length. These are, of course, hypothesis and possible interactions that deserve further research.

However, these results should be interpreted with caution for, at least, two reasons: first, our empirical strategy lacks baseline data for motivations prior to the introduction of payments, which means that our measures of motivations are already affected by participation in the programme, and, second, our sample size of former participants with panel data on motivations is very limited, which limits the robustness of our conclusions regarding motivation crowding in effects (we could reach only 8% of former Phase 1 participants and 37% of former Phase 2 participants).

Overall, YPAT represents a regional adaptive management experiment. The first phase of the programme was underpinned by a passive management approach in which experimentation with targeting and design criteria has been neither deliberate nor an explicit outcome of the changes in the programme. Rather, decision-making was modified as stakeholders' experience grew in a context of time pressures and pronounced nonconformity with creating a market mentality for conservation (Williams, 2011). The

[13] Household income is based on self-reported data, contract length and total payment during the contract are based on official programme information. We could calculate these figures only for a sub-sample of total participants because official programme data had missing information for a large fraction of former participants. We report the median estimate because data is highly skewed to the right, and reporting the mean would be misleading.

second and third phases of the programme represent a shift towards an active management approach characterized by the redesign of policies in response to feedback from key stakeholders such as PN. In the third phase, a logic of budget expenditure that was predominant in phases 1 and 2, which pushed implementers to show results in terms of hectares enrolled, gradually disappeared as a result of the ordinance that guaranteed budget allocations to YPAT for the next 20 years. This long-term political and financial support is expected to release time pressures related to the yearly execution of public funds and to allow YPAT to pursue an active management approach in which "feedback and redesign cycles can be planned and enacted" (Sims et al., 2014: 1157).

4.6. Conclusions

In this study, we set out to investigate the relationship between re-targeting, equity and motivation crowding among excluded participants using the case study of YPAT scheme in Colombia. We have demonstrated the existence of three driving factors of institutional change in PES that were identified by reconstructing the history of the programme: (1) accumulated learning over time, (2) the entrance of a new relevant stakeholder, and (3) changes in environmental regulation. Further, our preliminary exploration of the effects of re-targeting in motivation crowding suggests that instead of crowding out motivations, the exclusion from a PES programme might reinforce intrinsic pro-environmental motivations.

We believe that this research opens up an important and underexplored research agenda which aims to gain a deeper understanding of the dynamic relationship between re-targeting, equity, and motivation crowding when participants are excluded from implementation as a result of changing rules, and not necessarily due to their violation of

PES requirements. Future research could benefit from qualitatively exploring fairness perceptions among removed participants to uncover potential reactions to exclusion. Further research can also gain from testing this relationship in an experimental manner to simulate exclusion, programme removal, and different contract lengths in a controlled environment.

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Chapter Five. Payments for ecosystem services and motivational crowding in Colombia's Amazon Piedmont

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Abstract

Globally, there is an increasing level of funding targeted to pay farmers and rural communities for the provision of ecosystem services, for example through Payments for Ecosystem or Environmental Services (PES) schemes and pilots for Reducing Emissions from Deforestation and forest Degradation, and maintaining or enhancing forest carbon stocks (REDD+). Therefore, there is growing interest in understanding the effects of economic incentives on participants' behaviour and motivations. We adopt here an innovative research design to test for motivational crowding effects through a forest conservation game in Colombia's Amazon Piedmont, using individual, collective and crop-price premium economic incentives. We implement a post-experiment survey on different types of motivations based on Self-Determination Theory (SDT) to test for changes in motivations. Our findings show that all types of PES, except for the crop-price premium payment, increased conservation behaviour in the experiment. However, not all types of payments affected motivations equally: collective payments enhanced social motivations to protect forests and the crop-price premium reduced intrinsic and guilt/regret related motivations. These findings contribute to disentangling the interaction between incentives, motivations and behaviours in a context of agricultural expansion and growing concern for forest conservation.

Key words: Ecosystem services, Payments, Experiment, Motivational Crowding, Colombia

5.1. Introduction

Environmental science and policy is increasingly interested in understanding if conservation initiatives that use direct monetary incentives to promote pro-environmental behaviours can unwillingly result in a "crowding out" effect. The latter would imply either an alteration or substitution of intrinsic motivations to protect and sustainably manage the environment by extrinsic and more instrumental motivations (Gómez-Baggethun et al., 2010; Kosoy & Corbera, 2010; Pascual et al., 2010; Sven Wunder, 2013). Understanding this alleged effect is relevant because increasing levels of international and national funding are channelled to pay farmers and communities to support pro-environmental behaviour (e.g. Payments for Ecosystem or Services at local and global scales)[14], which in turn sparks a growing concern over the temporal stability of such behaviours once economic incentives are removed (Fisher, 2012).

In this article, we investigate the relationship between motivational crowding, types of motivations, and the specific features of a simulated scheme of Payments for Ecosystem or Environmental Services (PES) in Colombia's Amazon Piedmont. PES usually involve the transfer of direct economic incentives to individuals and communities in exchange of specific or bundled ecosystem services, usually provided through sustained forest and biodiversity conservation activities. PES schemes emerged in the late 1990s as a policy tool to tackle deforestation and unsustainable resource use, and to maintain or provide specific ecosystem services (Engel et al., 2008), while payment conditionality was alleged to guarantee the provision of such services over time (Sommerville et al., 2010).

[14] As an example, Colombia recently launched the *Visión Amazonía* project, which will invest US$ 200 million (50% donated by international donors) until 2020 to halt deforestation processes completely. This project will be based on direct payments to landholders, and complemented by the BIOREDD+ program in Colombia, which aims to invest an additional US$ 27,8 million to promote sustainable livelihoods compatible with forest conservation.

Given their potential to involve less resource use restrictions relative to other conservation measures such as protected areas (Pagiola et al., 2005), PES have been widely promoted and implemented as an incentive for conservation in Latin America, Asia, and Africa (Grima, Singh, Smetschka, & Ringhofer, 2016).

The largest PES schemes worldwide have been often designed and implemented by governments, following a subsidy-like approach that targets specific ecosystems and mostly rural communities, while smaller initiatives have been brokered by NGOs and international donors, sometimes with the backing of national or sub-national governments (Engel, 2016; R Muradian et al., 2013; a Vatn, 2010). Most PES initiatives have delivered direct cash payments per hectare targeted at farmers or social groups, and very few have rewarded providers in-kind, either individually (e.g. individual beehives or barbed wire) or collectively (e.g. through the improvement of public goods) (Asquith, Vargas, & Wunder, 2008). Such diversity of PES schemes reflects the flexibility of the policy tool to adjust to specific contexts and needs, but it also entails analytical challenges when aiming to compare and assess their environmental effectiveness (Börner et al., 2017) and their contribution to human well-being (Alix-Garcia, Sims, Yanez-Pagans, & Shapiro, 2015; Arriagada, Ferraro, Sills, Pattanayak, & Cordero-Sancho, 2012; Calvet-Mir et al., 2015).

People's motivations to participate in PES have been qualitatively explored asking participants their reasons and perceived barriers to engage in such initiatives. In different countries, both instrumental (e.g. increasing household income) and non-instrumental reasons (e.g. maintaining forests' non-provisioning services) have been reported as key participation drivers (Bremer et al., 2014; Grillos, 2017; Hendrickson & Corbera, 2015;

Kosoy, Corbera, & Brown, 2008; Pagiola et al., 2005). However, very few studies have addressed the possible effects of payments on motivations over time (J. Fisher, 2012).

To understand such possible effects, we draw on Ryan and Deci's (2000) Self-Determination Theory (SDT) and build on the scarce research that has investigated motivational crowding in PES (Handberg & Angelsen, 2019; Kaczan et al., 2016; Midler, Pascual, Drucker, Narloch, & Soto, 2015; Narloch, Pascual, & Drucker, 2012; Salk, Lopez, & Wong, 2017; Vollan, 2008). Most of these studies use controlled economic experiments to recreate real life, individual decision-making dilemmas. In addition, these studies have, at least implicitly, equated motivational crowding to changes in individuals' behaviour. However, we sustain that concluding that changes in behaviour between experimental rounds are equivalent to motivational crowding is probably inaccurate, since observed behaviours in experiments may change after the introduction of an incentive while motivations may remain unchanged or their change might be lagged in time (Young, 1986). Furthermore, social psychology has noted that motivations and behaviour might not necessarily be aligned, and it has asserted that although motivations precede behaviours, the former can be shaped by institutions and previous behaviours (Agrawal, 2005; Steg & Vlek, 2009; Schulter et al. 2017)

To take into account this possible misalignment between motivations and behaviour, we introduce in our research design a post-experiment survey to observe if different types of payments during an economic experiment have an impact on participants' intrinsic and extrinsic motivations to protect forests. The survey allows us to distinguish between changes in behaviour and changes in different types of motivations. Furthermore, it allows us to attribute any changes in survey responses to participation in the experiment while controlling for observable variables.

Therefore, we understand crowding out as any reduction in pro-environmental motivations across control versus treatment experimental groups.

In what follows, we present a brief literature review on pro-environmental motivations and motivational crowding. Section three justifies the choice of the study site and section four presents our methodological approach. Section five discusses the results in the context of existing literature and the article concludes with a summary of findings and recommendations for future PES design.

5.2. Literature on motivations and experimental evidence

5.2.1. Motivational and crowding out theories

A general definition of motivation is "to be moved to do something" (R. Ryan & Deci, 2000), and motivation is thus a driving force of human behaviour. We draw here on the Self-Determination Theory (SDT) as proposed by Ryan and Deci (Ryan & Deci, 1985; Ryan et al., 2000)[15] because of its predictive power and the fact that it distinguishes across *types* of motivational processes (Moller, Ryan, & Deci, 2006). According to SDT, human motivation should be understood as a continuum between two extremes: intrinsic motivation and a-motivation. A person is *intrinsically motivated* to perform a task when such task is inherently interesting or enjoyable, while a person is *a-motivated* when she lacks an intention to act. In between, there are four types of *extrinsic* motivations (i.e. external regulation, introjection, identification and integration) that refer to doing something driven by external reasons (e.g. fear of punishment, avoiding the feeling of

[15] There are other theories about motivation, including e.g. the Two-Factor theory (Herzberg, 1965)the Expectancy value theory (Vroom, 1964)or the Self-efficacy theory (Bandura, 1977)

guilt or regret) or doing something because it leads to a separable outcome (e.g. money, reputation). These extrinsic motivations vary in their degree of *autonomy* (the individual's experience of choice) and *internalization* of external regulations by the individual's values and attitudes.

SDT posits that the process of moving away from or towards intrinsic motivation is determined by the interaction between the external incentive and three psychological moderators (autonomy, feelings of competence, and relatedness). Any incentive, including PES, that undermines an individual's autonomy, perceived confidence on reaching a goal, or her sense of belongingness to a community or social group is expected to crowd-out motivations, moving the individual towards the *a-motivation* extreme, driven for example by feelings of control aversion or frustration. In contrast, any incentive that supports or reinforces these psychological mechanisms is expected to do the opposite (Ezzine-de-Blas et al., 2019; Rode et al., 2015).

General knowledge on incentives and motivational crowding comes primarily from psychology (Deci, Koestner, & Ryan, 1999; Frey, 1994; Kahneman, Knetsch, & Thaler, 2011; Moller et al., 2006; R. Ryan & Deci, 1985, 2000), behavioural economics (Bowles & Polanía-Reyes, 2012; Gneezy, Meier, & Rey-Biel, 2011; Gneezy & Rustichini, 2000) and public policy literature (Ariely, Bracha, & Meier, 2009; Dolan, Hallsworth, Halpern, King, & Vlaev, 2011; Le Grand, 2006; Thaler & Sunstein, 2008; Titmuss, 1970). A common reported result in this literature is a negative effect of tangible rewards on intrinsic motivations. In the environmental policy domain, a review of 18 articles that tested for motivational crowding concludes that crowding out effects are more often reported than crowding in (Rode et al., 2015). However, the authors emphasize that some of the reviewed articles are unclear in their use of the term "motivation", which is often

used interchangeably with social norms, pro-social behaviours and even emotions (e.g. guilt, shame). This is not a minor caveat, since contributions from environmental psychology suggest that these are different concepts (Steg, Bolderdijk, Keizer, & Perlaviciute, 2014).

5.2.2. Motivations in environmental studies

In environmental psychology there is a prolific debate focused on disentangling the relationship between attitudes, values, beliefs, motivations and pro-environmental behaviours in urban settings (De Groot & Steg, 2008; Lindenberg & Steg, 2007; Steg, 2016; Young, 1986). Motivations are hereby understood as the reasons to engage in behaviours that benefit the environment (Steg et al., 2014; Steg & Vlek, 2009). Different theories of pro-environmental behaviour have developed their own instruments to capture the reasons people have to behave in an environmentally friendly manner, being the Environmental Motives Scale –EMS- (Schultz, 2000) the New Ecological Paradigm Scale –NEP- (Dunlap, Liere, Mertig, & Jones, 2000) and the Motivation Towards the Environment Scale –MTES- (Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998) the most cited and used.

However, as the set of pro-environmental behaviours is wide, it is no surprise that no single theory is broad enough to explain or predict every pro-environmental behaviour (Steg & Vlek, 2009). Additionally, scales are not completely exclusive and there are correlations between them (De Groot & Steg, 2010). Nonetheless, with different names and labels, in environmental psychology it is commonly accepted that pro-environmental behaviours are guided, in general, by reasons related to pleasure, moral duty and economic gains (Steg et al., 2014).

In the context of environmental conservation initiatives in rural areas, some authors have equated motivations to the set of reasons to engage in specific activities or initiatives, such as community-based conservation initiatives (Ruiz-Mallén et al., 2015; Souto et al., 2014), biodiversity provision contracts (Dedeurwaerdere et al., 2016; Greiner, 2015; Greiner, Patterson, & Miller, 2009), PES or integrated conservation and development projects (Bremer et al., 2014; Fisher, 2012; Hendrickson & Corbera, 2015; Kosoy et al., 2008; Rico García-Amado, Ruiz Pérez, & Barrasa García, 2013), and agri-environmental schemes (Lastra-Bravo, Hubbard, Garrod, & Tolón-Becerra, 2015; Ryan, Erickson, & De Young, 2003). These studies have relied on surveys, ranking exercises or semi-structured interviews to capture the factors and drivers of individuals' participation, which can be generally classified in two sometimes overlapping categories: instrumental vs. non-instrumental reasons. Among instrumental reasons, economic benefits derived from ecosystem services or social rewards such as recognition or reputation are included. Non-instrumental reasons include a sense of moral duty, respect for nature and animals, or stewardship ethics (Rode et al., 2015). However, motivation theory guides only a minority of these studies (Ruiz-Mallén et al., 2015) and most of them do not reflect a clear coherence between theory and the methods deployed. Our study addresses directly this gap by directly relying on SDT and MTES frameworks to capture pro-environmental motivations.

5.2.3. Experimental evidence in PES

Theoretical studies caution about the potential side effects of payments on intrinsic motivations (Corbera et al., 2007; Sommerville et al., 2009) but few have tried to measure these alleged effects. This void might relate to the fact that in order to examine whether PES crowd out other values one should ideally employ a longitudinal research design and

be able to determine causality of outcomes (Fisher, 2012 p.45). To date, two methodological approaches have been employed to address this challenge: quasi-experimental evidence and economic experiments. Grounded on quasi-experimental evidence, Agrawal et al. (2015) find that crowding out of motivations has occurred when participants of an environmental and development project in the Himalayas received private economic incentives while crowding in happened when participants received communal assets or collective benefits. In Cambodia, Chervier et al., (2017) show that PES participants report more money related reasons to protect forests and are more likely to break conservation rules after payments cease compared to a control group.

Studies using decision-making experiments to test for motivational crowding have been often structured around two stages: a first stage that sets the behavioural baseline, i.e. recreating a situation in which no communitarian, governmental or market regulatory mechanisms are implemented to manage forests, and a second stage in which an incentive or regulation is introduced to allow for a comparison of individuals' behaviour between phases 1 and 2. Crowding in happens when the desired environmental behaviour in phase 2 (with incentives) is higher than in phase 1 (without incentives), while crowding out occurs when the opposite is observed. However, as noted earlier, the problem of this approach is to implicitly equate changes in behaviours to changes in motivations, which is problematic given that observed behaviours may change in the experiment but motivations may remain unchanged, or their change might be lagged in time. Hence, the durability of observed behaviours depends on the motivations operating behind (McClelland & Canter, 1981; Moller et al., 2006; Young, 1993).

Four out of six experimental studies identified find no support for the behavioural crowding out hypothesis (Handberg & Angelsen, 2019; Kaczan et al., 2016; Salk et al.,

2017; Vollan, 2008) while the other two (Midler et al., 2015; Narloch et al., 2012) conclude that crowding out occurs when collective payments are implemented and crowding in when payments are granted individually (Table 5.1). Only two of these five studies have added a third stage in which the incentive is removed to test the persistent effects of the incentive (Kaczan et al., 2016; Salk et al., 2016). These studies have been developed in very different institutional contexts, using distinct types of experiments and lack a baseline of motivations, which limit their ability to generalize about both behavioural and motivational crowding in PES. By combining an economic experiment with a motivations-focused survey, our study thus aims to analyse separately motivations and behaviours and provide a more nuanced analysis of the interaction between motivations and behaviours under different types of payments.

Table 5.1. A review of experimental economics and quasi-experimental studies measuring motivational crowding.

Study	Country	Method	Crowd out	Crowd in
1. Vollan (2008)	South Africa and Namibia	Experimental Economics: Common Pool Resources game-Penalty vs payment/ Controlling vs. Supportive intervention High vs low self-determination/ trust and social norms	No evidence	No evidence
2. Agrawal, Chhatre and Gerber (2015)	India	Quasi-experimental Before and after Matching with non-participants	When participants received private economic benefits	When participants received communal assets or collective benefits
3. Narloch et al. (2012); Midler et al. (2015)	Perú and Bolivia	Experimental economics: agro biodiversity game- public goods game with threshold- individual and collective payments w/wo communication	Collective payments crowd out social norms	Individual payments crowd in social norms
4. Chervier, Le Velly and Ezzine-de-Blas. (2017)	Cambodia	Quasi-experimental Matching with non-participants	Participants reported more money related reasons to protect forests and were more likely to rule breaking after payments cease	No evidence
5. Handberg and Angelsen (2017)	Tanzania	Experimental economics 0%, 20%, 60% and 100% PES in a public goods game	No evidence	No evidence
6. Kaczan, Swallow and Adamowicz (2016)	Tanzania	Experimental economics: Dictator game- Individual vs. collective payment low and high mandated levels of contribution, backed by penalties	No evidence	No evidence
7. Salk, López and Wong (2017)	Lao PDR	Experimental economics: Common pool resources game Individual, collective and insurance payments	No evidence after incentive removal	No evidence after incentive removal

5.3. Case study and methods

5.3.1. *El Caraño* in *Caquetá*

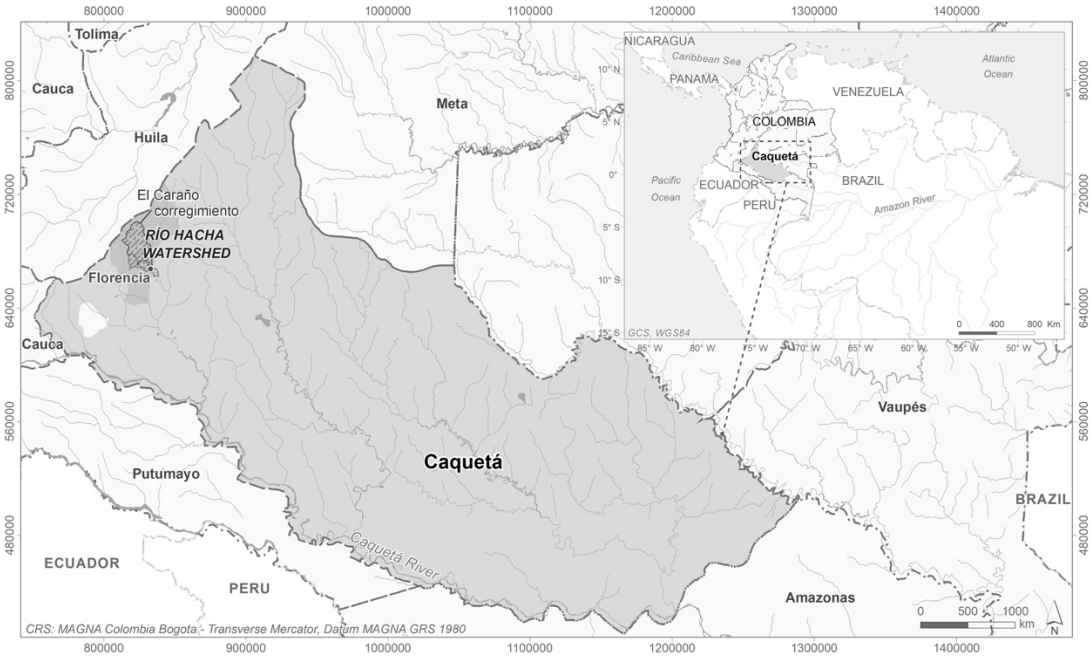
This research was conducted in the *corregimiento*[16] of *El Caraño*, municipality of Florencia, department of *Caquetá*, south-west Colombia (Figure 5). *El Caraño* sits within the Amazon Piedmont, an ecological transition zone characterized by high rates of biodiversity and deforestation and laying between the Andes and the tropical Amazon rainforest. Two of the main tributaries of the Amazon river, the Caquetá and the Putumayo rivers, start in the Amazon Piedmont.

Deforestation in *Caquetá* was the highest of Colombia in 2015, with 23.812 hectares lost (IDEAM, 2016) as a result of expanding agricultural and cattle rearing activities. 18.7% of the remaining forests in *El Caraño* are highly vulnerable to deforestation because they can be easily reached by road, which facilitates the advancement of the agricultural frontier, and the development of illegal logging, mining exploration and charcoal making activities (Vélez et al., 2016). Not surprisingly then, several public, private, and multilateral conservation initiatives have targeted or plan to operate in *Caquetá*. The department is one of the selected strategic zones for piloting the 2017 National PES programme and it is one of the districts where the national NGO Patrimonio Natural (PN) plans to design and start the implementation of a PES scheme within the next few years. This research is part of a scoping study to support PN in the design of such PES scheme.

[16] A Colombian administrative unit that involves a specific number of rural districts.

Our study involved participants from 13 rural districts in *El Caraño*, where land tenure is mostly informal: 65% of research participants do not hold any legal land title but claim possession of their farmed and forest plots. Plots are located either inside the National Forest Reserve of the Amazonia- public lands- or are legally owned by large private landholders. Settlements in the area are the product of violent conflict in other regions that forced families to re-locate. This settlement pattern is important because many of the inhabitants are officially considered *colonos* who cleared the forest to plant subsistence crops (Vázques- Delgado, 2015). The median farm size of the research participants is 15 hectares and approximately 5% of plot size is allocated to coffee cultivation, which is the main cash crop in *Caquetá*, alongside sugarcane (6.2%) and profitable cattle rearing.

Figure 5. Location of Río Hacha watershed.



Source: cartographic data from Digital Chart of the World, GDAM, SO HYBAM and IGAC 2014.

Forests cover 50% of the research participants' plots on average, while the rest is allocated to farming and cattle. Material conditions vary greatly: some farmers have extremely precarious living conditions (e.g. very low income and no kitchen or toilet in their house) while others are above the municipality average condition (e.g. a well-equipped house and various productive assets). Average household size is 4 people and families arrived approximately 11 years ago to *El Caraño*, with some settiling more than 40 years ago and others only a few months before our study (Vélez et al., 2016).

5.3.2. Methods

To explore the effects of PES on farmers' motivations we relied on two research instruments: a framed field economic experiment and a post-experiment survey. We also conducted a preliminary fieldwork process that included a series of interviews (n=7), workshops with community members (n=52), and deploying a pilot questionnaire in seven rural districts of *El Caraño* to test the motivation survey and to gather key socio-demographic, productive and environmental knowledge data (n=100). Between the 5th and the 10th of September 2016, 257 farmers participated in an experimental economics game and responded to a motivations-related survey after the experiment[17].

Participants were randomly assigned to control and treatment groups. Participants in the control groups (CGs) participated in a game without any PES involved, and participants in the treatment groups (TGs) played a game with one out of four possible payment types. Our test of motivational crowding is based on the comparison of post-experiment survey responses between CGs and TGs following a between group design. Crowding out is thus

[17] They were also invited to a socialization workshop to discuss research results in September 10th 2016, which was attended by 85 research participants.

understood as any *negative* difference in the responses to the motivations survey between groups; crowding-in is, in contrast, understood as any *positive* difference in the motivations survey comparing control vs. treatment groups. Hence, any difference on motivations between groups (CGs vs TGs) can be attributed to participation in the experiment[18].

As noted in the Introduction, we develop a post-experiment survey to compare participants' experimental behaviour with their survey responses in order to grasp more accurately the extent to which payments crowd-in or crowd-out motivations to conserve the forest. Experimental behaviour reveals participants' willingness to conserve in response to different incentives, but it does not say anything explicit about the kind of motivations that have driven such behaviour. The latter can, however, be captured through the survey. An alternative research design would have been to conduct a survey on motivations *before* and *after* the experiment (*within* research design). Two main reasons refrained us to do so: first, it is very likely that asking participants to respond to a survey on forest protection *before* participating in the experiment would have influenced their behaviour in the game towards more conservation behaviour. Second, we wanted to avoid that participants sought for consistency in their responses before and after the experiment (Festinger, 1962). Thus, and given our *between* group design approach, the recruitment strategy was set in order to ensure that individuals were randomly assigned to sessions and groups.

[18] We cannot rule out that CGs participants' motivations could have changed before and after the game. However, this possibility does not undermine our results. If CGs motivations are enhanced (or diminished) as a result of the baseline game, all our participants experienced the same baseline and the difference between them could only be related to the treatments. If anything, it would be harder for us to find significant differences between CGs and TGs, which is not the case.

Each participant received a written note including the date and hour of her/his session and slots were allocated randomly across villages and families. This random allocation to groups and sessions allowed us to control for observable and un-observable variables, such as pre-existent motivations to protect forests. Eleven game sessions were conducted in Spanish with the support of six research assistants. Each session implemented a different treatment. Farmers, both men and women older than 18 years, were invited both face-to-face by two research assistants and through a local leader. The sessions were implemented in a local school of a village that was conveniently located for ensuring participants' attendance. Each round of the experiments and the post-experiment survey were delivered in two sessions of 3 hours per day. Between 12 and 28 people participated in each session[19]. Before deploying the experiment and the survey, we introduced the project's aims to targeted participants and obtained their verbal consent, ensuring they had understood that participation was voluntary and that they could leave at any time (Appendix 10 and 11).

The economic experiment

Our experiment is an adapted version of the public goods game with threshold by Narloch et al. 2012 and Midler et al. 2015 (hereafter Narloch and Midler). This experiment recreates a situation in which the environmental service is provided only if the group accomplishes a specific environmental objective (threshold). The threshold aims to recreate real-life situations in which the provision of an ecosystem service (water in our case) is conditional on collective performance (conservation of the forest). Also, the

[19] Total number of participants in the experiment were 260. However, three participants left before conducting the survey and we have no socio-demographic data for them and are not included in our regression analysis.

payment to farmers is granted only if the group complies with the threshold. This feature captures the objectives of the environmental organization operating in the area, which is interested in regional scale impacts rather than programs tailored at individual-farm performance. We extended Narloch and Midler design by implementing also a voting for the preferred payment and a payment in the form of a crop-price premium (Table 5.2). Our design also differs in its framing and number of rounds. While the mentioned articles frame the decision around traditional vs. commercial crop cultivation, our framing relates to forest conservation vs. crop cultivation. And while in Narloch and Midler the public benefits resulting from reaching the threshold are generic, ours refer specifically to the provision of water. In our design, the benefits of water provision (not quality or water improvement but quantity) are monetized. We conducted 10 rounds (and two additional ones for practice that are not analysed), while Narloch and Milder implemented 12 rounds.

At the beginning of each session, the lead author of this paper read the instructions of the experiment following the conventional procedure for lab-in-the-field experiments. Posters with visuals were used to complement instructions and facilitate participants' comprehension of the experiment (Appendix 12). After explaining the instructions, participants were randomly assigned to groups of 4 people by picking out a piece of paper marked with a letter and a number. Letters identified groups and numbers the participant within a given group.

In each round (t), each participant (i) received 4 units of land and had to privately decide how to use the land: to conserve forests (f) or plant crops (c). For each land unit with forest cover (x_f), each participant received \$100 pesos (USD 3 cents). For each unit of

land with planted crops (x_C), each participant received \$600 (USD 20 cents)[20]. If the group reached a threshold of units of forest, then a public good (PG_i) in the form of water from the forest, and equivalent to \$200 pesos (USD 6 cents) for each unit of forest in the group, was provided to each participant regardless of his/her own level of forest conservation contribution. Participants are informed about the threshold at the beginning of the experiment. In the experiment, economic returns from crops are higher than those from forest conservation to recreate the current situation in the region, where economic earnings from forests in the form of timber, firewood, medicines or food are lower than the market returns farmers can get from selling their agricultural harvest.

The experiment was structured around two stages: the baseline stage (rounds 1-5) and the payment stage (rounds 6-10). The difference between the two stages is that in the second stage a payment for conservation was introduced. Please note that CGs play all 10 rounds without receiving payments. We did not introduce a third stage removing the incentive (see Kaczan et al. 2016; Salk et al. 2016) because of methodological challenges related to the deployment of the post-experiment motivations survey. Table 5.2 describes the resulting numbers of participants according to different treatments.

Table 5.2 Number of participants and groups by treatment.

Treatments	Control group	Individual Payment	Collective Payment	Crop-price premium payment	Voting	
					Individual by voting	Collective by voting
N=	52	52	52	52	20	32
groups	13	13	13	13	5	8

[20] Payoffs were set to cover opportunity cost of participants based on daily wages in the zone which range between 20.000-40.000 pesos (6- 12 euros). Earnings in the experiment ranged from 24.000-54.000 (6-16 euros) for three hours of participation.

The baseline rounds

During the baseline rounds, participants decided and marked their preferred combination supported by a "payoff table" (Appendix 13). Subsequently, a researcher added up the total units of land covered by forests (the sum of the land units covered by forest from each of the 4 participants ($\sum X_f$),), and she/he announced whether a threshold (θ) of 7 units had been reached. If so, and as noted earlier, a public good (PG_i) in the form of water from the forest, and equivalent to $200 pesos (USD 6 cents) for each unit of conserved forest in the group, was provided to each participant regardless of his/her own contribution to forest conservation. Therefore, as far as the minimum conservation threshold of 7 units was reached, this design allowed free-riding because participants who had not contributed to forest conservation could benefit from others' conservation efforts. Participants' earnings during the baseline rounds depended then on combining their private earnings from their own land-use choices –either forest or crops- ($x_{fit} + x_{cit}$) and the aggregate conservation levels of their group which yielded collective earnings from water provision ($\sum X_f$). Each participant (i) had thus the following payoff function in the baseline stage:

$$\pi_{it} = \begin{cases} \$100x_{fit} + \$600x_{cit} + \$200\left(\sum X_f\right) & if \sum X_f \geq 7 \\ \$100x_{fit} + \$600x_{cit} & if\ otherwise \end{cases} \qquad (1)$$

For example, if one participant allocated 2 units of land to crops and 2 to conserving forests his private earnings were $1.400 ($100x2 + $600x2). If, additionally, the group had managed to conserve a total of 7 forest units, the participant gained an additional sum of $200 pesos for each unit of forest conserved by the group ($200x7). Total earnings for this participant in this round were thus $2.800 pesos (see Appendix 13 for payoff table).

Choosing forest instead of crops represented a direct cost to participants of $500 pesos per unit of land ($600-$100) while the provision of the public good was uncertain since it depended on the decisions of other group members.

To understand players' best strategy during the baseline one needed to consider players' expectations about others' behaviour. If player (i) expected that the threshold was not going to be met, his best strategy was to allocate zero units of land to forest. If he expected the threshold to be reached, the best strategy was to allocate one or two units of lands to forest. The social optimum, i.e. when the group's aggregate earnings are maximized, resulted from each farmer allocating four units of land to forest. However, the social optimum is never a Nash equilibrium because there are always incentives to defect (Appendix 14).

The payment rounds

During the second stage (rounds 6-10) one of 4 different payments was implemented only if the community conserved a minimum of 7 units of forest. In other words, if the forest conservation threshold of 7 units was reached, each participant gained the $200 pesos for the provision of water, plus an additional monetary payment recreating a payment for ecosystem services. Following Midler et al. (2015) we introduced both individual and collective payments because these are feasible payment alternatives for the environmental organization operating in the area.

Each farmer played one of the 4 different payments after playing the baseline. All four payments were framed as if a generic environmental organization (OA, *organización ambiental* in Spanish) aimed to pay for the protection of biodiversity and forest ecosystem

services (e.g. climate regulation, soil protection and landslides prevention). The private payment for conserving the forests was $200 pesos for each unit of forest conserved, and only if the group collectively reached the threshold of 7 units of forest conservation. This meant that each participant was paid the following amount, according to his/her own conservation effort:

$$\pi_{it} = \begin{cases} \$100x_{fit} + \$600x_{cit} + \$200\left(\sum X_f\right) + \$200x_{fit} & if \quad \sum X_f \geq 7 \\ \$100x_{fit} + \$600x_{cit} & if\ otherwise \end{cases} \quad (2)$$

The collective payment consisted of a payment of $50 pesos per unit of land allocated to forest conservation by the group, and again only if the group had a minimum of 7 units of conserved forest. Unlike the private payment, in the collective payment each participant was rewarded according to the group collective conservation effort ($\sum X_f$):

$$\pi_{it} = \begin{cases} \$100x_{fit} + \$600x_{cit} + \$200\left(\sum X_f\right) + \$50\left(\sum fX_f\right) & if \quad \sum X_f \geq 7 \\ \$100x_{fit} + \$600x_{cit} & if\ otherwise \end{cases} \quad (3)$$

The crop-price premium payment had not been included in Midler et al. 2015. Each participant received $150 pesos for each unit of land allocated to crops only if the group allocated at least 7 units of land to forest. This payment aimed to recreate a situation in which efforts to preserve the forests were rewarded via a crop-price premium in agricultural products. Unlike the individual and collective payment, the crop-price premium condition explicitly considers that conservation and economic goals are not mutually exclusive, with the payoff function under this payment being as follows:

$$\pi_{it} = \begin{cases} \$100x_{fit} + \$600x_{cit} + \$200\left(\sum X_f\right) + \$150x_{cit} & if \ \sum X_f \geq 7 \\ \$100x_{fit} + \$600x_{cit} & if \ otherwise \end{cases} \quad (4)$$

Finally, in the voting payment, each person voted individually and privately before round 6 for their preferred payment between three options: no payment, individual or collective. The option with more votes was then implemented for the rest of the rounds. If there was a tie a coin was thrown. This feature was introduced to simulate a situation in which some level of agency, or participation in the design, is allowed. Voting on design features has been explored in common pool or public good studies with mixed results (Cherry & Shogren, 2007; Vélez et al., 2012; Wahl et al., 2010; Walker et al., 2000).

Depending on the expectations of others and assuming that individuals are profit maximisers, all payments are expected to increase the units of land allocated to forest because they expand the set of best strategies compared to the baseline rounds. However, under the crop price premium incentives to defect are higher because a payment for ecosystem service is provided conditional on the accomplishment of the environmental threshold, but final earnings depend on the individual units of land allocated to crops. Nash equilibria and best strategies for collective and crop-price premium are the same, but different from private payment (following original design). Hence, our experimental analysis is conducted comparing baseline vs. payment rounds for each type of payment. We did not have a hypothesis of which payment would work better in terms of forest conservation, but based on Midler and Narloch findings, we expected that individual payments would increase forest conservation levels compared to the no-payment condition. Payments decided by voting were also expected to increase forest conservation because this mechanism would, in theory at least, enhance feelings of autonomy and competence.

The motivations survey

We used the results of the pilot questionnaire as the basis for the design of the post-experiment survey. The pilot questionnaire was developed taking into account Ryan and Deci's SDT (2000) and Pelletier et al.'s MTES principles (1998) with six motivation categories. Each category included four statements or items, and participants were asked to respond from 1 to 4 if they agreed with the provided sentence. Items were anchored to deforestation because of its relevance to our study site: perception among inhabitants is that forest clearing is the main environmental problem they are actually facing (according to survey responses), and *Caquetá* is also the most deforested department in the country (IDEAM,2016).

A factor analysis of the pilot questionnaire results was conducted to determine the consistency of motivation categories and reduce the dimensionality of data. As a result, the final survey we employed after the economic experiment contained eight motivation items that had factor loadings[21] above 0.55 as suggested by Hair et al. (2009) and that conceptually captured four types of motivations to protect the forests that vary on their degree of being internally or externally driven: intrinsic, guilt/regret, social, and extrinsic motivations (Table 5.3).

Purely intrinsic motivations are the most self-directed and do not require the support of external institutions or incentives to persist over time (Pelletier et al., 1998). In the context of our study, they relate to the inherent pleasure or joy that arises from protecting forests.

[21] Factor analysis is a statistical method that describes the variability between observed and correlated variables in terms of a smaller number of unobserved variables, or *factors.*

According to SDT we can expect that feelings of autonomy or self-competence might trigger intrinsic motivations to protect forests.

Guilt/regret motivations are explained by one's desire of aligning with the values and beliefs held by a group of people, community or society, and they are related to ones' need of self-approval. The feeling of guilt/regret thus acts as an internal motivator to perform a particular task, but is externally influenced. In our study, these motivations refer to the feelings of guilt/regret that may arise as a result of deforesting, particularly when conservation is related to moral or ethical principles (Werff, Steg, & Keizer, 2013). According to SDT theory, guilt/regret could be triggered by moderators such as competence because individuals might feel frustrated/satisfied and their self-esteem or self-image might be reduced/enhanced.

Social motivations are related to the need of being accepted by others and maintaining certain social reputation, and they are thus also influenced by external institutions and customary practices. In our study, they refer to people's fear of being criticized by local peers and significant others that may promote socially and environmentally desirable behaviours (Kinzig et al., 2013). As for guilt/regret, the need to adhere to the social norm or maintain a certain reputation reflects the fact that social motivations are both internally and externally triggered. The moderator of social relatedness- or "the quality of one's relations with others" (Ezzine-de-Blas et al. 2019) - is expected to activate social motivations through reinforcing or reducing image motivation.

Finally, purely extrinsic motivations are those explained by the existence of direct incentives (e.g. payments) or penalties (e.g. fines), which exert as direct behavioural

drivers. In our study, these are represented by payments and fines designed to either encourage conservation or discourage deforestation (Table 5.3).

Table 5.3 Description of the survey motivation items, SDT moderators and the correspondent statements.

Motivation	Description	SDT moderators	Survey statements
Purely intrinsic	Captures inherent interest for forest conservation as well as self-endorsement of forest protection	Autonomy and competence	1. "I enjoy when I do not clear the forest" 2. "I see myself as someone who does not clear the forests"
Guilt or regret	Captures motivations related to need of self-approval	Competence	1 "I would feel guilty if I were to clear the forests" 2. "I would regret it if I were to clear the forests"
Social	Includes motivations that rise from the need of social approval or reputation	Social relatedness	1. "I would be criticized by my neighbours if I were to clear the forests" 2. "Significant others would be upset if I were to clear the forests"
Purely extrinsic - Incentives	Captures motivations that emerge exclusively from external payments	Combination of three moderators	"I would take care of forests only if I am paid to do so"
Purely extrinsic - Penalties	Captures motivations that emerge from fear to fines	Combination of three moderators	"I do not cut down the forests because of fear to fines that might be imposed by environmental authorities"

Our final survey used a four-point Likert scale to capture variations in the motivations to protect forests. The scale was symmetric, ranging from 1 (totally disagree) to 4 (totally agree), and did not have a central point with the aim of forcing respondents to go in one direction or another and eliminate the risk of neutral responses (Lozano et al., 2008). Socio-demographic information on gender, income, education level and economic activities as well as information related to forest management was also collected. The post-experiment survey took between 20-40 minutes and we used an open access mobile application (KOBO) to input responses offline and make data cleaning and analysis more efficient afterwards. Visual supporting material was also used to help participants note if they agreed with the sentence.

5.4. Results

5.4.1. Checking for randomization among groups

To compare survey responses between groups we needed first to establish if CGs and TGs were indeed comparable. We conducted t-tests for participants' age and monthly income, and chi-squared tests on proportion of men and women, and on levels of education. We found no statistically significant differences between CGs and TGs on observable socio-demographic characteristics (see Appendix 15 for sample details). There were some differences across treatments and we controlled for them in the regression analysis, but note that our main reference for comparison is CGs vs TGs.

We also conducted a regression analysis of allocations of forest in round 1 and in round 5 using a Tobit model[22]. Analysis of round 1 allowed us to capture initial levels of conservation and to determine whether groups started off with similar levels and thus were comparable. Analysis of round 5 allowed us to establish the dynamics in baseline stage across treatments and to check for particular trends that might affect our results. Conservation levels in round 1 were higher for participants in the individual payment treatment compared to the CGs and lower for the individual payment by voting compared to the CGs. In round 5 these initial differences disappeared for the individual payment treatment but remained for the individual payment by voting. In the behavioural analysis (see below), we used a difference-in-difference model (DiD) to control for such differences.

[22] Regression is not included but available upon request.

5.4.2. Motivations under different types of payments – survey results

Although our research design implemented the economic experiment first, followed by the motivations survey, we present below the survey results followed by the experimental results for analytic and argumentative purposes.

Descriptive statistics

We created an index of intrinsic, guilt/regret and social motivations as the average of the two items in each category[23]. For fines and payments, we did not build an index because there is only one item for each category. Figure 6 presents mean values for each type of motivation across treatments. Motivations range from 1 to 4 and higher values means more motivation of a specific type.

[23] Correlation coefficient between the two intrinsic items is 0.2539; between the two guilt/regret items is 0.3837 and for the social items is 0.5429. All correlation coefficients are statistically significant at 1. Correlation coefficient between intrinsic and payment type of motivations is negative (as expected because they measure conceptually opposite types of motivations) and statistically significant at 1%.

Figure 6. Mean values for different types of motivations. Asterisks mean statistically significant differences between CGs and each TGs using a Kruskal-Wallis test (*** p<0.01, ** p<0.05, * p<0.1).

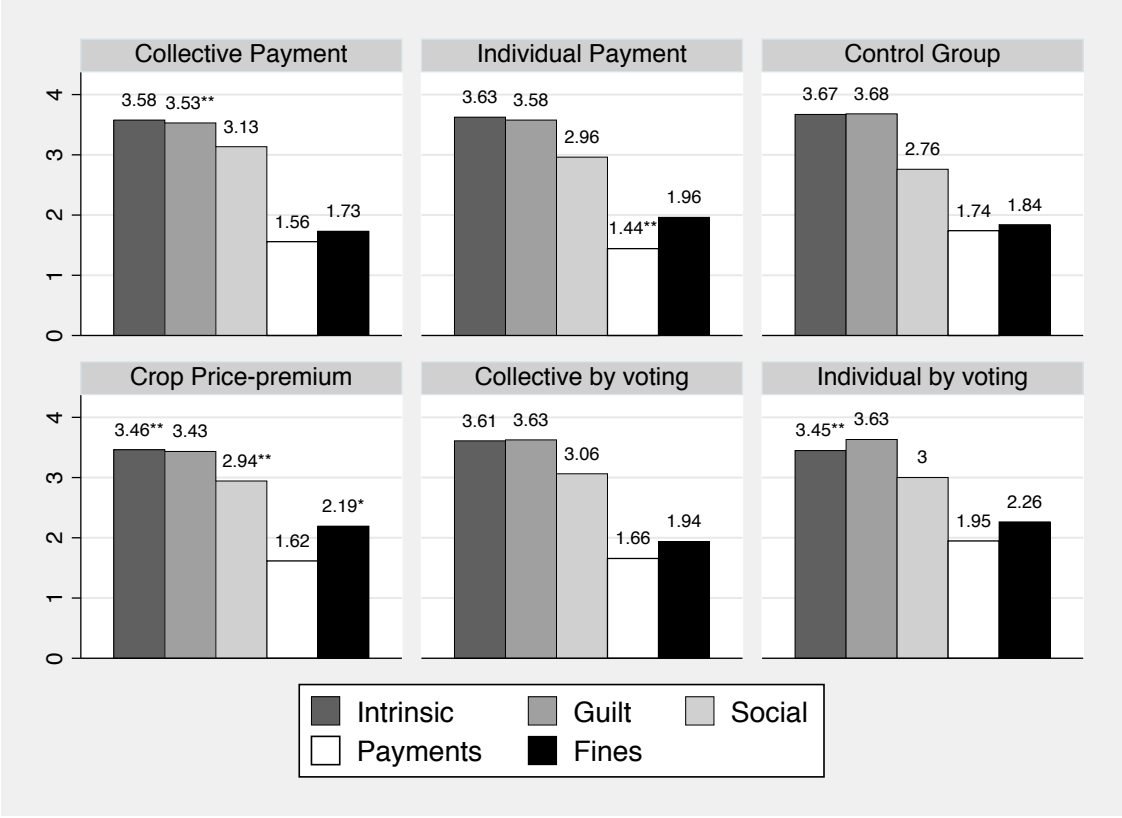


Figure 6 shows that higher values were reported for intrinsic and guilt/regret related motivations to protect forests across treatments. Social motivations appeared less important, and expectations of payments and fines did not seem very relevant. Histograms of each type of motivation per treatment show that the distribution of motivations is not symmetric (Appendix 16). We also compared the motivations of the CGs[24] and treatment groups using a Kruskal-Wallis test, which compares the medians of an ordinal variable between two or more groups when data distribution are not symmetric. In doing so, we found statistically significant differences between CGs and TGs.

[24] We also conducted Kruskal-Wallis test comparing motivations across treatments and found statistically significant differences at 10% in intrinsic, guilt and fines motivations between collective payment and crop Premium Price; differences at 10% in intrinsic motivations between individual payment and crop Premium Price; and differences at 10% in guilt motivations between crop premium price and collective payment by voting.

For example, we found that intrinsic motivations were lower for the crop-price premium group (p-value< 0.05) and the individual payment by voting group (p-value<0.05) compared to the CGs. We also found that social motivations were higher for the group that received the collective payment (p-value<0.05) compared to the CGs. Guilt/regret related motivations were lower for the group that received the crop-price premium payment (p-value<0.01) compared to the CGs, while extrinsic motivations related to payments were higher for the group that received the individual payment (p-value<0.05) compared to the CGs. Finally, we also found that extrinsic motivations related to fines were higher for the group that received a crop-price premium payment (p-value<0.1) compared to the CGs.

After this analysis, we conducted an ordered logistic regression for each type of motivation and controlled for socio-demographic variables and self-reported deforestation, as well as we included a dummy for each different type of payment to capture the effect of the treatment compared to the motivations in the CGs. Our dependent variables, each type of motivation, takes values from 1 to 4. The five resulting regressions for each motivation category are presented in Table 5.4 (see Appendix 17 for models with different specifications to test for consistency in our results). Coefficients represent the expected increase in the probabilities of the dependent variable due to an increase in the independent variable.

Not all types of payments crowd out motivations

Table 5.4 column (1) shows that crop-price premium payment has a negative effect on *intrinsic motivations* to protect forests (significant at 5%). Being able to vote on the type of payment has also a negative effect on intrinsic motivations. These results suggest a

crowding out effect of the crop-price premium payment and the individual payment by voting on intrinsic motivations to protect forests. Note, however, that for the case of the voting treatment, we need to be cautious on claiming causality since, as explained in the following section, these are self-selected groups by definition. Voting treatment is assigned randomly across groups, but the decision on the type of payment is not. Therefore, group behaviour in the first stage of the game might influence the voting decision.

Regarding the effect of demographics on intrinsic motivations, no difference is observed comparing men and women, or comparing by age groups. However, a higher level of education has a positive effect on intrinsic motivations to protect forests. If the participant reported to have cut down the forest or sold timber in the past, intrinsic motivations to protect forests are more likely to decrease compared to a participant who has never deforested or sold timber.

Column (2) shows that guilt/regret related motivations to protect forests are crowded out when an incentive in the form of crop-price premium is introduced compared to the CGs controlling for the correspondent socio-demographics. Contrary to intrinsic or social motivations (read below), guilt/regret motivations seem to be explained only by age, where older participants are more likely to report higher motivations related to guilt or regret compared to younger ones.

Column (3) suggests that participating in a collective payment (either pre-defined or selected by voting) vs CGs increases the likelihood of being sensitive to social motivations to protect forests. Note again that in the case of voting treatment we need to recall the self-selection nature of these groups and thus be cautious in interpreting these

results. However, this result suggests a crowding in effect of collective payments on social motivations to protect the forests. Socio-demographic factors explain to a small extent the participants' social motivations to protect forests: it is observed that older participants are more likely to report more social motivations to protect the forests than younger ones.

Finally, Table 5.4 also shows that responses to "I would take care of forests ONLY if I am paid to do so" (column 4) and "I do not cut down the forests because I am afraid of being fined by environmental authorities" (column 5) are not affected by the type of payment in the experiment (no significant differences). Men were more likely to report external payments or fines as the only reason to protect forests compared to women, and some level of education (e.g. primary school not finished) and higher levels of formal education decreases the probability of reporting payments as the only reason to protect forests, compared to participants without formal education. Older and more educated participants were less likely to report fines as a reason for forest protection compared to younger and not educated participants.

Table 5.4. Ordered logit regression for each type of motivation controlling for socio-demographic variables.

Variables	(1) Intrinsic	(2) Guilt/Regret	(3) Social	(4) Payments	(5) Fines
Individual payment	-0.576	-0.424	0.602	-0.668	0.319
	(0.427)	(0.393)	(0.371)	(0.442)	(0.424)
Collective payment	-0.372	-0.377	**1.021*** **	-0.349	-0.0720
	(0.445)	(0.413)	(0.376)	(0.427)	(0.436)
Crop-price premium payment	**-0.999** **	**-1.019*** **	0.558	-0.253	0.492
	(0.412)	(0.383)	(0.362)	(0.404)	(0.406)
Individual by voting	**-1.229** **	-0.299	0.328	0.400	0.848
	(0.531)	(0.527)	(0.468)	(0.580)	(0.557)
Collective by voting	-0.500	-0.341	**0.757***	-0.106	0.151
	(0.474)	(0.459)	(0.418)	(0.490)	(0.493)
Sex	-0.251	0.0229	-0.273	**0.699** **	**0.612** **
	(0.264)	(0.249)	(0.233)	(0.286)	(0.271)
Age	0.00823	**0.0231** **	**0.0276*** ** *	-0.00645	-0.0241**
	(0.00982)	(0.00949)	(0.00877)	(0.0109)	(0.0101)
Primary school incomplete	0.668	-0.260	0.162	**-1.236** **	-1.331***
	(0.466)	(0.475)	(0.422)	(0.497)	(0.459)
Primary school complete	0.305	-0.307	0.306	-0.508	-1.155***
	(0.412)	(0.442)	(0.380)	(0.420)	(0.420)
High school not finished	0.696	-0.476	0.444	-0.971*	-2.488***
	(0.541)	(0.556)	(0.481)	(0.571)	(0.581)
High school finished	-0.00837	-0.221	-0.267	**-1.764*** **	-2.311***
	(0.500)	(0.522)	(0.464)	(0.606)	(0.549)
More than high school (university, graduate)	**1.482** **	-0.0199	0.292	**-2.079*** **	-2.570***
	(0.587)	(0.550)	(0.492)	(0.691)	(0.647)
Has cut down the forest?	**-1.230*** **	**-0.501***	-0.399	0.239	0.242
	(0.277)	(0.272)	(0.252)	(0.298)	(0.284)
Want children to become farmers?	0.261	0.144	**-0.595** **	-0.0429	0.418
	(0.290)	(0.281)	(0.268)	(0.323)	(0.310)
Observations	257	257	257	257	257

Standard errors in brackets: *** p<0.01, ** p<0.05, * p<0.1

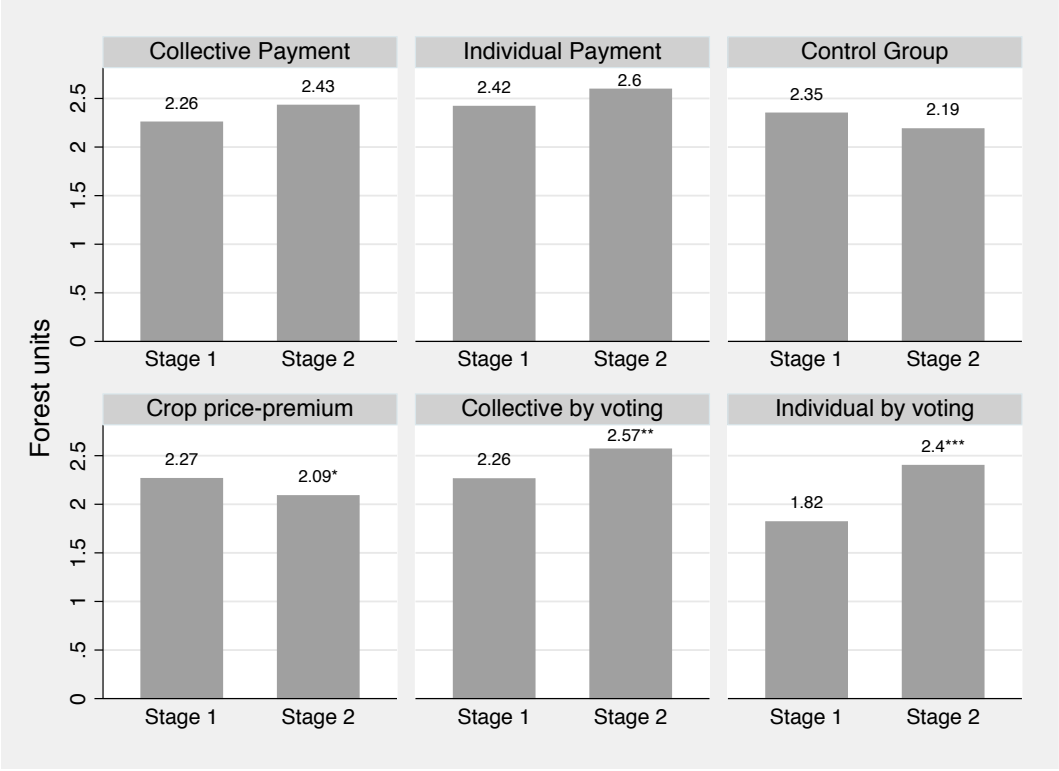
Behaviour under different types of payments - experimental results

Figure 7 describes the average units of land allocated to forest and the success rate by payment, comparing stage 1 with stage 2. This comparison reflects conservation levels *within* groups and it allows us to infer if the payment was effective *under* a particular type of payment. Conservation levels are high enough across treatments in stage 1 (from 1.82 to 2.42/4) and the success rate, calculated as the percentage of rounds in which the total forest in the community is greater than 7 units, is very high for all treatments except for individual payment by voting (56%). In the first 5 rounds of the CGs, for example, 90% of the rounds were observed to meet the threshold. This behaviour might reflect the effect that the threshold has on cooperation for conservation as it provides a clear sign of the desired behaviour and a focal point for coordination. This puts additional challenges for payments effectiveness because participants are already conserving forests without any external financial incentive (see Appendix 18 for success rates across treatments).

For CGs, Figure 7 shows that without any payment to protect forests units of land allocated to forest decrease from stage 1 (2.35) to stage 2 (2.19). This difference is not statistically significant but gives a first insight of what we can expect when running regressions that control for observables. For TGs, we observe a general increase in forest units except for crop-price premium. There are statistically significant differences for crop-price premium payment (p-value<0.1), collective payment by voting (p-value<0.05) and individual payment by voting (p-value< 0.01).

However, in the first stage, there are differences in the average forest units conserved between individuals who voted for individual payment and those who voted for collective payment: the former showed a lower average of forest units than the rest, which suggest that they might have been influenced by group dynamics during the first stage of the game[25].

Figure 7. Average units of forest by type of payment and per stage. Asterisks denote differences comparing stage 1 and stage 2 conservation levels per treatment (*** p<0.01, ** p<0.05, * p<0.1).



[25] Of the 13 groups that played under the voting treatment, in 4 groups there was a tie between the options and it was necessary to throw the coin to decide which treatment was played in the following 5 rounds. However, whether the payment was by majority or random does not seem to affect overall results. Of the 13 groups that played under the voting treatment, in 8 won the collective payment and in 5 the individual payment. In the groups in which it won the collective payment, the voting was of 3: 1 in all groups except for one group in which there was tie and the coin was thrown. In the 5 groups in which it won the individual payment, in three groups a coin was thrown and in 2 the individual payment won by 3 votes vs. 1

Taking advantage of the panel structure of our data, we conducted an individual-level analysis over time. Recall each individual made decisions over 10 rounds. Thus, we had 2570 observations in total. In Table 5.5 we take the units of land in forest cover as our dependent variable and conduct a random effects Tobit model considering participant repeated information. We followed the DiD framework, hence we created a *payment* dummy variable for each type of payment (treatment) that takes values of "1" if the participant was assigned to the treatment and "0" otherwise. We also included a dummy variable for *stage* of the game which takes values of "0" for rounds 1-5 and "1" for rounds 6-10. We interacted *payment* dummy with *stage* dummy in order to determine the differential effect of the second stage on each type of payment. We also included as independent variables the total units of forest in previous rounds to capture the dynamics and learning through the experiment, and socio-demographic information[26].

[26] We also conducted additional regression analyses following a random effects Tobit model and an OLS model with dummy variables for different types of payment including a dummy for the control group, a dummy for number of round to capture trends that might be affecting the behaviour in the game and socio-demographic information. Results drawn from this analysis confirm our findings using the DiD framework and are available upon request.

Table 5.5. Random effects Tobit analysis for units of land covered by forest using the DiD framework.

Variables	**Units of land covered by forest**	**Standard errors**
Individual payment (rounds 1 to 5)	-0.0476	(0.270)
Collective payment (rounds 1 to 5)	-0.0625	(0.272)
Individual payment by voting (rounds 1 to 5)	-0.767**	(0.366)
Collective payment by voting (rounds 1 to 5)	-0.202	(0.311)
Crop-price Premium payment (rounds 1 to 5)	0.00201	(0.268)
Stage	-0.148	(0.128)
Individual_payment* Stage	0.520***	(0.182)
Collective_payment*Stage	0.480***	(0.183)
Individual_payment_voting*Stage	1.123***	(0.251)
Collective_payment_voting*Stage	0.658***	(0.210)
Crop- Price_premium*Stage	-0.168	(0.180)
Total of forest in previous round	0.0408***	(0.0147)
Sex	-0.138	(0.160)
Age	0.00399	(0.00598)
Primary school incomplete	0.220	(0.265)
Primary school complete	0.516*	(0.292)
Highschool not finished	0.137	(0.337)
Highschool finished	0.163	(0.325)
More than high school (university, graduate)	-0.328	(0.339)
Has cut down the forest?	0.107	(0.174)
Want children to become farmers?	0.0166	(0.182)
Constant (Control rounds 1 to 5)	1.750***	(0.220)
Observations	2,313	
Number of id	257	

*** p<0.01, ** p<0.05, * p<0.1

Table 5.5 shows that the coefficient for all types of payments in rounds 1 to 5, except for the individual payment by voting are, as expected, not statistically significant compared to the CGs in rounds 1 to 5. This means that treatment groups are comparable and no particular group characteristics are affecting conservation levels. However, as noted, participants on the "individual payment by voting" group display less environmental preferences compared to the CGs. Although we acknowledge that individual payment and collective payment by voting are self-selected groups, we report results separately for the

two groups because these differences are still informative. Coefficient for variable *stage,* capturing rounds 6-10 for the CGs, is negative but not statistically significant.

As for the interactions, capturing the effect of rounds 6-10 for each type of payment, all (except for crop price-premium) are positive and statistically significant at 1%. This means that all types of payments increase forest conservation levels *when* the payment is introduced (round 6-10). The interaction term is not significant for the crop price-premium, suggesting that there are no differences in conservation levels comparing stage "0" and stage "1" of the game for this group. Although comparing treatments directly is not entirely correct due to the self-selection bias of the voting treatment, we conducted a post estimation test to compare coefficients. We observe that individual payment by voting is the most effective compared to individual (p-value< 0.05), collective payments (p-value<0.01) and collective by voting (p-value< 0.1). No other differences are observed. However, these results should be taken with caution because, as mentioned earlier, individuals who voted for the individual payment were choosing more crops than forest in the first stage compared to other treatment groups.

5.5. Discussion and conclusion

This paper set out to investigate the relationship between motivational crowding, types of motivations, and the specific features of a simulated PES scheme to be implemented in the study area. In doing so, we implemented a framed field experiment and a post-experiment motivations survey, involving 257 rural dwellers of the Colombian Amazon Piedmont. In summary, our findings show that all types of PES, except for the crop-price premium payment, increased conservation behaviour in the experiment; but not all types of payments affected motivations equally: collective payments enhanced social motivations to protect forests, the crop-price premium reduced intrinsic and guilt/regret

related motivations, while voting reduced intrinsic motivations for the case of individual payment and enhanced social motivations for those who voted for the collective type of payment (Table 5.6).

Table 5.6: Summary of findings analysing motivations and behaviours separately.

Treatment	**Motivations to protect forests**	**Forest conservation Behaviour**
Individual payment	n/e	Increases
Collective payment	**Crowd in** social motivations	Increases
Premium price payment	**Crowd out** intrinsic and guilt/regret motivations	n/e
Collective by Voting	**Crowd in** social motivations	Increases
Individual by voting	**Crowd out** intrinsic motivations	Increases

The fact that collective payments fostered social motivations to protect forests might be because participants probably perceived such payments as a means to promote a cooperative culture (Gagné & Forest, 2008), which led them to consider others' opinions regarding forest conservation more centrally in their individual reasoning. Collective payments might have activated the psychological mechanism of social belongingness and connectedness to a group (social relatedness). Consequently, we expected that the possibility of voting would have increased participants' sense of autonomy for those voting for collective payments and thus would have translated into higher social motivations to conserve, particularly compared to those who received a collective payment but did not have a choice. However, we found that *both* the pre-defined and voted collective payment crowded-in social motivations.

When discussing with participants their preferred type of payment after the experiment and the survey were conducted, no consensus was reached and more disadvantages than opportunities were mentioned for the collective payment compared to the individual. Community leaders thought collective payments could help coordinating pro-environmental collective action across the district, while other community members preferred individual payments, as the latter depended on "one's responsibility" and reflected "one's willingness to care about the forest". Our results on collective payments are consistent with findings of motivational crowding in when collective benefits are realized (Agrawal, Chhatre, & Gerber, 2015) but contradict those of Narloch et al. (2012) and Midler et al. (2015), who found that collective payments crowd-out social norms for conservation. This contradicting result might be explained by the social and institutional context where the experiment was implemented, or by the fact that Narloch and Midler measure motivational crowding through an experiment alone.

Another finding of our research is that individual payments selected by voting reduced intrinsic motivations to protect forests, which consistently align with those who argue that individual payments, regardless of whether they have been selected or not over other payment options, are likely to erode intrinsic motivations and reinforce extrinsic ones (Chervier, Le Velly, & Ezzine-de-blas, 2017; Frey, 1994). This result, however, should be treated with caution since some form of reverse causality may have been operating when conducting the voting: choosing the individual payment was probably the result of participants' low level of intrinsic environmental motivations and not *vice versa*.

Finally, crop-price premium payments reduced intrinsic and guilt/regret related motivations, probably because this type of payment conveyed a message that released participants from a moral responsibility to conserve forests and, simultaneously,

reinforced positive attitudes about crop production. This type of payment is different from individual and collective PES because it pays for allocating land to crops and not to forest conservation. Hence, while the "desired behaviour" in the context of paying for forest conservation was clear, the crop-price payment made such desirable behaviour less evident. In a participant's own words, "under this type of payment, it is easy to forget the initial environmental objective [of the payment]". Also, it is no surprise that our results showed no effect of the crop-price premium on social motivations because the cooperative framework mentioned above is not activated under this treatment.

In conclusion, how do our results inform the future implementation of PES in *El Caraño* and beyond? In contrast with other studies (Midler et al., 2015; Narloch et al., 2012), we think that collective PES can reinforce social motivations and potentially result in increased forest protection. From the implementer's perspective, such payments are suitable when transaction costs of individual payments are high and/or local collective action is strong and involves high levels of trust and equitable benefit sharing (Engel, 2016). In whichever form, and given that PES are far from "neutral" policy tools, their design and implementation should be carefully crafted, taking into account and adapting over time to existing social-ecological and development pathways, institutional settings, cross-scale power dynamics, and participants' preferences, among others (Berbés-Blázquez, González, & Pascual, 2016; Rodríguez-de-Francisco & Budds, 2015; van Hecken, Bastiaensen, & Windey, 2015).

This article has hopefully also illuminated new areas of enquiry. For example, more research is needed to understand how participatory mechanisms -such as voting for the type of preferred incentive- affects pro-environmental motivations in experimental and real implementation settings. Replicating our methodological approach across distinct

tenure regimes and social organization settings could help exploring if such regimes affect experimental behaviour and individual motivations. We could expect that social motivations to protect forest are more important in contexts of strong community organization than in context of individual land ownership, as observed in many ethnic territories around the world (Ostrom, 1999; Ostrom, 2000).

Investigating the effects of cancelling payments on individuals' motivations and conservation behaviour is of theoretical and practical relevance. Policies and programs are not commonly funded in perpetuity, and they suffer budgetary and implementation adjustments along the way. It would also desirable to develop more research to understand how pro-environmental motivations affect real life decisions on forest conservation. Quantitatively, this would require including a measure of motivations as an explanatory variable of real conservation behaviour using, for example, historical satellite images of forest cover at farm-level. Additionally, future experimental research would benefit from considering the role of self-reported motivations on observed environmental behaviours. All these research endeavours together would expand our understanding of the relation between PES, motivations and observed behaviours in environmental conservation.

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Chapter Six. Beyond proximate and distal causes of land-use change: Linking Individual Motivations to Deforestation in Rural Contexts

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Abstract
Most of the literature on the causes of tropical deforestation has focused on the proximate and distal causes. However, research exploring the psychological drivers of deforestation, i.e., motivations, is still scant despite being crucial to understand the processes of land-use change and individual decision making within social-ecological systems. We studied the combined effect of structural and individual causes of deforestation, with particular emphasis on motivations, for a sample of rural households in Colombia's foremost tropical deforestation frontier. We implemented a new instrument based on self-determination theory to measure five different types of motivations to protect the forests: intrinsic, guilt/regret, social, extrinsic motivations, and amotivation (lack of motivation). Our findings show that, controlling for the structural and household drivers widely identified in the deforestation literature, intrinsic motivations positively correlate with less self-reported deforestation. Also, amotivated people and those with extrinsic motives, such as expected payments for conservation, are more likely to deforest. Our results show that motivations can explain variation in land-use decisions and thus should be considered when designing, implementing, and evaluating conservation policies aiming to halt deforestation.

Key words: agricultural expansion; Colombia; deforestation frontier; land-use change; motivations

6.1. Introduction

Tropical deforestation continues to be a major concern in the developing world. Around 129 million hectares of forest were lost between 1990 and 2015 mainly in the tropical regions of South America and Africa (FAO 2015). Identifying distal and proximate drivers of tropical deforestation has been one of the main concerns of the literature on land use change (DeFries, Rudel, Uriarte, & Hansen, 2010; Geist & Lambin, 2002; Kaimowitz & Angelsen, 1998; Lambin et al., 2001). Most of these studies focus on both the behaviour of landholders and the structural processes that affect such behaviour, based on objective or observable factors. These studies have explored the demographic, economic, institutional, and cultural factors that lead agents to clear forests (Geist & Lambin, 2002). Such research has been developed at different scales: from the household or firm level, to regional, national and global scales, and using analytical, empirical or simulation models (Kaimowitz & Angelsen, 1998).

Although civic values and behavioural factors have been described as important drivers of deforestation (Geist & Lambin, 2001), little systematic effort has been made to link motivations (i.e., the set of reasons to protect the forests) to the observed patterns of land-use change in tropical settings. Other fields of study, such as environmental psychology, have focused on understanding the relationship between pro-environmental motivations and behaviours, mostly in urban settings (e.g., car use, energy saving, recycling). In general, this body of literature has established that both contextual and individual factors such as attitudes, motivations, goals, values, beliefs, concerns and self-identity influence behaviours that benefit the environment (Steg & Vlek, 2009). Also, the literature on environmental studies and policy has attempted to establish the effect of conservation programs on motivations (Rico García-Amado et al. 2013, Moros et al. 2019) and drivers of engagement in particular conservation practices or programs (Greiner, 2015; Greiner

et al., 2009; Ruiz-Mallén et al., 2015; Souto et al., 2014). However, to our knowledge, no study has attempted to determine the interaction between pro-environmental motivations of rural dwellers and stated land use change. Understanding baseline motivations of rural inhabitants and forest users is important given that the design of policy instruments aiming at reducing deforestation may have unintended effects on motivations, which, in turn, can affect conservation outcomes and behaviours (see for example, Rico García-Amado et al. 2013, Moros et al. 2019).

In this article, we study the effect of motivations on the stated decision to deforest for a group of farmers, controlling by individual and structural variables. We used the questionnaire designed by Moros et al. (2017), based on the Self-Determination Theory (SDT) proposed by Ryan and Deci (2000), to explore the different types of motivations and their effect on the reported decision of farmers to deforest. Using a set of different types of motivations allows us to capture more precisely the specific reasons behind preserving forests and, as such, design and improve programs and policies suited to particular types of individuals. We applied a survey to a group of 64 farmers in the rural area of Florencia, the capital city of Caquetá, one of the regions with the highest rates of deforestation in Colombia. Our findings show that, controlling for socio-economic factors, intrinsic motivations negatively correlate with self-reported deforestation. That is, more intrinsically motivated individuals report less deforestation. Also, a-motivated individuals are more likely to deforest, as well as people concerned with external motivations such as expected payments for conservation. Our findings contribute to the discussion of land use change beyond the proximate and distal or underlying causes of deforestation usually considered in the literature. Although our empirical strategy does not allow us to claim causality, our results open an urgent and unexplored research agenda, and raise considerations for the implementation of conservation policies, such as

payment for ecosystems services, aimed to change behaviour. In particular, they highlight the importance of considering the impacts on motivations when designing, implementing and evaluating the effects of such types of policies to avoid possible crowding out effects (Agrawal et al., 2015).

This paper is organized as follows. Section 2 discusses relevant literature regarding the distal and proximate causes of deforestation, as well as the motivational factors underlying pro-environmental behaviour. Section 3 presents our methods. Section 4 describes our field setting. Section 5 shows our results. Finally, Section 6 discusses our findings and concludes the paper.

6.2. Literature review

6.2.1. Evolution of the drivers of land use change

There is a large body of literature that attempts to unravel the causes of land-use change (Turner, Lambin, & Reenberg, 2007). Original studies on tropical deforestation found population to be the main explanatory variable, either because of the so-called "frontier theory" in which entrepreneurs and smallholders colonized the frontier in search of profitable economic activities, or because they were pushed out of the agricultural frontier and into marginal lands (i.e., the "immiseration" theory) (Rudel & Roper, 1997). When more variables were included, population started to lose its prominence as the main driver of deforestation, and other elements such as road building, state-sponsored development programs, and credit availability began to combine with population to explain deforestation in areas such as the Brazilian Amazon (Pfaff, 1999).

The causes of deforestation have since been classified as direct or proximate and distal or underlying. According to Geist and Lambin (2002), proximate causes include local level human activities such as agricultural expansion or infrastructure development that affect land use decisions and therefore, forest cover. Underlying driving forces are social processes, such as human population dynamics or agricultural policies that support the proximate causes. Underlying causes can operate at a local, national, or global level.

Empirical studies of drivers of deforestation have been summarized in two seminal meta-analyses (Geist & Lambin, 2002; Kaimowitz & Angelsen, 1998). Kaimowitz and Angelsen (1998) identify farm-level explanatory factors of deforestation, such as wages, availability of off-farm employment, and the price of agricultural inputs. As wages increase, off-farm employment is more abundant, and the price of agricultural inputs rises, as the pressure on forests decreases. Geist and Lambin (2002) separate the causes of deforestation into: biophysical, technological or economic, institutional, demographic and cultural. Their analysis shows that different combinations of proximate and underlying driving forces determine tropical forest decline world-wide (Lambin et al., 2001). The basic assumption of these studies is that land-users behave like rational agents who respond to price incentives, given by the opportunity cost of deforestation. Within such models, only instrumental reasons guide land-use decisions. In some cases, other considerations, such as values and beliefs are mentioned, but how they shape people's behaviours is not theorized (Geist and Lambin 2002).

More recent studies have reported that clearly established property rights are associated with less deforestation (Robinson, Holland, & Naughton-Treves, 2014). Additionally, since deforestation decisions depend on expected profits, neighbourhood deforestation

influences the probability of deforestation in a particular parcel. There are, therefore, patterns of spatial interactions in deforestation (Robalino & Pfaff, 2012).

Drivers and patterns of deforestation also evolve over time due to changes in international markets, globalization and urbanization. Thus, instead of focusing exclusively on the local causes of land change, newer streams of research have identified the importance of its distant drivers. Currently, the main agents of deforestation are private agricultural enterprises (well-capitalized ranchers, farmers and loggers) that have led the activity, in particular in Southeast Asia and the Amazon basin, to satisfy global markets (DeFries et al., 2010; Rudel, Defries, Asner, & Laurance, 2009). It is the demand for agricultural products in distant urban and international locations that is fuelling current deforestation (Leblois, Damette, & Wolfersberger, 2017). Globalization affects land use change directly by increasing the opportunity cost of forested land. Also, the "geographies of trade" that interconnect distant social-ecological systems cause leakage or indirect effects on land use within and across countries as a consequence of local or national interventions (Meyfroidt, Lambin, Erb, & Hertel, 2013). For example, policies to promote sustainable land use in a specific site may have unintended effects by displacing land change to less regulated places. These studies focus on global-scale social processes that are shaping decisions on the land. Urbanization for instance, increases the demand for agricultural commodities, such as vegetable oils, widely used in processed food. This demand is manifested in price transmission to local land users, increasing the profitability of soy or palm cultivation in tropical regions. Since the main agents of land change are companies and entrepreneurs, decision-making is mainly related to extrinsic, profit-seeking motives. In some instances, reputational risks for branded companies might deter them from engaging in deforestation, either direct or indirectly through their providers, but the underlying motives are profit-driven (Mayer & Gereffi, 2010).

As the role of international markets becomes more prominent in explaining land transformation, agricultural intensification has been suggested as a strategy to reduce the use of forested land for agriculture while satisfying agricultural demand. However, empirical analysis has shown a weak or non-existent relationship between intensification and land sparing for conservation (Phelps, Carrasco, Webb, Koh, & Pascual, 2013). Intensification can increase future agricultural land rents which creates incentives to clear more land for agricultural expansion, particularly when driven by market pressures (Byerlee, Stevenson, & Villoria, 2014; Carrasco, Larrosa, Milner-Gulland, & Edwards, 2014; Phalan, Onial, Balmford, & Green, 2011). Thus, whether farmers have market outlets for their crops, especially in the international market, could be a significant driver of deforestation. All of these studies are based on the assumption that only extrinsic, instrumental reasons explain farmers' behaviour towards deforestation. Our study takes into account some of these variables to predict self-reported deforestation, but adds a more complex and wider array of motivations for engaging in deforestation in the forest frontier.

6.2.2. Motivations and environmental behaviour

Although behavioural factors have been described as important in driving deforestation (Geist & Lambin, 2001), little systematic effort has been made to link intrinsic motivations (i.e., the set of non-instrumental reasons to protect the forests) to the observed patterns of land-use change. One stream of literature, particularly in environmental psychology, has studied the role of values, beliefs, and attitudes to understand the determinants of urban pro-environmental behaviour (e.g., energy saving, recycling, composting). In addition, studies applied to rural contexts focus on the effect of attitudes

on environmental practices and conservation behaviour, but few efforts have been made to link such psychological aspects to land use change, the object of our study.

Different theories are used to model the determinants of pro-environmental behaviour (e.g., the theory of reasoned action - Fishbein and Ajzen 1975; values-norms beliefs - Stern 2000; and the theory of planned behaviour -Ajzen 1991, among others). We use the Self-Determination Theory (SDT) (Ryan and Deci 2000) as our framework, because of its predictive power in explaining pro-environmental behaviours (Festré and Garrouste 2015). The SDT, instead of conceiving motivations as a dichotomous phenomenon of motivated and a-motivated people, proposes a model with six types of motives guiding human behaviour: intrinsic, integrated, introjected, identified, external, and a-motivated. People are intrinsically motivated if they protect forests because it is inherently interesting or enjoyable, while people who are a-motivated lack an interest or see no reason to do so. In between, there are four different types of extrinsic motivations that vary in their degree of autonomy and internalization. Autonomy is understood as the psychological need for "the experience of choice" (ibid) and internalization, as "a proactive process through which people transform regulation by external contingencies into regulation by internal processes" (Deci et al. 1991 p. 328). It is important to understand extrinsic motivation because most of the tasks individuals undertake are not inherently valued or enjoyable.

The least autonomous form of extrinsic motivation is external regulation in which an individual's behaviour is motivated by an expected external reward or punishment and there is no internalization process involved. Introjected regulation is somewhat more autonomous given that feelings of guilt, anxiety or pride, among others, drive behaviour. In other words, introjection occurs when behaviour is motivated by self-esteem contingencies and controlled by feelings of pressure to maintain or enhance self-esteem

and the feeling of worth. A more autonomous form of extrinsic motivation is identified motivation which occurs when an individual identifies with the personal importance of the behaviour "and has thus accepted its regulation as his or her own" (Ryan and Deci, 2000, p. 62) but the drivers of action continue to be somewhat external to the self. The most autonomous form of extrinsic motivation is integrated motivation in which identified motivations have been fully assimilated to the self. Integrated and intrinsic motivations are both autonomous forms of motivations; however, they differ in the sense that under integrated motivation the action is motivated by its instrumental value, while under intrinsic motivation the action is motivated by its inherent value. In this framework, there is no ideal sequence or "evolution" of motivations, or, in the authors' own words, "we do not suggest that the continuum underlying types of extrinsic motivation is a developmental continuum" (p. 62).

Three types of feelings determine how people move through different types of motivations: autonomy, competence, and social relatedness. Any external reward that affects one of these three "moderators" is expected to affect intrinsic motivations. Interventions that support autonomy, feelings of self-efficacy (feeling capable or as having the skills to perform and activity), and that enhance or activate one's relationship to others as well as one's self-image (social-relatedness) are expected to maintain intrinsic motivation for a task and more self-determined types of extrinsic motivation. For example, social interventions perceived as controlling have an effect on individuals' feelings of autonomy, thus negatively affecting intrinsic motivations to perform a task.

As described by Moros et al. (2019), empirical analyses in environmental psychology and environmental studies commonly rely on self-report responses to questionnaire items both to identify the frequency of environmental practices and the patterns of attitudes,

beliefs, and motivations that drive such reported behaviour (Steg & Vlek, 2009). Ruiz-Mallén et al. (2015) and Souto et al. (2014), for example, explored engagement in community-based conservation activities, while Greiner and colleagues (Greiner, 2015; Greiner et al., 2009) analysed farmers' willingness to participate in biodiversity contracts. These studies make use of semi-structured interviews, surveys based on Likert scales and focus groups to capture individuals' reasons to participate in conservation programs. However, this body of literature refers to attitudes, motivations, social norms, emotions and perceptions as if they were equivalent, which limit its comparability as no unified language is used.

Nonetheless, despite being measured and labelled in different ways, most of the studies in this field report two broad categories: instrumental vs. non-instrumental reasons. Instrumental reasons include economic benefits derived from ecosystem services or social rewards such as recognition or reputation, whereas non-instrumental reasons include a sense of moral duty, respect for nature and animals, or stewardship ethics (Rode et al., 2015). In general, strong non-instrumental reasons favouring conservation, positively correlate to pro-environmental behaviour (Beedell & Rehman, 1999; Lynne, Shonkwiler, & Rola, 1988; Price & Leviston, 2014; Ryan et al., 2003), while strong instrumental reasons toward profit maximization, affect pro-environmental behaviour either negatively or not at all (Greiner et al., 2009; Ryan et al., 2003).

In both environmental psychology and environmental studies, different types of motivations are reported to guide pro-environmental behaviour. However, most of the studies applied to rural contexts focus on the effect of attitudes/motivations in environmental practices and conservation behaviour (Gelcich, Kaiser, Castilla, &

Edwards-Jones, 2008; Greiner, 2015; Greiner et al., 2009). To our knowledge, this study is the first of its kind to link such psychological aspects to self-reported land use change.

6.3. Methods

Site description

The study was carried out in the region of El Caraño within the rural area of Florencia, an Amazonian city in southwestern Colombia. The study area is part of the Amazon foothills, a region that links the Andes with the Amazon basin, a key biodiversity ecotone and a major area of deforestation. Our study involves participants from 13 rural districts from El Caraño, a colonization frontier where displaced families from other regions in Colombia have moved over the last 40 years. These villages were included in the study because they are located in the headwaters of the *Hacha* River, the main water source for the 170,000 urban inhabitants of the city of Florencia, and because of the significant area of remaining forest they harbour (Moros et al. 2019).

Agriculture and cattle ranching have driven forest clearing in El Caraño (Vásquez, 2015), and the area is populated by over 100 families, mainly smallholders who cultivate staple foods combined with coffee, sugar cane, and pastures. There are few large farms; average farm size in the area is of 35 hectares, while the median is 15 hectares (Vélez et al., 2016).

In our fieldwork, farmers mentioned deforestation as their main environmental concern caused mainly by conversion to subsistence agriculture. There are no official records of deforestation rates for our study area but, based on available forest cover data for the 13 rural districts that were part of the study zone, 7,879 of the 10,588 hectares (74%) are still forested. Almost 19% of the forest in the zone is highly vulnerable to deforestation

because of its proximity to roads and to the agricultural frontier. On average, forests cover 50% of the farms, while the rest is allocated to pastures, cash crops (such as coffee and sugar cane), and subsistence crops. The villages in the study area are located at higher altitudes and are adjacent to two national protected areas (Vélez et al., 2016).

Smallholders live in poverty: incomes are low, access to education is limited, and they possess few or no assets. Average household size is of four people and migration patterns have been very dynamic: people arrived in the region 11 years ago, on average, but there is a large dispersion in the data, with some households having resided in the area for over 40 years, and others having resided there for just a few months. Less than 40% of households declare that they have a legal land title (Vélez et al., 2016).

6.3.1. Data and variables

Our source of data is a household survey conducted by Vélez et al. (2016) between June and September 2016 in 13 villages. Although we tried to contact all households in the study area, we reached only 64 respondents, equivalent to approximately 60% of household heads in the villages, according to our own field assessment (as there are no recent census data for the region). Dwellers are mainly *mestizo* peasants, from several regions in Colombia that have been forced to leave more productive rural areas and move to this agricultural frontier.

In the survey, we asked about motivations to protect forests, socio-demographics, productive practices, perceptions of environmental problems, existing forms of social capital, and land use history (Appendix 19). The data helped us establish whether they

have cleared forests since their arrival in the region, and which socio-demographic and economic conditions might have influenced that behaviour.

We designed a logit model in which we explain the decision of farmers to clear forest as a function of different social, economic, biophysical, and motivational factors, following those usually measured in the literature.

The biophysical variables linked to deforestation are slope, altitude, and distance to markets. Farmers are expected to clear forest for agriculture if the land is suitable for cultivation (in terms of slope and altitude), and if they are close to markets, which reduces transaction costs. The economic characteristics include self-reported measures of household income, farm size (as a proxy for wealth), and whether households engage in commercial cultivation (coffee, sugar, and cattle ranching). We expect wealthier households and those engaged in commercial activities to have engaged in forest clearing. As for the social characteristics of the household, we included the time of residence on the farm; household size; a binary variable relating to land tenure (i.e., property title); age of the household head; and a binary variable for participation in local, voluntary organizations. We ran a comparison of these variables between the samples to identify variables that could influence the decision to cut forest. For this, we use a Two-Sample Fligner-Policello Robust Rank Order test for ordinal or interval data and Chi-squared test for categorical data. The two-sample Fligner-Policello Robust Rank Order test is an alternative of the Wilcoxon–Mann–Whitney that assumes neither normality, nor equal variances, nor equal distribution (Feltovich, 2003).

Finally, we rely on the questionnaire developed by Moros et al. (2019) to measure motivations among rural dwellers to protect the forest. This questionnaire follows the Self-Determination Theory and Pelletier's et al. (1998) Motivation towards the

Environment Scale. The survey contains nine statements intended to measure five different types of reasons to protect the forests: intrinsic, guilt/regret, social, extrinsic motivations, and a-motivation (lack of motivation) (see Table 6.1 for a summary of survey statements). We would like to point out that the original motivations questionnaire was made up of 24 items. The nine items used in this paper to capture each type of motivation are those that, after conducting a factor analysis, had a factor loading of above 0.55 as suggested by Hair et al. (2009). The survey, designed and implemented in Spanish by native speakers, used a four-point bipolar Likert scale to capture variations in the motivations to protect forests. The scale is symmetric, ranging from 1 (totally disagree) to 4 (totally agree). Items were presented in the same order each time. Although we did not control for order effects, items were spread through the entire survey, thus reducing the risk of consistency across responses in relation to the motivations. For intrinsic, guilt/regret, and social motivations, we created indexes of responses giving equal weights to each item considering that, to our knowledge, there are no theoretical reasons to impute different weights to particular items.

Following SDT, we expect individuals with higher levels of intrinsic, guilt, and social motivations to be less likely to clear the forests because they have internalized the importance of taking care the forests either because of pleasure (intrinsic motivations), self-approval (guilt and regret related motivations), or social approval (social motivations). Further, we expect intrinsic motivations to be stronger predictors of forest protection compared to less self-determined types of motivations (guilt, regret, social or external) because, as mentioned above, intrinsic motivations have been shown to increase pro-environmental behaviours (De Groot & Steg, 2010). For extrinsic motivators, such as potential payments and fines, we expect a positive relationship with deforestation as for these individuals, taking care of forest is contingent upon external rewards or

punishments, (i.e., pro-environmental behaviour is not internalized). In this line of reasoning, we expect a-motivated individuals to be the most likely to deforest, when compared to all other motivational types because this type of motivation is the least autonomous and self-determined.

Table 6.1. Description of the survey motivation items and the correspondent statements

Motivation type	Survey statements
Intrinsic	1. "I enjoy when I do not clear the forest"
	2. "I see myself as someone who does not clear the forests"
Guilt or regret	1 " I would feel guilty if I were to clear the forests"
	2. "I would regret if I were to clear the forests"
Social	1. " I would be criticized by my neighbours if I were to clear the forests"
	2. "Significant others would be upset if I were to clear the forests"
Extrinsic- payments	" I would take care of forests ONLY if I am paid to do so"
Extrinsic-fines	"I do not cut down the forests because I am afraid of being fined by environmental authorities"
A-motivation	"I do not see what I can get from protecting the forests. There is no point in doing so."

Source: Moros et al (2019)

6.4. Results

6.4.1 Descriptive results

We used two non-parametric tests, the Two-Sample Fligner-Policello Robust Rank Order test for ordinal or interval data and Chi-squared test for categorical data, to explore whether households that had cleared forests since their arrival at the farm (33% of respondent) were significantly different from their counterparts (Table 6.2). We observed that the two samples are similar in most biophysical and productive characteristics, except that farms that report having cut down forests are larger, have more land in forests, and are further away from main roads than farms that have not been deforested. Also, the percentages of sugar cane growers and cattle ranchers are significantly higher for those households that have cut down forests. The households that have deforested are

significantly more dependent on crop-related income than their counterparts. Demographic characteristics such as education, household size, and age of the household head are not significantly different between the two samples. Only the time of residence is different, with households that have engaged in deforestation having resided in the region for longer. Regarding motivations, intrinsic and social motivations are, as expected, significantly lower among heads of households that reported having cut down forests.

Table 6.2. Descriptive characteristics of farmers. Note: Asterisks represent differences between groups, using two-sample Fligner-Policello robust rank-order test for ordinal or interval data and chi-square test for categorical data. ***$P < 0.01$, **$P < 0.05$, *$P < 0.1$. Standard errors in parentheses.

	Households who have cut forests	Households who have NOT cut forests	p-value
Observations	21	43	
Biophysical and productive characteristics of the farm			
Size of the farm (hectares)	30.14**	25.55	0.0334
	(25.82)	(42.21)	
Size of the productive area (hectares)	8.91	9.73	0.1562
	(6.70)	(18.65)	
Proportion of productive area relative to total area (%)	29.90	32.47	0.4093
	(18.09)	(23.44)	
Size of area in forest (hectares)	13.26**	10.66	0.0375
	(17.69)	(19.08)	
Proportion of area in forests relative to total area (%)	39.66*	31.66	0.0756
	(22.12)	(23.36)	
Proportion of area in forests and stubble relative to total area (%)	54.41	59.32	0.1570
	(17.48)	(23.40)	
Altitude (m.a.s.l.)	1065.05	999.62	0.1263
	(149.71)	(210.83)	
Slope (degrees)	44.469	41.562	0.1346
	(8.399)	(12.361)	
Distance to nearest road (meters)	2167.82***	806.40	0.0096
	(1910.30)	(1258.94)	
Productive uses of the land			
Coffee (% farmers)	71.42	65.11	0.614
	(46.29)	(48.22)	
Coffee (hectares)	1.40	1.12	0.219
	(0.973)	(0.7441)	
Sugar cane (% farmers)	80.95**	51.16	0.022
	(40.24)	(50.58)	

Sugar cane (hectares)	95.25	80.74	0.484
	(1.078)	(0.969)	
Pasture (% farmers)	85.71	67.44	0.120
	(35.86)	(47.41)	
Pasture (hectares)	10.19	7.39	0.128
	(13.65)	(11.73)	
Cattle (% farmers)	61.90**	34.88	0.041
	(49.76)	(48.22)	
Cattle (units)	8.38	9.86	0.372
	(8.99)	(12.93)	
Socioeconomic characteristics of the household			
Time living in the farm	15.76**	10.93	0.0371
	(14.78)	(13.01)	
Household size	3.67	3.72	0.4778
	(1.65)	(1.67)	
Formal property of land (%)	38.09	44.18	0.643
	(49.76)	(50.25)	
Education level of the most educated member of the household (years)	6.67	6.66	0.4622
	(3.71)	(3.84)	
Education level of the household head (years)	4.09	3.61	0.4454
	(3.88)	(3.25)	
Age of the household head (years)	50.05	50.70	0.4506
	(15.03)	(13.58)	
Sex of the household head (% male)	80.95	81.4	0.966
	(40.23)	(39.37)	
Monthly Income (US$)	142.95 (120.53)	178.15 (143.66)	0.1842
Preference for their offspring to become farmers (%)	65.00 (48.94)	68.29 (47.11)	0.8357
Social capital and social networks			
Household head member of productive or community organization (%)	19.04 (40.24)	16.27 (37.35)	0.783
People in this rural district (1-3 scale)	2.14 (0.654)	2.23 (0.751)	0.2993
Help each other a lot (%)	28.57	41.86	
Don't help each other that much (%)	57.14	39.53	
Do not help each other at all (%)	14.29	18.6	
Income sources (% farmers)			
Crops	80.95	65.11	0.193
	(40.24)	(48.22)	
Cattle ranching	33.33	18.60	0.192
	(48.30)	(39.37)	
Wage labourer	57.14	53.48	0.783
	(50.71)	(50.47)	
Self-employed	0	6.98	0.215
	(0)	(25.78)	
Employee	9.5	13.95	0.615
	(30.08)	(35.06)	
Diversified income source	95.24	72.09	0.1351
	(21.82)	(45.38)	
Main income source (% farmers)			
Crops	57.14*	32.55	0.060
	(50.71)	(47.41)	

Cattle ranching	14.28	4.65	0.177
	(35.86)	(21.31)	
Wage labourer	9.52	25.58	0.134
	(30.08)	(44.15)	
Self-employed	0	4.65	0.315
	(0)	(21.31)	
Employee	4.76	9.30	0.525
	(21.83)	(29.39)	
Motivations (scale 1-4)			
Intrinsic	2.85**	3.22	0.0306
	(0.76)	(0.69)	
I see myself as someone who does not clear the forests	2.66*	3.09	0.0639
	(1.02)	(0.95)	
I enjoy when I do not clear the forest	3.04*	3.34	0.0644
	(0.74)	(0.78)	
Guilt or regret	3.09	3.24	0.2527
	(0.77)	(0.69)	
I would feel guilty if I were to clear the forests	3.09	3.37	0.1653
	(0.89)	(0.69)	
I would regret if I were to clear the forests	3.09	3.11	0.4760
	(0.94)	(0.90)	
Social	2.26*	2.62	0.0673
	(0.83)	(0.92)	
I would be criticized by my neighbours if I were to clear the forests	2.19	2.25	0.4178
	(1.17)	(1.16)	
Significant others would be upset if I were to clear the forests	2.33**	3	0.0108
	(1.06)	(1.09)	
External – payments			
I would take care of the forests only if I am paid to do so	3.43	3.11	0.1622
	(1.07)	(1.16)	
External – fines			
I do not cut down the forests because I am afraid of being fined by environmental authorities	1.95	2.23	0.2396
	(1.07)	(1.21)	
A-motivation			
I do not see what I can get out of protecting forests. There is no point in doing so	2 (1.18)	1.744 (1.05)	0.2341

6.4.2. Logistic Model

We built a logistic model to assess the role of different variables in predicting the binary decision of having cut down forest in the past (has cut down forest= 1; has not cut down forest= 0). We report odds ratios for eight models in Table 6.3. Model (1) includes biophysical, socio-economic, and income source variables. Models (2) - (7) include a different type of motivation in each regression. We do not report a model including all types of motivations at the same time because, although they capture different types of motives, some of them are correlated causing multi-collinearity. This correlation implies that each motivation coefficient in models (2) – (7) could be capturing other motives. Table 6.4 reports a correlation matrix showing that, in fact, four correlations are statistically significant. Intrinsic and guilt-related motivations are, as expected by SDT theory, positively correlated. Payments for conservation, a specific type of extrinsic motivations, is negatively correlated with intrinsic and guilt motivations (the two types of most internalized and autonomous motivations). We found an unexpected significant correlation between fines and social motivations, which are positively correlated, meaning that people who reported fines to be an important motive for forest conservation also reported peer pressure (from neighbours and relatives) as an important driver for the task. We also calculated the variance inflation factor for these variables to analyse the severity of multi-collinearity. We found that all motivations coefficients are inflated by an order of 4 or more, alerting about the impossibility of combining all the variables in the same model. Thus, in order to have stable and reliable beta coefficients, we first test the different motivations independently in models (2) - (7) because it is in our interest to disentangle the differences between types of motivations and deforestation behaviour. However, as a robustness test, in Table 6.5, we repeat the models in Table 6.3 with different combinations of motivations. In each version, models (8)-(13), we include those

motivations that are not significantly correlated with each other, and results are consistent. We do not include a model with a motivation index, because our interest, beyond asserting the value of motivations in decision-making, is to find out which of them are significantly associated to specific behaviours. By presenting an aggregate index we would lose that information. SDT theory precisely argues the relevance of understanding motivation as a continuum and not as an aggregated dichotomous phenomenon. In fact, policy instruments may affect each motivation type differently (see Moros et al. 2019).

Table 6.3: logistic model for binary variable of having cut down forests in the past controlling for biophysical, socio-demographic and motivations variables.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size of the farm	0.00936 (0.0205)	0.0648 (0.0496)	0.00768 (0.0208)	0.00824 (0.0207)	0.0119 (0.0223)	0.00740 (0.0208)	0.00225 (0.0214)
Altitude	-0.00174 (0.00306)	0.00216 (0.00455)	-0.00188 (0.00320)	-0.00201 (0.00309)	-0.000534 (0.00383)	-0.00214 (0.00315)	-0.00132 (0.00395)
Distance to nearest road	0.000575 (0.000402)	0.00226* (0.00122)	0.000535 (0.000408)	0.000618 (0.000421)	0.000404 (0.000432)	0.000644 (0.000432)	0.000893* (0.000492)
Slope	0.0433 (0.0511)	0.267* (0.145)	0.0507 (0.0533)	0.0491 (0.0542)	0.0603 (0.0556)	0.0537 (0.0567)	0.0250 (0.0607)
Coffee	-0.548 (1.069)	-4.188* (2.312)	-0.392 (1.101)	-0.562 (1.058)	-1.175 (1.180)	-0.720 (1.112)	-1.096 (1.263)
Sugar cane	2.062* (1.114)	7.476** (3.371)	2.119* (1.111)	2.051* (1.123)	2.048* (1.146)	1.959* (1.131)	2.396** (1.190)
Cattle ranching	1.570 (1.286)	7.282* (3.912)	1.645 (1.301)	1.560 (1.280)	2.443 (1.556)	1.684 (1.316)	1.934 (1.418)
Time living in the farm	0.0165 (0.0384)	-0.123 (0.0859)	0.0183 (0.0383)	0.0153 (0.0386)	0.0185 (0.0409)	0.0184 (0.0387)	0.0419 (0.0442)
Household size	-0.177 (0.276)	0.0158 (0.668)	-0.133 (0.289)	-0.159 (0.276)	-0.141 (0.322)	-0.146 (0.276)	-0.143 (0.308)

Formal property of land	-1.205 (1.196)	-1.471 (2.000)	-1.248 (1.186)	-1.094 (1.215)	-1.609 (1.317)	-1.219 (1.203)	-1.563 (1.375)
Crops main income source	0.660 (1.026)	-4.144 (2.927)	0.488 (1.099)	0.662 (1.028)	0.883 (1.154)	0.615 (1.034)	0.574 (1.218)
Income USD$	-0.00190 (0.00772)	-0.0238 (0.0176)	-0.00166 (0.00753)	-0.00120 (0.00778)	-0.00574 (0.00804)	-0.00131 (0.00792)	-0.00375 (0.00782)
Member of productive or community organization	-0.555 (1.413)	6.466* (3.684)	-0.384 (1.468)	-0.815 (1.540)	0.163 (1.531)	-0.728 (1.463)	-0.597 (1.546)
Intrinsic motivations		-6.354** (2.528)					
Guilt			-0.352 (0.684)				
Social motivations				-0.235 (0.487)			
External motivation - Payment					1.172* (0.604)		
External motivation - Fines						-0.248 (0.407)	
Amotivated							1.262** (0.610)
Constant	-3.141 (3.130)	-1.427 (7.370)	-2.403 (3.476)	-2.674 (3.253)	-8.890* (5.147)	-2.785 (3.188)	-5.331 (3.937)
Observations	50	50	50	50	50	50	50

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6.4: Correlation matrix between different types of motivations

	Intrinsic	Guilt	Social	Payments	Fines
Guilt	0.4472				
	(0.0002)				
Social	-0.0555	0.0590			
	(0.6634)	(0.6431)			
Payment	-0.4396	-0.2881	0.1536		
	(0.0003)	(0.0210)	(0.2257)		
Fines	0.0202	0.0521	0.5194	0.1084	
	(0.8739)	(0.6826)	(0.0000)	(0.3938)	
Amotivated	-0.0972	-0.0883	0.0256	0.1591	0.0567
	(0.4448)	(0.4876)	(0.8411)	(0.2092)	(0.6565)

Table 6.5: logistic model for binary variable of having cut down forests in the past controlling for biophysical, socio-demographic and motivations variables.

VARIABLES	(8)	(9)	(10)	(11)	(12)	(13)
Size of the farm	0.0549 (0.0579)	0.0512 (0.0643)	0.00460 (0.0221)	0.00382 (0.0219)	0.00740 (0.0264)	0.000555 (0.0257)
Altitude	0.00221 (0.00538)	0.00181 (0.00477)	-0.00141 (0.00384)	-0.00161 (0.00393)	5.33e-05 (0.00446)	-0.000418 (0.00460)
Distance to nearest road	0.00277* (0.00158)	0.00296* (0.00160)	0.00110* (0.000613)	0.00121* (0.000640)	0.000683 (0.000538)	0.000887 (0.000582)
Slope	0.252 (0.158)	0.252* (0.151)	0.0215 (0.0709)	0.0299 (0.0791)	0.0700 (0.0737)	0.101 (0.0890)
Coffee	-4.882* (2.910)	-5.372* (3.169)	-1.633 (1.494)	-2.104 (1.668)	-1.734 (1.338)	-2.469 (1.577)
Sugar cane	8.116** (3.823)	8.151** (3.847)	2.265* (1.232)	2.066* (1.246)	2.634* (1.368)	2.460* (1.303)
Cattle ranching	7.460* (4.172)	7.616* (4.013)	1.722 (1.425)	2.193 (1.585)	2.682 (1.654)	3.844* (2.208)
Time living in the farm	-0.112 (0.0922)	-0.0906 (0.0965)	0.0382 (0.0473)	0.0520 (0.0503)	0.0248 (0.0477)	0.0491 (0.0495)
Household size	-0.138 (0.758)	-0.256 (0.730)	-0.160 (0.323)	-0.169 (0.319)	-0.0690 (0.341)	-0.161 (0.357)
Formal property of land	-1.584 (2.237)	-2.022 (2.268)	-1.221 (1.545)	-1.615 (1.564)	-1.503 (1.441)	-2.533 (1.663)

Crops main income source	-4.113 (3.098)	-3.924 (3.033)	0.865 (1.317)	0.845 (1.350)	0.833 (1.312)	0.640 (1.359)
Income USD$	-0.0252 (0.0197)	-0.0248 (0.0197)	-0.00466 (0.00823)	-0.00506 (0.00859)	-0.00628 (0.00788)	-0.00578 (0.00848)
Member of productive or community organization	6.338 (4.142)	5.886 (4.059)	-1.254 (1.742)	-1.311 (1.682)	-0.558 (1.797)	-0.500 (1.780)
Intrinsic motivations	-6.430** (2.825)	-6.479** (2.859)				
Guilt			0.645 (0.932)	0.704 (0.897)		
Social motivations	-0.0861 (0.847)		-0.432 (0.572)		-0.860 (0.702)	
External motivation - Payment					1.282* (0.760)	1.394* (0.792)
External motivation – Fines		-0.438 (0.843)		-0.542 (0.505)		-0.943 (0.646)
Amotivated	1.096	1.442	1.474**	1.647**	0.730	1.031
	(1.096)	(1.413)	(0.712)	(0.788)	(0.645)	(0.733)
Constant	-1.937 (8.822)	-0.785 (8.467)	-6.201 (4.555)	-6.739 (4.702)	-10.04* (6.101)	-11.90* (6.780)
Observations	50	50	50	50	50	50

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Variables commonly reported in the literature as drivers of deforestation such as farm size, altitude, distance to nearest road, and plot slope do not affect the likelihood of cutting down forests in our study, nor do socio-demographic variables, such as age, education, or household size, predict deforestation. Nonetheless, households that reported having sugar cane on their farm are more likely to deforest across models. Likewise, households further away from main roads are more likely to have cut down forests since their arrival to the plot. For our particular interest, those heads of households who reported more intrinsic motivations to protect forests are less likely to deforest while those that reported payments as the only reason for forest protection are more likely to cut down forests. This result is robust to different specifications, even those that include different motivations simultaneously. Heads of households lacking any motivation to protect forests are also more likely to deforest. However, the a-motived variable loses significance when we include other types of motivations in the same model. None of the other motivations (guilt, social, or fines) significantly explain having cut down forest areas in any of the models reported.

6.5. Discussion

Our study moves beyond the proximate and distal causes of land-use change and considers the effect of individual motivations on deforestation in the region with the highest deforestation rates in Colombia. Controlling for socio-economic factors, we find that intrinsic motivations negatively correlate with self-reported deforestation. In addition, a-motivated and extrinsically motivated individuals report more deforestation. These results are novel and contribute to understanding the drivers of deforestation.

Our results are important because motivational factors can explain differences in self-reported deforestation even when households do not have significant differences in their

socioeconomic characteristics or the biophysical conditions of their farms. Intrinsic motivations prevent deforestation, even in the context of an active deforestation frontier. Social motivations and guilt did not explain self-reported deforestation. This could be related to the lack of social cohesion among community members in this ongoing deforestation frontier with low levels of associativity, very loose or inexistent kinship ties, and little social capital. Also, external motivations driven by expected fines for cutting the forest did not explain deforestation, a result consistent with the lack of enforcement and legitimacy of local environmental authorities in the study region.

One should be cautious about claiming causality with our empirical strategy and results. Our data report farmers' motivations at a certain point in time. Three months later they are asked to report the history of forest clearing at a time by when deforestation is a *fait accompli*. It could be argued that farmers are just creating a consistent narrative of forest use or that clearing practices determine motivations. In addition, we have no observed behaviour (i.e., actual changes in forest cover) and rely exclusively on self-reported practices. Thus, at this point, we can only claim association between our dependent and independent variables. In addition, we acknowledge the small size of our sample and the possibility of some variables becoming significant once we increase it.

Nevertheless, motivations are significant, and our results open an important and unexplored research agenda, and they raise important considerations for the implementation of conservation policies aiming at behavioural changes such as payment for ecosystems services. In particular, it highlights the importance of considering the impacts on motivations when designing, implementing, and evaluating the effects of such type of policies to avoid possible crowding out effects (Agrawal et al. 2015). Further

research should move beyond self-reported behaviour to actual behaviour in order to establish a causal relationship between motivation and deforestation.

The literature on environmental psychology has explored the importance of motivations in determining urban pro-environmental behaviour, whereas the experimental economics literature has explored the effect of economic incentives on individual motivation and forest conservation behaviour with mixed results (Salk et al. 2016, Narloch et al. 2012; Moros et al. 2019). Thus, empirical studies exploring the effect of different types of motivations as drivers of deforestation are crucial for the design of tailored policies that consider fundamental drivers of individual behaviour. Ignoring the role of motivations could affect the expected effect of conservation policies and the durability and stability of behaviour over time.

Understanding the role of pro-environmental motivations as drivers of land use change is the first step on a new research agenda aimed to design policies that attempt to change mental models, via education and communication campaigns, along with structural changes aimed at improving farmers' poor social conditions. Motivations can play a crucial role in the success of interventions, especially in areas with low state presence and limited capacity to enforce traditional command and control interventions. New policies should aim to work on motivations, as they are an important piece of the behavioural change puzzle.

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Chapter Seven. Conclusions

This thesis has investigated the conceptualisation, implementation and effects of Payments for Ecosystem Services in Colombia. Using a mixed-methods and multi-disciplinary approach, it has paid attention to discursive characteristics using Q- method (Chapter Three), to the institutional design of PES using a case study with interviews and surveys (Chapter Four) and to individual motivations in implementation contexts based on an experimental and survey approach (Chapters Five and Six). This chapter concludes the dissertation by summarising its main findings (Section 7.1) and introducing areas for future research based on the main findings of this thesis (Section 7.2).

7.1. Summary of findings and contributions

This dissertation was structured around four questions that taken together aim at providing a comprehensive understanding of PES conceptualisation, implementation and its likely effects in Colombia and beyond. At a discursive level, this thesis aimed to determine *How is PES conceptualized in Colombia?* (Chapter Three). This question is particularly relevant for the Colombian PES experience because unlike other countries in the region, such as Costa Rica, Mexico or Ecuador, Colombia does not have a national PES programme but a series of dispersed initiatives each one operating from different logics. Drawing on the concept of discourses (Chapter Two, Section 2.4) and using Q-methodology (Chapter Two , Section 2.7), I identified two discourses that are supportive of PES and a third one that is more critical to this approach. In this Chapter, I show that

these discourses reflect different assumptions about forest loss and degradation, the required solutions, and the role PES should play in this context. The discourses vary according to their degree of support to PES as an environmental policy tool and to the relative importance given to environmental and equity concerns. This suggests the existence of a broad community which believes PES are a pragmatic conservation strategy and supports PES because payments can correct the often-uneven distribution of conservation costs and benefits between ES providers and beneficiaries.

This chapter contributes to PES conceptualizations debates (van Hecken & Bastiaensen, 2010; McAfee & Shapiro, 2010; van Hecken, Bastiaensen, & Huybrechs, 2015), and advances the research frontier in environmental discourses, by making visible the premises that underlie present debates and implementation in Colombia. By identifying PES discourses and offering a typology for its characterisation, this dissertation highlights the importance of understanding the ideas behind practices and subtly reminds that PES are far from being "neutral" policy tools.

At an institutional level of analysis, the dissertation aimed to understand *What drives institutional change in PES*? (Chapter Four). Many PES programmes go through design changes and adjustments in eligibility criteria over time, and the analysis of the YPAT programme contributes to PES debates about environmental targeting, efficiency-equity trade-offs and motivation crowding (Chapter Two, Sections 2.2 and 2.5). Relying on semi-structured interviews and a motivations survey (Chapter Two, sections 2.8 and 2.9), I showed that the scheme, which was structured into three phases, underwent several changes in its design features and eligibility criteria over time as a product of three factors: accumulated learning over time; the entrance of a new experimented stakeholder; and changes in national environmental laws. As a result, a discursive shift took place

within the programme's operators which resulted in changes in PES design characteristics. These changes, although intended to increase environmental impact, resulted in the exclusion of hundreds of former participants, a situation that unexpectedly did not result in diminishing intrinsic motivations among removed participants as predicted by PES theoretical literature. Further, the programme became more sensitive to equity in access and equity in outcomes over time, for example by incorporating a redistributive type of PES in Phase 3. Overall, the results show that during its first two phases, YPAT followed a logic of passive adaptive management where design changes have been the outcome of accumulated experience rather than a deliberate pursue of experimentation or learning. The third phase marks a shift towards an active management approach which opens up the possibility of improving the programmes' environmental performance.

The analysis of YPAT contributes to PES literature about targeting and institutional change (Chapter Two, Section 2.2). While this body of literature usually focus on how to improve spatial or social eligibility criteria with the purpose of increasing environmental additionality (Börner et al., 2017; Sims et al., 2014; Wünscher et al., 2008), little is known about the underlying logic of specific design criteria and the main factors driving institutional changes. The YPAT case contributes to PES literature by showing how a discursive shift materialized into changes in eligibility criteria (i.e. re-targeting) and highlighting the importance of analysing how removed participants might react to being excluded from future benefits as a result of re-targeting (Alpízar et al., 2017a).

At an individual level of analysis, this thesis explored *What is the relationship between types of PES and motivation crowding?* (Chapter Five). PES are flexible policy tools and its effectiveness and potential adverse effects are highly sensitive to its design and

implementation contexts. One common concern among PES scholars and practitioners relates to what would happen after the introduction and subsequent removal of payments for conservation or sustainable land-use management. In this context, and using a combination of a framed-field experiment (Chapter Two, Section 2.10) and a post-experiment motivations survey (Chapter Two, Section 2.9) based on self-determination theory (Chapter Two, Section 2.5), I showed that all types of PES (individual and collective), except for the crop-price premium payment, increase conservation behaviour in the experiment but not all types of payments affected motivations equally: collective payments enhance social motivations to protect forests while the crop-price premium reduces intrinsic and guilt/regret related motivations.

At the micro and behavioural level, this thesis contributes to disentangling the behavioural and motivation crowding out puzzle in PES literature (Ezzine-de-blas et al., 2019). The empirical evidence in this dissertation shows that PES, *per se*, do not crowd out intrinsic pro-environmental motivations, as has been frequently considered among some PES scholars. Rather, collective PES are shown to have the potential of reinforcing pre-existent peer-pressure related motivations to guarantee ecosystem service's provision. This thesis, hence, calls for the important task of not disregarding, analytically, the potential crowding in effects that PES might have on motivations and how this relationship might be contingent upon specific design features such as payment type.

Further, this thesis also set out to explore, at the micro level, *What is the relationship between deforestation and pro-environmental motivations?* (Chapter Six). This question is particularly relevant for land-use policies aiming at behavioural change such as PES. However, the majority of studies that have attempted to establish this relationship empirically have done so in urban and developed contexts to explain, for instance, energy

consumption behaviour or recycling preferences. In rural contexts and in the particular case of land-use change and deforestation, motivations have been overlooked. Based on self-reported deforestation behaviour and responses to a new survey on motivations (Chapter Two, Section 2.9), this thesis contributes to understanding the role of motivations in deforestation behaviour in Colombia's foremost tropical agricultural frontier. Results from a logistic regression show that, controlling for the classical structural and household drivers of deforestation, intrinsic motivations positively correlate with less self-reported deforestation; thus, providing empirical evidence to support the crucial role of motivations in the design of conservation and land-use policies.

Methodologically, this thesis has relied on different research methods and advances PES research in several important ways: first, I contribute to Q-methodology by proposing an innovative process, based on a web algorithm, to capture, define and prioritise PES statements from social media. Second, the elaboration of a questionnaire to measure pro-environmental motivations in rural contexts provides a theoretically-informed and replicable research tool that can be tested in other settings. Finally, I adapted a forest conservation game to analyse, in a controlled environment, the likely role of PES in reconciling the trade-offs between forest conservation and agricultural production in active agricultural frontiers.

7.2. Limitations and further research

Finally, this section outlines the limitations of these findings and the future lines of research identified in this dissertation. At the discursive level, the identification of PES discourses through the use of Q-method has many advantages in terms of providing a

structured and replicable process to capture and identify individuals' opinions regarding a certain topic. However, although I actively sought for diversity in views and interests among participants and despite great effort was put in the sampling method to this aim, critical voices outside academia were very challenging to identify and contact and could be underrepresented in the study. For example, representatives of a discourse that is simultaneously environmentally concerned but critical to PES are probably missing from the sample. Future research in PES discourses would gain from using a structured procedure to capture statements (such as the algorithm) and complement it using in-depth interviews with relevant stakeholders. The discourses that were identified represent a snapshot of PES debate in a particular period of time. Analysing the evolution of such discourses and the conditions that marked discursive shifts over time is also a thrilling line of future research. This entails, of course, the implementation of other research methods than Q-method, which include for example, content analysis of press releases over time which are more likely to contain information prior to the emergence of social media. Another natural extension of this research is to replicate the protocols of Q-method in several countries in Latin America or elsewhere to establish to what extent the discourses that were identified are also evident in other countries of the Global South. In addition, one aspect that is worth considering for future research relates to the fact that this study over PES ideas was almost exclusively based on the views of experts or high-level participants. Therefore, further research should explore PES visions and conceptualisations among ES providers to gain insights for PES design and implementation.

At the institutional level, this thesis was set out to reconstruct the institutional history of the first publicly funded PES in Colombia and to identify the driving factors of institutional change by making an emphasis on re-targeting and its effects on equity and

removed participants' pro-environmental motivations. Constructing the institutional history and identifying the underlying logics of design changes over time is relatively easy in methodological terms. In-depth interviews with key stakeholders and the revision of official programme documents were sufficient to identify the key breaking points characterising each phase of the programme. However, researching the effects of re-targeting in the context of an on-going programme imposes many limitations in terms of data collection and analysis. One evident limitation relates to the fact that participants from Phase 3 could not be surveyed because at the moment of data collection applications were still open. Hence, the analysis of re-targeting effects is limited to the first two phases of the programme. Further, the sample size of former participants with panel data on motivations is very limited because removed participants were very difficult to reach as official records with basic contact information were not constantly updated by the programme implementing agency. Therefore, in a context of limited data and challenging conditions, further research in PES that aims to explore the consequences of re-targeting on motivation crowding could do so following an experimental approach that simulates payment size and type, contract length and exclusion in a controlled environment. In this context, it would be possible to explore to what extent do changes in motivations and behaviours depend upon the size and length of payments .Additionally, based on the suggestive results regarding: 1) that the programme enrolled plots with potentially low to mid deforestation risk, and 2) that pro-environmental motivations were, if something, reinforced after the participation in the programme, it would be relevant to further explore land-use change using satellite imagery to establish if removed participants changed their behaviour as a consequence of re-targeting.

At the micro and individual level of analysis, this thesis explored how a particular feature of a PES scheme, namely the type of payment, affects conservation behaviours and pro-

environmental motivations using an economic experiment. The forest conservation game was designed and used to test to what extent the introduction of different types of PES affected conservation behaviour and motivations among farmers residing in an active deforestation frontier. The analytical approach to separate the effects in behaviours from those in motivations was based on conducting a post-experimental motivations survey and on comparing survey responses across control and treatment experimental groups (between design). Two main related limitations arise from this methodological approach. First, results can be attributed to the introduction of PES but not to its removal. It was decided not to include PES removal because it will imply methodological challenges in terms of when to measure motivations. Removing the payment would have entailed to conduct the motivations survey either *after* the introduction of the payment or *after* its removal. However, conducting it after the introduction of the payment would have affected behaviour in subsequent rounds. And conducting the survey after its removal would not allow to attribute changes in motivations due to the introduction of payments. Second, given the between group design approach, recruitment was set in order to ensure random assignment to sessions and groups. However, the lack base-line motivations data does not allow to completely rule-out pre-experimental differences in motivations between control and treatment groups. Further research exploring the relationship between types of PES and conservation and motivational outcomes could gain from conducting a base-line survey of motivations a certain amount of time before participating in the experiment expecting that the passage of time mitigates the influence that the responses to the survey might have on experimental behaviour. Additionally, as PES duration is likely to be finite due to budget and political constraints, new lines of inquiry could explore the effects of PES removal in pro-environmental behaviour and motivations. For example, following an experimental approach it is possible to test for

partial removal, i.e., among those getting PES, it is removed for only some recipients, and total removal, i.e., when PES is removed, it is removed for all current recipients.

Further to overcome potential limitations regarding the external validity of experimental results, future research would gain from understanding how pro-environmental motivations affect real life decisions on forest conservation and more generally in sustainable land-use management. Chapter Six set out to explore this relationship and found that controlling for socio-economic and structural factors, intrinsic motivations positively correlate with less self-reported deforestation. An evident limitation of this research relies on its self-reported nature. It is plausible that surveyed participants are creating a consistent narrative to explain their deforestation behaviours. Therefore, a natural extension of this research would imply using satellite data at the plot level. Further, new lines of research could also explore this relationship in collective regimes to determine if, for example, apart from intrinsic motivations, other types motivations (e.g., of those related to peer pressure) play a role in explaining sustainable land use and conservation behaviours.

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APPENDIXES

Appendix 1. Final statements that constitute the Q-set

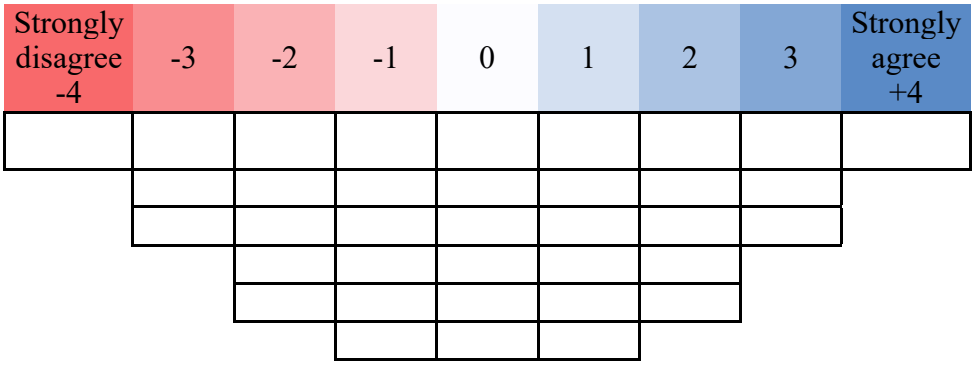
The source of each statements is marked with an (A) for statements drawn from the web searching algorithm or with an (L) for statement drawn from the literature review.

#	Statement in Spanish	Statement in English	A/L
1	“Los PSA contribuyen a cumplir los acuerdos internacionales de conservación como los de la COP21”	"PES contribute to compliance with international conservation agreements such as those reached in COP21"	A
2	“Los PSA son una herramienta para reconocer los servicios culturales que proveen las comunidades indígenas"	“PES are a tool for the recognition of cultural services provided by indigenous communities"	A
3	"Los PSA son un instrumento para alinear los intereses de los dueños/poseedores de tierras y la sociedad en general"	"PES are an instrument for aligning the interests of landowners/holders and society in general"	L
4	"Los PSA someten la gestión de los servicios ecosistémicos a un modelo de mercado enfocado en la eficiencia"	"PES surrender the management of ecosystem services to a market model focused on efficiency"	L
5	"Los PSA son una herramienta para conservar especies amenazadas"	"PES are a tool for the conservation of endangered species"	A
6	Los PSA son un instrumento de política efectivo porque involucra a diferentes actores de manera amplia e incluyente"	"PES are an effective policy instrument because they engage different actors in a broad and inclusive manner"	L
7	"Los PSA son un instrumento que debilita las motivaciones intrínsecas para conservar"	"PES are an instrument that crowd-out the intrinsic motivations for conservation"	L
8	"Los PSA son un instrumento que al buscar reducir la pobreza se limita en sus objetivos de conservación"	"PES are an instrument that, in seeking to reduce poverty, is limited in its conservation objectives"	L
9	“Los PSA son un mecanismo para reducir los cultivos ilícitos”	"PES are a mechanism for the reduction of illicit crops"	A
10	“Los PSA son una herramienta para luchar contra la deforestación y proteger ecosistemas estratégicos"	"PES are a tool for the fight against deforestation and protect strategic ecosystems"	A
11	“Los PSA son una alternativa a los instrumentos de comando y control que desplazan a los campesinos de sus tierras”	"PES are an alternative to command and control instruments that displace peasants from their lands"	A
12	"Los PSA crean nuevas fuentes de financiación para la protección de los servicios ecosistémicos"	"PES create new sources of funding for the protection of ecosystem services"	L
13	"Los PSA son una herramienta de conservación que menosprecia los derechos y el valor intrínseco de la naturaleza"	"PES are a conservation tool that disparages the rights and intrinsic value of nature"	L
14	“Los PSA son un instrumento para la mercantilización de funciones y bienes ecosistémicos que tradicionalmente han sido bienes públicos”	"PES are an instrument for the commodification of ecosystem functions and goods that have traditionally been public goods"	L
15	“Los PSA son un instrumento para el ordenamiento del territorio”	"PES are a land-use planning tool"	L
16	“Los PSA son una herramienta para construir territorios en paz”	"PES are a tool for the construction of territories in peace"	A

17	"Los PSA son un instrumento más simple para los tomadores de decisión pues simplifica la evaluación de impacto"	“PES are a simpler tool for decision makers as they simplify the impact evaluation "	L
18	"Los PSA reconfiguran las relaciones entre los seres humanos y su entorno promoviendo una relación de explotación de la naturaleza"	"PES reconfigure the relationships between human beings and their environment, promoting a relationship that hinges on the exploitation of nature"	L
19	"Los PSA son una herramienta efectiva para la conservación porque distribuye sus beneficios de una manera que es percibida como justa a nivel local"	"PES are an effective tool for conservation because they distribute their benefits in a way that is perceived as fair at a local level"	L
20	"Los PSA son una herramienta que contribuye a la adaptación al cambio climático"	"PES are a tool for contributing to adaptation to climate change"	A
21	"Los PSA contribuyen a mejorar la calidad y cantidad de agua"	"PES contribute to improving the quality and quantity of water"	A
22	“Los PSA permiten que las comunidades rurales que cuidan los bosques reciban un ingreso digno”	"PES allow rural communities who care for forests to receive a decent income"	A
23	"Los PSA son una herramienta para vincular a los campesinos en la conservación de los recursos naturales y ecosistemas estratégicos"	"PES are a tool for involving peasants in the conservation of natural resources and strategic ecosystems"	A
24	“Los PSA reconocen la labor de conservación de los campesinos, indígenas y afro-colombianos en áreas de importancia ecosistémica”	"PES recognize the conservation work of peasant, indigenous and Afro-Colombian communities in areas of ecosystemic importance"	A
25	“Los PSA involucran a la ciudadanía y empresas privadas en la conservación”	"PES engage citizens and private companies in conservation"	A
26	“Los PSA contribuyen a un Desarrollo Agrario Integral según lo previsto en los acuerdos de la Habana”	"PES contribute to Integral Agrarian Development, according to the provisions of the Havana agreements”	A
27	"Los PSA son un instrumento que reconoce implícitamente la distribución desigual en los costos y beneficios de la conservación y por esto transfieren recursos a quienes asumen tales costos "	"PES are an instrument that implicitly recognizes the unequal distribution of the costs and benefits of conservation and therefore transfers resources to those who assume such costs"	L
28	"Los PSA aprovechan las fuerzas del mercado para conseguir resultados ambientales más eficientes"	"PES take advantage of market forces to achieve more efficient environmental results"	L
29	"Los PSA son un instrumento para recompensar la restauración de los servicios ecosistémicos"	"PES are an instrument for rewarding the restoration of ecosystem services"	L
30	"Los PSA son un instrumento más costo-efectivo para la conservación en comparación a los instrumentos de comando control"	"PES are a more cost-effective instrument for conservation compared to command and control instruments”	L
31	“Los PSA son una herramienta para motivar practicas productivas acordes con la conservación”	"PES are a tool for motivating productive practices consistent with conservation"	A
32	"Los PSA son una herramienta para despojar a los campesinos pobres de sus tierras"	"PES are a tool for depriving poor peasants of their lands"	L
33	"Los PSA son un chantaje para los guardianes del territorio que contribuye a ceder el control de los recursos naturales a actores más poderosos"	"PES are bribes paid to the guardians of the territory, contributing to the handover of control of natural resources to more powerful actors"	L
34	“Los PSA tienen como objetivo hacer que en las comunidades rurales sea más rentable proteger los bosques que acabarlos”	"PES aim to make it more profitable for rural communities to protect forests than to deplete them"	A
35	"Los PSA son un instrumento de politica neoliberal que introduce criterios de mercado en la gestión de bienes públicos ambientales"	"PES are an instrument of neoliberal policy that introduces market criteria to the management of environmental public goods"	L
36	"Los PSA contribuyen a la reducción de emisiones de efecto invernadero"	"PES contribute to the reduction of greenhouse gas emissions"	A

Appendix 2. The Q-grid used in Chapter 3

It consists of 36 cells, one for each statement. Participants were asked to organize statements into cells along a continuum from (-4) Strongly disagree to (+4) Strongly agree.



Appendix 3. Q-sorts and factor loadings

Q-sort #	Factor 1	Factor 2	Factor 3
1	0,5	0,57*	0,2
2	0,29	0,76*	0,11
3	0,72*	0,37	0,01
4	0,13	0,13	0,71*
5	0,73*	0,31	0,19
6	0,46	0,6*	-0,01
7	0,51	0,27	0,49
8	0,11	0,75*	0,28
9	0,64*	0,1	0,32
10	-0,13	-0,1	0,76*
11	0,4	0,65*	-0,1
12	0,66*	0,1	0,05
13	0,74*	0,41	0,02
14	0,54*	0,33	0,11
15	0,77*	0,21	-0,06
16	0,41	0,78*	0
17	0,44	0,68*	0,12
18	0,45	0,68*	-0,12
19	0,29	0,68*	0,08
20	0,3	0,71*	0,06
21	-0,06	0,86*	0,26
22	0,65*	0,3	0,07
23	0,39	0,51*	-0,21
24	0,83*	0,23	-0,17
25	0,4	0,42	0,26
26	0,58*	0,33	-0,44
27	0,4	0,58*	0,25
28	0,25	0,53*	0,35
29	-0,08	0,13	0,6*
30	0,15	0,77*	0,24
31	0,71*	0,48	-0,01
32	0,37	0,46	0,45
33	0,62*	0,26	0,16
34	0,59	0,65*	-0,04
35	0,35	0,32	0,24
36	0,64*	0,43	-0,01
37	0,6*	0,43	0,08
38	0,82*	0,29	0
39	0,72*	0,09	0,2
40	0,87*	0,21	-0,13
41	0,1	0,3*	0,38

Appendix 4. Principal Components Analysis per statement.

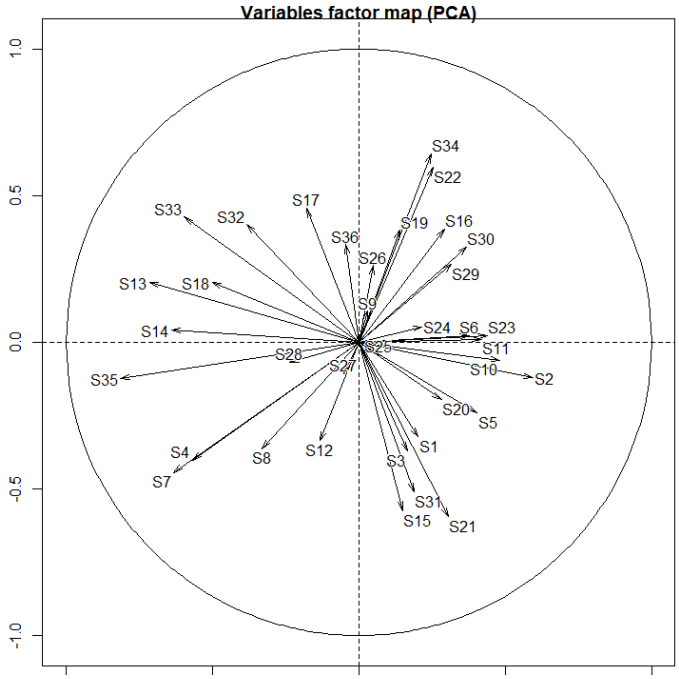
We used the function qmethod from the "qmethod" R package to generate this graph. The description of the qmethod command asserts that the function performs a full Q method analysis using principal component analysis. The main results are factor characteristics, statement scores z-scores. We then used a direct plot of the principal component analysis (PCA) plot, which was in turn performed using the "FactoMineR" package. The line was plot.PCA(PCA(t(BASE))).

The intuition behind a PCA Factor Map is that of vector interpretation. This plot shows the relationships between all statements which are represented by their projections (Abdi and Williams 2010). The PCA factor map can be interpreted as follows:

- Each row is a vector representing a statement
- All statements take values between -1 and 1.
- Positively correlated statements are grouped together.
- Negatively correlated statements are positioned on opposite sides of the plot origin (opposed quadrants).

It can be observed in this graph that statements project in different directions and with different intensities (length of the vector). This means that the statements are capturing diverse opinions about PES. If vectors were projecting in one or two dimensions it would mean that the statements are not balanced and thus not capturing an array of PES views, which is not the case for the present study.

For example, statements #15 "PES are a land-use planning tool", #22 "PES allow rural communities who care for forests to receive a decent income" and #35 "PES are a neoliberal policy tool that introduces market criteria into environmental public goods management" are representative of three different discourses of PES because they project in different directions, and vectors show high values compared to others.



Appendix 5. Informed consent interviews YPAT scheme

Descripción del proyecto doctoral

Título del proyecto doctoral: Pagos por servicios Ambientales en Colombia: discursos, diseño y cambios en motivaciones

Candidata doctoral: Lina Moros- Universitat Autònoma de Barcelona (UAB)
Supervisores: Dr. Esteve Corbera (UAB) y Dr. M. Alejandra Vélez (Universidad de los Andes- Colombia)

Financiadores: Primer año- Fondo Patrimonio Natural, United States Agency for International Development (USAID) y Universidad de los Andes. Segundo y tercer año- Fundación Autónoma Solidaria (FAS) y Universidad de los Andes.

Pregunta de investigación

Esta entrevista hace parte del segundo capítulo empírico de mi tesis en el cual busco responder: ¿Qué factores influencian el cambio institucional en los esquemas de PSA? Y ¿Qué efectos pueden tener esos cambios términos de equidad y cambios en motivaciones?

Consentimiento informado

Buenos días/tardes. Mi nombre es Lina Moros y soy estudiante doctoral de la Universidad Autónoma de Barcelona. Como parte de mi proyecto doctoral estoy realizando entrevistas a los actores involucrados en el esquema de PSA "Yo protejo, ¡agua para todos!". Las entrevistas están estructuradas en tres partes: historia, funcionamiento y percepciones del esquema. La entrevista tomará alrededor de una hora y usted es libre de contestar las preguntas que desee. Si usted lo desea, sus respuestas serán anónimas. Usted puede terminar la entrevista en cualquier momento y esta entrevista no implica ningún riesgo para usted. Si usted lo permite, lo grabaré para tener un registro de la entrevista que me ayude en el análisis. ¿Está de acuerdo con participar en esta entrevista? Si quiere participar por favor firme en la línea de abajo:

Quiero participar en la entrevista: SI _ NO_ Quiero que mi entrevista sea anónima: SI_ NO_
Permito que graben mi entrevista: SI_ NO_

Firma _____ Fecha_____

_____
Cualquier información adicional sobre el proyecto puede comunicarse con Lina Moros, estudiante doctoral de la UAB al correo limoros@gmail.com o al teléfono 321.4284879

Appendix 6. Informed verbal consent motivations survey

Descripción del proyecto doctoral

Título del proyecto doctoral: Pagos por servicios Ambientales en Colombia: discursos, diseño y cambios en motivaciones

Candidata doctoral: Lina Moros- Universitat Autònoma de Barcelona (UAB)
Supervisores: Dr. Esteve Corbera (UAB) y Dr. M. Alejandra Vélez (Universidad de los Andes- Colombia)

Financiadores: Primer año- Fondo Patrimonio Natural, United States Agency for International Development (USAID) y Universidad de los Andes. Segundo y tercer año- Fundación Autónoma Solidaria (FAS) y Universidad de los Andes.

Buenos días/tardes. Mi nombre es Lina Moros y soy estudiante doctoral de la Universidad Autónoma de Barcelona. Como parte de mi tesis doctoral estoy revisando los efectos de los pagos por servicios ambientales en los participantes. En el día de hoy estaremos encuestando a participantes del programa "Yo protejo, agua para todos" con el objetivo de entender más a profundidad el perfil de cada participante del programa.

La encuesta incluye preguntas sobre su predio, sus percepciones sobre el programa y algunas preguntas sobre usted y su hogar. En caso de no alcanzar a realizar la entrevista hoy, la realizaremos en la visita de verificación de actividades que se hará a su predio en los próximos días. Las respuestas a la encuesta se usarán para mejorar el programa y sus actividades y para que el programa esté más acorde con las realidades locales.

La encuesta durará entre 20 y 30 minutos y usted es libre de contestar las preguntas que desee. Es decir que usted no está obligado/a a responder las preguntas que no quiera responder. Esta encuesta no implica ningún riesgo para usted y sus respuestas no afectarán su participación ni su continuación en el programa: no hay respuestas buenas ni malas por lo que le pedimos que responda de manera sincera.

¿Está de acuerdo con participar en esta encuesta?

SI__ NO__Fecha___ Lugar_____

** Cualquier información adicional sobre el proyecto puede comunicarse con Olga Adriana León, Coordinadora Programa PSA Cundinamarca-Patrimonio Natural. Calle 72 No. 12-65 piso 6 Edificio Skandia Teléfono: +57(1)7562602 ext 120 o con Lina Moros, estudiante doctoral al correo limoros@gmail.com o al teléfono 321.4284879

Appendix 7. Socio-demographic and motivations questionnaire YPAT programme

Questions are presented in same order as in Table 4.5

¿Cuántos predios tiene usted en total?
¿Qué tamaño tiene su predio principal?
¿Cuántas personas dependen económicamente de usted?
¿Dónde vive usted actualmente?
-En el predio que recibió pagos del programa
-En la ciudad
-En el pueblo
-En otro predio que NO recibió pagos del programa
¿Cuál es el nivel de educación más alto que usted ha cursado?
¿Qué edad tiene?
Sexo (no preguntar)
¿Cuál es el ingreso mensual de su hogar? (el ingreso del hogar es la suma de los ingresos de los miembros del hogar)
¿Cuál es su actividad económica principal?
-Agricultor
-Ganadero
-Comerciante
-Empleado
-Jornalero
-Otro
¿Usted recuerda cuántos pagos le realizaron?
¿Cuánto dinero recibió en total?
Ahora le voy a leer unas frases y le voy a preguntar qué tan de acuerdo está usted o no con esas frases. Responda usando una escala de 1 a 4 donde 1 es totalmente en desacuerdo, 2 es un poco en desacuerdo, 3 es de acuerdo y 4 es totalmente de acuerdo. [recordar tener ayuda visual con la escala]

Disfruto cuando cuido el bosque
Me siento orgulloso de cuidar el bosque
Me siento culpable si tumbo el bosque.
Me arrepiento si tumbo el bosque.
Mis vecinos me criticarían si tumbo el bosque.
La gente más cercana a mi se molestaría conmigo si tumbo el bosque
Yo SOLO cuido el bosque si me pagan por hacerlo
Yo no tumbo el bosque por miedo a las multas que me pueda poner la autoridad ambiental.

Appendix 8. Characteristics of former YPAT participants and non-participants

Note: Phase 1 and 2 are aggregated. Data for 2018 Asterisks represent differences between groups, using Two-Sample Fligner-Policello Robust Rank Order test for ordinal or interval data and Chi-squared test for categorical data *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis.

	A	**B**	**C**
	Non-participants (3)	**Participants (4)**	**p-value (3) vs(4)**
Observations	80	123	
Characteristics of the plot			
Total number of plots	1.61	1.86	0.17
	(1.20)	(1.36)	
Size of main plot in hectares	9.85	35.07	0.00000***
	(16.53)	(80.04)	
Characteristics of the participant			
# of people economically dependent	2.28	2.58	0.056*
	(2.16)	(1.75)	
% of respondents living in the PES plot or other plot	72.5%	52%	0.0069***
Education level of the respondent (years)	4.57	5.39	0.0243**
	(2.95)	(3.13)	
Age of respondent (years)	58.8	57.8	0.4183
	(15.6)	(12.6)	
Sex of respondent (% male)	77.50	68.3	0.13
Monthly Income in (US$)	507.7	622.9	0.050**
	(1029)	(831.9)	
Main income activity (%)			
Farmers	46.25%	23%	0.0057***
Cattle ranchers	13.75%	19%	0.25
Merchant	3.75%	0.07	0.342
Employee	11.25%	22%	0.084*
Wage labourer	**0%**	**0.01%**	**0.428**
Other (mostly retired)	25%	25%	0.49
Motivations 2018 *(scale 1-4)*			
Intrinsic			
I enjoy taking care of forests	3.76	3.86	0.0909*
	(0.50)	(0.39)	
I feel proud of myself for taking care of forests	3.86	3.91	0.242

	(0.44)		
Guilt or regret	3.75	3.80	0.43
	(0.477)	(0.43)	
I would feel guilty if I were to clear forests	3.75	3.76	0.786
	(0.58)	(0.57)	
I would regret it if I were to clear forests	3.75	3.84	0.242
	(0.58)	(0.44)	
Social	3.38	3.29	0.267
	(0.822)	(0.80)	
I would be criticized by my neighbours if I were to clear forests	3.41	3.35	0.746
	(0.96)	(0.97)	
Significant others would be upset if I were to clear forests	3.36	3.23	0.156
	(0.88)	(1.00)	
External – payments			
I would take care of the forests only if I am paid to do so	1.31	1.37	0.427
	(0.62)	(0.67)	
External – fines			
I do not cut down the forest because I am afraid of being fined	1.92	1.682	0.131
	(1.16)	(1.04)	

Appendix 9. Logistic model YPAT programme

Logistic model to assess the extent to which participating in YPAT programme has affected motivations "Participant" variable takes values of "1" if the individual participated in phases 1 or 2 of the programme and the value of "0" otherwise. We found no evidence of differences in motivations between participants and non-participants controlling for socio-demographic variables.

VARIABLES	1 Intrinsic	2 Guilt	3 Social	4 Fine	5 Payment
participant	0.568	0.244	-0.358	-0.146	0.298
	(0.418)	(0.348)	(0.286)	(0.307)	(0.351)
Farm Size	0.0129	0.00106	-0.000371	-0.0115*	0.000540
	(0.0115)	(0.00317)	(0.00218)	(0.00692)	(0.00239)
people economically dependent	-0.0304	0.0230	0.189**	0.0275	-0.0495
	(0.112)	(0.0951)	(0.0747)	(0.0833)	(0.0927)
Respondents living in the PES plot	0.621	-0.0534	-0.166	0.183	0.0412
	(0.472)	(0.386)	(0.308)	(0.349)	(0.379)
Education level of the respondent (years)	0.104	0.0492	-0.0446	-0.170***	-0.115*
	(0.0807)	(0.0626)	(0.0480)	(0.0578)	(0.0631)
Farmers	0.0570	0.265	0.149	-0.212	-0.259
	(0.469)	(0.393)	(0.321)	(0.340)	(0.391)
Observations	201	201	201	201	201

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix 10. Informed verbal consent (economic experiment)

Buenos días (tardes). Mi nombre es Lina Moros y soy investigadora de la Universidad de los Andes y estudiante doctoral de la Universidad Autónoma de Barcelona.
La siguiente actividad es una manera diferente de participar en un proyecto de investigación para entender **cómo la gente toma decisiones.**
Usted ha sido invitado hoy porque estamos interesados en entender las opiniones sobre la conservación de los recursos naturales y las prácticas productivas en el Corregimiento de El Caraño. Esta actividad es parte del proyecto de Conservación y Gobernanza de Patrimonio Natural, una organización ambiental colombina, en alianza con la gobernación de Caquetá.
El objetivo de esta actividad es entender **cómo las personas deciden usar sus tierras**.
Esta actividad puede ser diferente a otras en las que usted haya participado en el pasado porque en esta actividad usted ganará plata por cada decisión que tome. Usted se debe estar preguntando ¿por qué hacemos esta actividad con plata? Usamos plata porque queremos recrear situaciones de la vida real en la que las decisiones que usted toma tienen un costo económico para usted.
Esta actividad la hemos hecho con agricultores en otras partes de Colombia: en el Pacífico, en Antioquia, en Huila, en Cundinamarca, entre otros, con el objetivo de entender que motiva a las personas a hacer lo que hacen. Los fondos para financiar esta actividad de hoy vienen de Cooperación Internacional.

Lo que usted gane depende de las decisiones que usted tome y las que tomen los otros miembros de su grupo. Las ganancias de esta actividad están entre $10.000 y $70.000 y la actividad durará 3 horas.

Sus respuestas serán anónimas es decir, nadie sabrá cuáles decisiones tomó, ni cuánto ganó. Solo los investigadores lo sabremos. Esta actividad no implica ningún riesgo para usted y usted puede irse en el momento que quiera sin ninguna justificación. Sin embargo, si se retira antes de terminar la actividad, no le podemos pagar lo que ha ganado.
Durante la actividad le pediremos que siga unas reglas establecidas como no hablar con los otros cuando no esté permitido y llenar unos formatos. Cuando se termine la actividad le pediremos que responda una encuesta corta sobre sus prácticas productivas. Daremos un refrigerio y al final cada participante recibirá sus ganancias en efectivo.

¿Estamos listos para comenzar? Por favor tómese su tiempo para leer la hoja de información. Si no puede leer o no trajo sus gafas uno de nosotros le va a ayudar. [dar tiempo para que lean]

Si quiere participar por favor levante su mano.

Appendix 11. Project information sheet (economic experiment)

Información del Proyecto para los participantes

Título del proyecto: Paisajes productivos sostenibles: propuesta para el diseño de un sistema de incentivos para la conservación en el piedemonte Amazónico

Financiadores: Fondo Patrimonio Natural

Investigadores: María Alejandra Vélez, Ximena Rueda, Lina Moros, Andrés Guerrero, Andrés Link y Juan Sebastián Rodríguez; todos de la Universidad de los Andes en Bogotá.

Contexto del proyecto y metodología

El objetivo de esta proyecto es utilizar metodologías mixtas de investigación para **diseñar una propuesta de incentivos para la conservación en una zona prioritaria del Piedemonte Amazónico** reconociendo la realidad productiva y social de sus habitantes.

Este proyecto está estructurado en dos fases:

1. Diagnóstico inicial: desde marzo hasta junio de 2016 hemos realizado **dos talleres de diagnóstico participativo** con representantes de las veredas de la parte alta del corregimiento de el Caraño, más **seis entrevistas a líderes y representantes** de gremios productivos. También realizamos **encuestas a 100 hogares** sobre caracterización social, productiva y manejo ambiental. Esta fase tuvo como objetivo la definición de una zona prioritaria y la caracterización a nivel de hogar/finca de las veredas de la parte alta del corregimiento de El Caraño, así como en un análisis preliminar de las motivaciones e interés de participar en proyectos de conservación.

2. Ejercicios de toma de decisiones: durante las primeras semanas de septiembre estaremos realizando ejercicios de toma de decisiones sobre el uso de los terrenos en ocho veredas del Corregimiento el Caraño. Esperamos que participen 300 productores y al final de los ejercicios se realizará un taller de análisis de los resultados el cual se espera que genere un espacio de diálogo entre los miembros de la comunidad sobre temas de manejo del territorio y conservación de los recursos naturales.

Nota: En enero de 2017 haremos llegar una cartilla de socialización de los resultados del proyecto a los presidentes de las Juntas de Acción Comunal de las veredas parte del proyecto.

Detalles de contacto para inquietudes adicionales:

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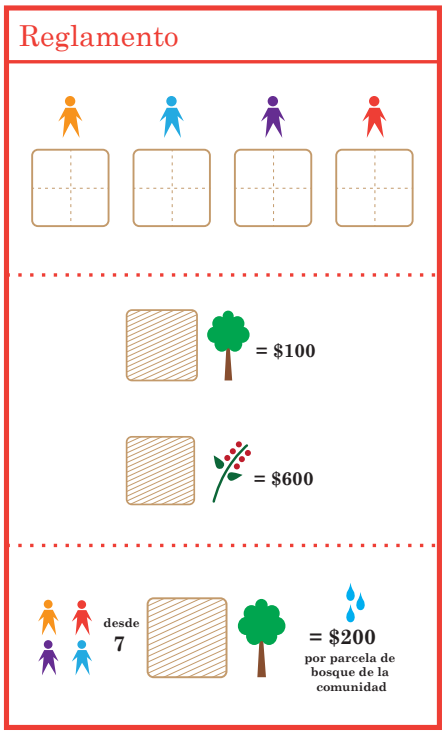
Appendix 12. Experimental protocol

INSTRUCCIONES DE LA ACTIVIDAD

Voy a comenzar a explicar las instrucciones de esta actividad. Si alguno tiene una pregunta por favor levante la mano, nosotros responderemos sus preguntas individualmente y en privado. Por favor, NO pregunte en voz alta.

Para empezar, vamos a darle a cada uno $5.000 pesos para cubrir sus costos de transporte y por llegar a tiempo a esta actividad.

Durante su participación en la actividad, ustedes ganarán más plata dependiendo de sus decisiones y las decisiones de los demás. Por esto, es muy importante que pongan mucha atención a estas instrucciones. [usar poster instrucciones para explicar]



En esta actividad, usted va a participar en un grupo de 4 personas. Cada grupo de cuatro personas es como si fuera una comunidad.
Usted va a tomar decisiones por varias rondas.
En cada ronda usted recibe 4 parcelas.
En cada ronda usted tiene que decidir qué hacer con esas 4 parcelas: dejarlas como bosque o ponerlas a cultivar.
Por cada parcela que deja como bosque usted recibe $100 pesos.
Por cada parcela que usted dedica a cultivos usted recibe $600 pesos.
Piense que los $100 por cada parcela de bosque es por la leña, madera, o carne de monte que puede sacar del bosque.
Piense que los $600 por cada parcela de cultivo son las ganancias que usted le puede sacar a su cultivo por vender la cosecha.
Las parcelas cultivadas le dan más plata que el bosque porque le permite generar ingresos por la venta de su cosecha.

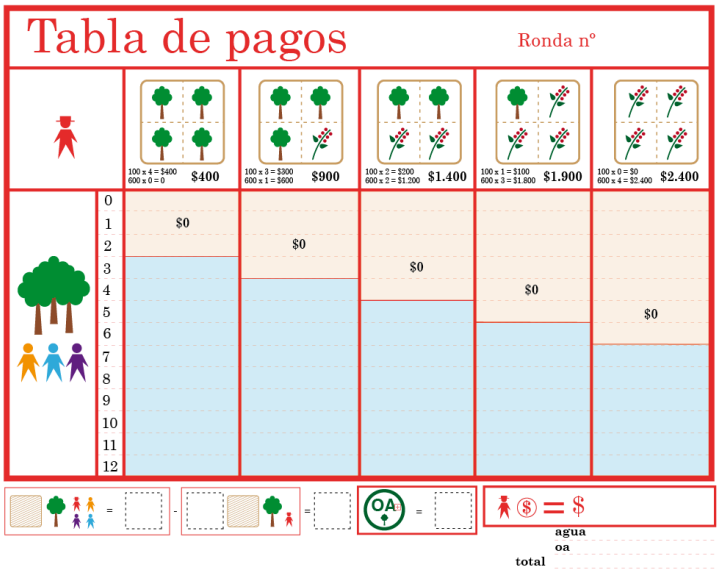
Ahora, si hay mucho bosque, además de darle unos beneficios a usted en leña, madera y carne de monte, el bosque también le da beneficios a todos en su comunidad manteniendo en buen estado las fuentes de agua.
Por eso, si entre todos en su comunidad logran tener 7 o más parcelas en bosque, van a recibir cada uno $200 pesos por cada parcela de bosque que la comunidad haya dejado sin importar cuántas parcelas dejó usted en bosque.
Piense en estos pesos como si fuera el valor del agua que usted recibe gracias a que su comunidad mantuvo una cantidad mínima de bosque necesaria para mantener las fuentes de agua.
Entonces usted puede ganar plata de tres formas:
1. Por sus parcelas dedicadas a bosque: 100 pesos por cada parcela en bosque.
2. Por sus parcelas dedicadas a cultivo: 600 pesos por cada parcela en cultivo
3. Por las parcelas que entre los cuatro miembros del grupo dejaron en bosque: si hay 7 o más parcelas en bosque en la comunidad reciben cada uno 200 pesos por cada parcela en bosque.
Es decir, sus ganancias dependen de SUS decisiones y de las decisiones de los DEMÁS.
Este actividad tiene 12 rondas y al final de las 12 rondas le pagaremos en efectivo sus ganancias que son la suma de las ganancias de cada ronda.
Algo muy importante: sus decisiones son privadas! Es decir que no debe comentar ni mostrarle a su vecino su decisión. Usted no sabrá qué decisión están tomando los demás.

EXPLICACIÓN DE ACTIVIDAD CON INSTRUCCIONES
Voy a explicar con más detalle la actividad. Para eso voy a hacer tres ejemplos usando este afiche que está aquí.
EJEMPLO 1 LB
[mostrar poster de instrucciones]
Supongamos que el usted dejó 1 parcelas de bosque y 3 en cultivo.
Por la parcela en bosque recibe $100 pesos, que son 1 parcela en bosque * $100 pesos.
Por las tres en cultivo recibe $1.800 pesos, que son 3 parcelas en cultivo* $600 pesos .
Vamos en $1.900 pesos.
Para saber si ud recibe la plata del agua tenemos que ver qué hicieron los otros participantes.
Supongamos que el participante #2 dejó 3 en bosque y 1 parcelas de cultivo
El participante #3 dejó 0 en bosque y 4 en cultivo
El participante #4 dejó 3 en bosque y una en cultivo
¿Cuánto es el total de bosque en la comunidad? El total de parcelas en bosque en la comunidad en este caso es 7 parcelas. [mostrar en el poster] Es decir que cada uno SI va a recibir los $200 pesos del agua por cada parcela de bosque, porque hay 7 parcelas en bosque en la comunidad. En este caso cada uno de ustedes recibe 7 parcelas en bosque*$200=1.400.
¿Entonces, cómo serían sus ganancias?
Sus ganancias serían 1.900 pesos + $1.400 pesos por el agua = $3.300.
EJEMPLO 2 [mostrar poster]
Ahora, otro ejemplo.
Supongamos que usted dejo 4 parcelas en cultivo y no dejó ninguna para bosque.
Por las cuatro parcelas en cultivo recibe 2.400 pesos que son 4 parcelas en cultivo * 600 pesos.
Para saber si ud recibe la plata del agua tenemos que ver qué hicieron los otros participantes.

Supongamos que el participante #2 dejó 1 en bosque y 3 en cultivo.
El participante #3 dejó 1 parcelas en bosque y 3 en cultivo.
El participante #4 dejó 4 parcelas en bosque y 0 en cultivo.
¿Cuánto es el total de bosque en la comunidad? El total de parcelas en bosque en la comunidad en este caso es 6 parcelas. [mostrar en el poster] Es decir que NADIE va a recibir los $200 pesos del agua por cada parcela de bosque, porque hay MENOS de 7 parcelas en bosque en la comunidad.
¿Entonces, cómo serían sus ganancias?
Sus ganancias serían los $2.400 pesos SIN las ganancias por el agua por que hubo menos de 7 parcelas en bosque en la comunidad.
¿Está claro hasta aquí? ¿Hay preguntas?
EJEMPLO 3 [Mostrar poster]
Un último ejemplo antes de seguir.
Supongamos que usted # 1 dejó 4 parcelas en bosque y cero en cultivo.
Por las cuatro parcelas en bosque recibe 400 pesos que son 4 parcelas en cultivo * 100 pesos.
Para saber si ud recibe la plata del agua tenemos que ver qué hicieron los otros participantes.
Supongamos que el participante #2 dejó 3 en bosque y 1 en cultivo.
El participante #3 dejó 3 en bosque y 1 en cultivo.
El participante #4 dejó 4 en bosque y 0 en cultivo.
¿Cuánto es el total de bosque en la comunidad? El total de parcelas en bosque en la comunidad en este caso es 14 parcelas. Es decir que cada uno SI va a recibir los $200 pesos del agua por cada parcela de bosque, porque hay más de 7 parcelas en bosque en la comunidad. En este caso cada uno de ustedes recibe 14 parcelas en bosque*$200=2.800
¿Entonces, cómo serían sus ganancias?
Sus ganancias serían entonces $400 de su decisión, 4 parcelas en bosque * 100 pesos + $2800 por el agua.
¿Está claro hasta aquí? ¿Hay preguntas?
Recuerde, usted puede escoger usar sus cuatro parcelas como usted quiera. Ud puede escoger dejar las cuatro en bosque, tres en bosque y una en cultivo, dos en bosque y dos en cultivo, una en bosque y tres en cultivo o cuatro en cultivo.
Entre más parcelas tenga en cultivo mayores son sus ganancias. Sin embargo entre más bosque haya en la comunidad mayores son las ganancias del agua!!

EXPLICACIÓN TABLA DE PAGOS
Para ayudarle a tomar su decisión le vamos a entregar una TABLA DE PAGOS como esta que resume todas las posibles ganancias de acuerdo con su decisión y las ganancias por el agua.
Voy a comenzar explicando la parte de arriba de la tabla. Esta parte muestra las ganancias por SU decisión.
Usted puede escoger 4 parcelas en bosque y cero en cultivo
3 parcelas en bosque y 1 en cultivo
2 parcelas en bosque y 2 en cultivo
1 parcela en bosque y 3 en cultivo o
0 parcelas en bosque y 4 en cultivo
Recuerde que por cada parcela de bosque recibe $100 pesos y por cada parcela en cultivo recibe $600 pesos.
Si ud escoge 4 parcelas en bosque y cero en cultivo ud gana $400 pesos
Si escoge 3 parcelas en bosque y 1 en cultivo, gana $900 pesos.
Si escoge 2 parcelas en bosque y 2 en cultivo , gana $1.400 pesos.
Si escoge 1 parcela en bosque y 3 en cultivo, gana $1.900 pesos.

Si escoge 0 parcelas en bosque y 4 en cultivo, gana $2.400 pesos.
Ahora voy a explicar las ganancias por el agua que dependen del TOTAL de PARCELAS EN BOSQUE en la COMUNIDAD.
Recuerde que si hay 7 o mas parcelas de bosque cada uno recibe 200 pesos por cada parcela de bosque en la comunidad.
Hay diferentes formas de tener 7 o mas parcelas de bosque en la comunidad.
Esta parte muestra el TOTAL DE PARCELAS EN BOSQUE DE LOS DEMÁS de su grupo. Estos números van de 0 a 12.
Si los otros tres miembros de la comunidad dejan cero parcelas en bosque el TOTAL DE PARCELAS EN BOSQUE DE LOS DEMÁS es 0. Si los otros tres miembros de la comunidad dejan 4 parcelas en bosque, el TOTAL de PARCELAS EN BOSQUE DE LOS DEMÁS es 12.
Por ejemplo si usted deja 4 parcelas en bosque y los demás dejan 2. El total de bosque de la comunidad es 6, las 4 suyas mas las 2 de los demás y NADIE recibe las ganancias por el agua. Toda esta parte amarilla son los casos en que la comunidad tiene menos de 7 parcelas en bosque.
En esta parte amarilla NADIE recibe los $200 pesos por el agua y sus ganancias dependen SOLO de su decisión.
Ahora si usted escoge otra vez 4 parcelas en bosque y los demás de su comunidad dejan 3 parcelas de bosque. Hay 7 parcelas en bosque, las 4 suyas mas los 3 de los demás, y entonces cada uno recibe los 1.400 por la ganancias del agua (200 por 7).
Toda esta parte azul son los casos en los que la comunidad tiene 7 o mas parcelas de bosque. Es decir, la parte azul serían sus GANANCIAS POR EL AGUA si hay 7 o más parcelas en bosque en su comunidad. En esta parte azul TODOS reciben los 200 pesos por cada parcela de bosque de la comunidad sin importar las parcelas que usted dejó en bosque.
Sus ganancias totales son la SUMA de las ganancias de su decisión mas las ganancias del agua.
Por ejemplo:



¿Qué pasa si usted escogió 1 parcelas en bosque y cero en cultivo y el TOTAL de BOSQUE en la COMUNIDAD es de 7?
Sus ganancias van a ser la suma de SU decisión más las GANANCIAS POR EL AGUA. De su decisión usted gana 1.900 pesos. Que son los 100 pesos * 1 parcelas en bosque + 600 pesos*3 parcelas en cultivo.

Además, en este caso, como fueron 7 parcelas DE BOSQUE DE LA COMUNIDAD cada uno recibe 7* $200 pesos = $1.400 pesos del agua.
En la tabla de pagos, esos $1.400 pesos están donde se cruza SU decisión con el TOTAL DE BOSQUE DE LOS DEMÁS. EL TDBDD es el Total de bosque de la comunidad, en este caso 7, menos las parcelas que usted dejó en bosque, 4. 7 menos 4, es igual a 3. Donde se cruza el 3 del bosque de los demás y el 4 de su decisión están los 1400 por el agua.
En total, usted recibiría, $3.300 pesos. 1.900 pesos de su decisión + 1.400 pesos del agua.
¿Está claro hasta aquí?

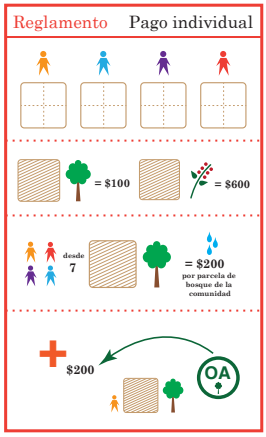
EXPLICACIÓN DE LA DINÁMICA
Ahora les voy a explicar cómo va a ser la dinámica.
En cada ronda usted va a recibir una TABLA DE PAGOS como esta que ya vimos.
Ayudándose con la TABLA DE PAGOS usted debe marcar con una EQUIS GRANDE su decisión: ud. puede escoger dejar sus 4 parcelas en bosque; dejar 3 en bosque y 1 en cultivo; 2 en bosque y 2 en cultivo; 1 en bosque y 3 en cultivo o las 4 en cultivo.
Después de que usted decida cómo usar sus parcelas, el asistente recoge las TABLAS DE PAGOS de cada miembro de su comunidad y suma las parcelas que se dejaron en bosque en su comunidad y les informa el TOTAL DE PARCELAS EN BOSQUE DE LA COMUNIDAD y SUS GANACIAS para esa ronda.
Ahí se acaba la ronda y comenzamos una ronda nueva. Al final de las 12 rondas pagamos sus ganancias en efectivo.
¿Esta claro hasta aquí? ¿Hay preguntas? Recuerde que sus decisiones son privadas y nadie sabrá lo que usted está haciendo.

COMENZAR
Ahora voy a armar los grupos de 4 personas. Un asistente pasará por su puesto con una bolsa en la que hay números del 1al 6. Cada número es una comunidad. Por favor coja un papelito y no lo muestre a nadie. El número y el color que le salió es su identificación durante el juego. Por favor no pierda ese papelito pues con ese papel es con el que recibirá sus ganancias en efectivo.
Los número 1 se van con Juan Sebastián; Los números 2 se van con Santiago; Los números 3 se van con Liliana; Los números 4 se van con Juliana; Los números 5 se van con Yady; Los números 6 se van con Camilo
[Preguntar en cada grupo si hay familiares que viven en la misma casa. Si sí, separarlos en otro grupo]
Vamos a hacer dos rondas de práctica para asegurarnos de que las instrucciones fueron claras. Estas rondas no cuentan para sus ganancias; son solo para practicar.
R PRÁCTICA 1
[entregar a cada participante su tabla de pago]
Vamos a comenzar la ronda de práctica. El asistente le va a ayudar a marcar su color de jugador en la parte de arriba de la tabla de pagos y también el número de ronda que en este caso es Práctica 1 o P1.
Por favor decida cuántas parcelas quiere dejar en cultivo y cuántas en bosque y marque con una equis grande en la parte de arriba de la tabla de pagos.
Recuerde que por cada parcela en bosque ud recibe $100 pesos y por cada parcela en cultivo ud recibe $600 pesos.
Recuerde que si la comunidad logra tener 7 o más parcelas en bosque reciben $200 pesos por cada parcela en bosque que son como si fuera el agua que recibe gracias a que su comunidad mantuvo una cantidad mínima de bosque necesaria para mantener las fuentes de agua.
[monitores tomarse su tiempo para explicar]

Terminamos la ronda de práctica 1 vamos a comenzar la ronda de práctica 2, P2.

R6 TRATAMIENTO 2 PAGO ADICIONAL INDIVIDUAL [colgar afiche de explicación y ejemplo]

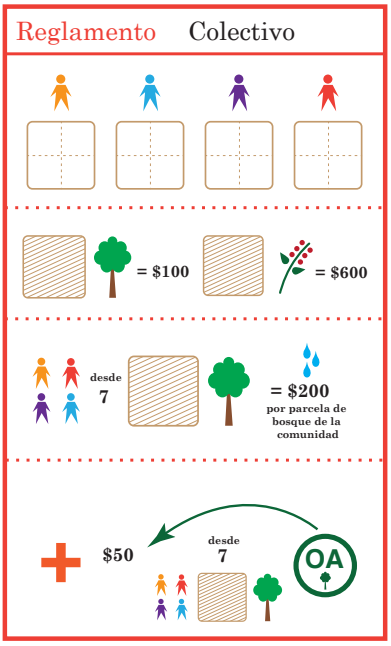
A partir de esta ronda las reglas cambian. Por favor ponga mucha atención.



Una ORGANIZACIÓN AMBIENTAL está interesada en conservar los bosques en su comunidad pues regulan el clima y ayudan a combatir el cambio climático; protegen los suelos y evitan derrumbes; y son el hábitat de miles de especies por lo que protegen la biodiversidad.

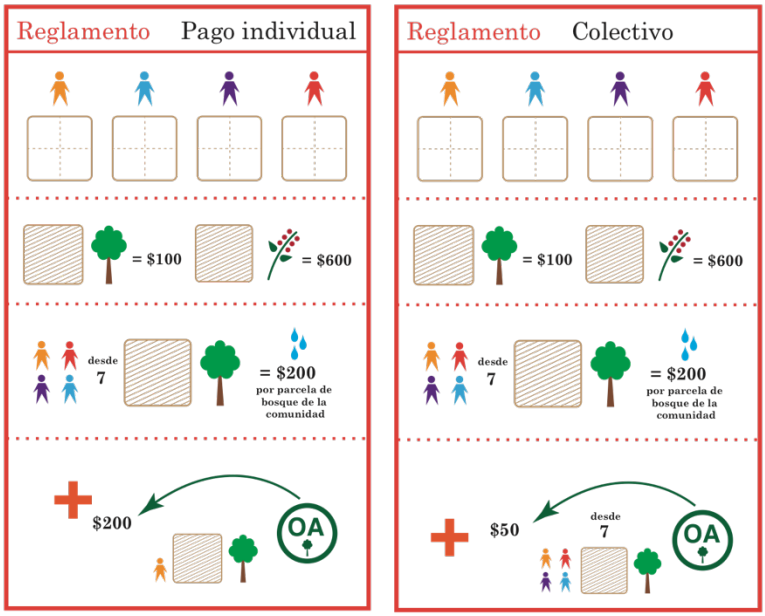
Por estas razones, esta organización ambiental está interesada en dar un PAGO ADICIONAL si hay un mínimo de 7 parcelas de bosque en su comunidad.
Este pago consiste en que cada uno de ustedes recibe un PAGO ADICIONAL de $200 pesos por cada parcela en bosque que USTED dejó SI la comunidad comunidad tiene en total 7 o más parcelas de bosque.
Desde ahora si se cumple con que la comunidad tiene 7 o más parcelas de bosque, usted recibe las ganancias del agua MÁS un pago adicional de la organización ambiental.
Es decir, sus ganancias van a ser Las ganancias de su decisión + las ganancias del agua + las ganancias de la organización ambiental.
Usted va a recibir una nueva tabla de pagos donde ABAJO dice Organización Ambiental.
Todo los demás espacios siguen funcionando igual y desde esta ronda el asistente va a anotar cuánto recibe UD por la organización ambiental en este espacio que está aquí.

R6 TRATAMIENTO 3 PAGO ADICIONAL COLECTIVO
[colgar afiche de explicación y ejemplo]



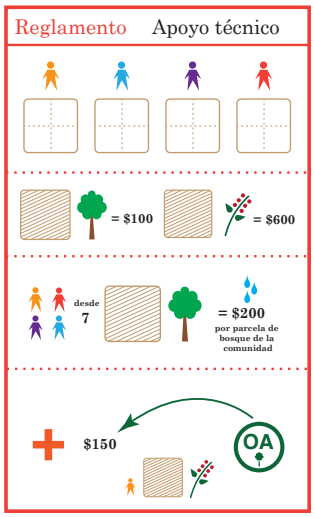
A partir de esta ronda las reglas cambian. Por favor ponga mucha atención.
Una organización ambiental está interesada en conservar los bosques en su comunidad pues regulan el clima y ayudan a combatir el cambio climático; protegen los suelos y evitan derrumbes; y son el hábitat de miles de especies por lo que protegen la biodiversidad.
Por esta razones, esta organización ambiental está interesada en dar un PAGO ADICIONAL si hay un mínimo de 7 parcelas de bosque en su comunidad.
Este pago consiste en que cada uno de ustedes recibe un PAGO ADICIONAL de $50 pesos por cada parcela que la comunidad haya dejado SI y solo SI la comunidad comunidad tiene en total 7 o más parcelas de bosque. Usted recibe los $50 adicionales por cada parcela en bosque sin importar cuántas parcelas deja USTED en bosque.
Es decir, desde ahora si se cumple con que la comunidad tiene 7 o más parcelas de bosque, usted recibe las ganancias del agua MÁS un pago adicional de la organización ambiental.
Usted va a recibir una nueva tabla de pagos donde ABAJO dice Organización Ambiental.
Todos los demás espacios siguen funcionando igual y desde esta ronda el asistente va a anotar cuánto recibe UD por la organización ambiental en este espacio que está aquí.

R6 Tratamiento 4: VOTACIÓN



[colgar afiche de explicación y ejemplo]
A partir de esta ronda las reglas cambian. Por favor ponga mucha atención.
Una organización ambiental está interesada en conservar los bosques en su comunidad pues regulan el clima y ayudan a combatir el cambio climático; protegen los suelos y evitan derrumbes; y son el hábitat de miles de especies por lo que protegen la biodiversidad.
Por esta razones, esta organización ambiental está interesada en dar un PAGO ADICIONAL si hay un mínimo de 7 parcelas de bosque en su comunidad.
Su comunidad va a poder decidir SI QUIERE ESE PAGO ADICIONAL y si lo quiere, cómo le gustaría que fueran las ganancias: o individuales o colectivas.
Las ganancias individuales consisten en que cada uno de ustedes recibe un PAGO ADICIONAL de $200 pesos por cada parcela en bosque que USTED dejó SI la comunidad comunidad tiene en total 7 parcelas de bosque. En esta opción usted recibe de acuerdo con el número de parcelas en bosque que dejó.
Las ganancias colectivas consisten en que cada uno de ustedes recibe un PAGO ADICIONAL de $50 pesos por cada parcela en bosque que su COMUNIDAD dejó SI la comunidad tiene en total 7 parcelas de bosque sin importar si UD dejó bosque o no ud. recibe el pago adicional!!
La diferencia entre el pago individual y el pago colectivo es que en el individual usted recibe de acuerdo con lo que USTED deja en bosque mientras que en el colectivo USTED recibe sin importar lo que usted deja en bosque siempre y cuando se cumpla el mínimo de 7 parcelas en bosque.
En otras palabras, en el pago individual se premia su esfuerzo por dejar bosque; mientras que en el colectivo se premia el esfuerzo de la comunidad sin importar lo que hizo un miembro en particular. OJO, recuerde que el pago adicional, sea individual o colectivo, solo se recibe si hay 7 o más parcelas en bosque en la comunidad!!!!

R6 TRATAMIENTO 4 PAGO ADICIONAL EN FORMA DE SOBREPRECIO
A partir de esta ronda las reglas cambian. Por favor ponga mucha atención.



Una organización ambiental está interesada en conservar los bosques en su comunidad pues regulan el clima y ayudan a combatir el cambio climático; protegen los suelos y evitan derrumbes; y son el hábitat de miles de especies por lo que protegen la biodiversidad.

Para esto, esta organización está interesada en dar un SOBREPRECIO a su COSECHA SI y SOLO SI hay 7 o más parcelas de bosque en su comunidad.

Es decir, desde ahora si se cumple con que la comunidad tiene 7 o más parcelas de bosque, usted recibe las ganancias del agua MÁS el pago adicional de la organización ambiental de $150 pesos por cada parcela que puso a CULTIVAR. Este pago adicional de la organización ambiental es como si fuera un SOBREPRECIO a su COSECHA por mantener en buen estado los bosques y fuentes de agua.

Usted va a recibir una nueva tabla de pagos donde ABAJO dice Organización Ambiental. Todos los demás espacios siguen funcionando igual y desde esta ronda el asistente va a anotar cuánto recibe UD por la organización ambiental en este espacio que está aquí.

Appendix 13. Pay-off tables economic experiment

Individual payment

	Units of land in fore ($100)	4	3	2	1	0
Units of forest of the other 3 members of the community	0	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	1	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	2	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	3	$ 2.600	$ 900	$ 1.400	$ 1.900	$ 2.400
	4	$ 2.800	$ 2.900	$ 1.400	$ 1.900	$ 2.400
	5	$ 3.000	$ 3.100	$ 3.200	$ 1.900	$ 2.400
	6	$ 3.200	$ 3.300	$ 3.400	$ 3.500	$ 2.400
	7	$ 3.400	$ 3.500	$ 3.600	$ 3.700	$ 3.800
	8	$ 3.600	$ 3.700	$ 3.800	$ 3.900	$ 4.000
	9	$ 3.800	$ 3.900	$ 4.000	$ 4.100	$ 4.200
	10	$ 4.000	$ 4.100	$ 4.200	$ 4.300	$ 4.400
	11	$ 4.200	$ 4.300	$ 4.400	$ 4.500	$ 4.600
	12	$ 4.400	$ 4.500	$ 4.600	$ 4.700	$ 4.800

	Nash Equilibrium
	Best strategies for player i
	Best stratagies that are a nash equilibrium
	Social optimum

Collective payment

	Units of land in forest ($100)	4	3	2	1	0
Units of forest of the other 3 members of the community	0	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	1	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	2	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	3	$ 2.150	$ 900	$ 1.400	$ 1.900	$ 2.400
	4	$ 2.400	$ 2.650	$ 1.400	$ 1.900	$ 2.400
	5	$ 2.650	$ 2.900	$ 3.150	$ 1.900	$ 2.400
	6	$ 2.900	$ 3.150	$ 3.400	$ 3.650	$ 2.400
	7	$ 3.150	$ 3.400	$ 3.650	$ 3.900	$ 4.150
	8	$ 3.400	$ 3.650	$ 3.900	$ 4.150	$ 4.400
	9	$ 3.650	$ 3.900	$ 4.150	$ 4.400	$ 4.650
	10	$ 3.900	$ 4.150	$ 4.400	$ 4.650	$ 4.900
	11	$ 4.150	$ 4.400	$ 4.650	$ 4.900	$ 5.150
	12	$ 4.400	$ 4.650	$ 4.900	$ 5.150	$ 5.400

Crop-price premium payment

	Units of land in forest ($100)	4	3	2	1	0
Units of forest of the other 3 members of the community	0	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	1	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	2	$ 400	$ 900	$ 1.400	$ 1.900	$ 2.400
	3	$ 1.800	$ 900	$ 1.400	$ 1.900	$ 2.400
	4	$ 2.000	$ 2.450	$ 1.400	$ 1.900	$ 2.400
	5	$ 2.200	$ 2.650	$ 3.100	$ 1.900	$ 2.400
	6	$ 2.400	$ 2.850	$ 3.300	$ 3.750	$ 2.400
	7	$ 2.600	$ 3.050	$ 3.500	$ 3.950	$ 4.400
	8	$ 2.800	$ 3.250	$ 3.700	$ 4.150	$ 4.600
	9	$ 3.000	$ 3.450	$ 3.900	$ 4.350	$ 4.800
	10	$ 3.200	$ 3.650	$ 4.100	$ 4.550	$ 5.000
	11	$ 3.400	$ 3.850	$ 4.300	$ 4.750	$ 5.200
	12	$ 3.600	$ 4.050	$ 4.500	$ 4.950	$ 5.400

Appendix 14. Set of best private strategies for forest conservation and Nash equilibria by payment

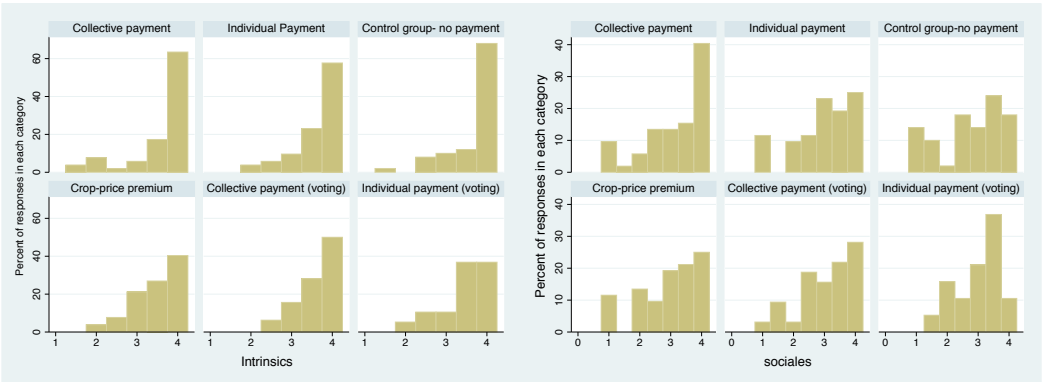
	Base-line	Individual payment	Collective payment	Crop-price premium payment
Set of best private strategies	$X_{fi} \in \{0,1,2\}$	$X_{fi} \in \{0,1,2,3,4\}$	$X_{fi} \in \{0,1,2,3\}$	$X_{fi} \in \{0,1,2,3\}$
Set of Nash equilibria	{0,0,0,0} {1,2,2,2}	{0,0,0,0}{0,1,3,3} {0,1,2,4}{0,0,3,4} {0,2,2,3}{1,2,2,2} {1,1,2,3}{1,1,1,4}	{0,0,0,0}{0,1,3,3} {0,2,2,3}{1,2,2,2} {1,1,2,3}	{0,0,0,0}{0,1,3,3} {0,2,2,3}{1,2,2,2} {1,1,2,3}

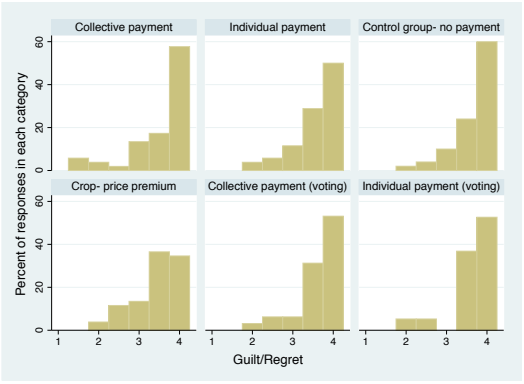
Appendix 15. Socio-demographic data for control and treatment groups (economic experiment)

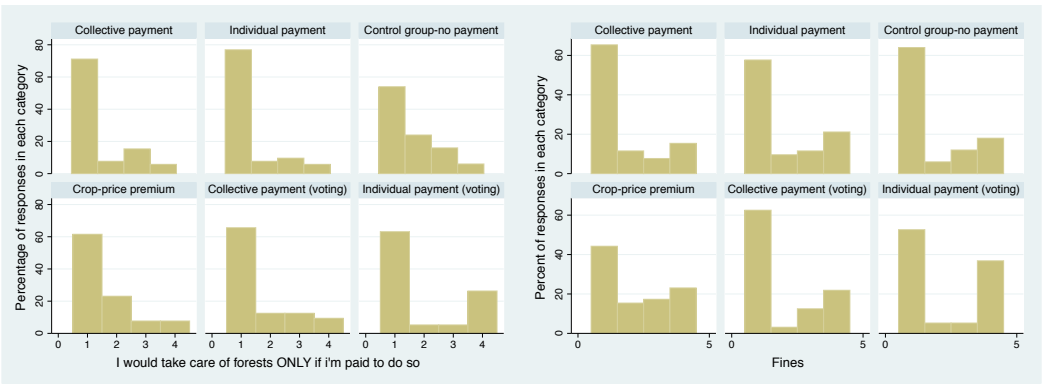
*Monthly income is reported for a subsample because no data was available for the whole sample.

Treatment	**Men**	**Age**	**Education (%)**						**Monthly income***
	(%)	**(years)**							
			None	Incomplete primary	Complete primary	Incomplete high school	Complete high-school	Technician or superior	
Control group n =52	54.00	48.4	12.00	40.00	16.00	14.00	6.00	12	$498.750 (n=36)
Individual Payment n =52	46.15	45.5	11.54	25.00	23.08	15.38	15.38	9.62	$659.230 (n=39)
Collective Payment n =52	53.85	49.07	9.62	26.92	17.31	9.62	17.31	19.23	$681.227 (n=44)
Premium price n=52	63.46	49.28	17.31	30.77	19.23	11.54	13.46	7.69	$560.950 (n=40)
Individual payment by voting n =20	52.63	51.7	15.79	15.79	31.58	15.79	10.53	10.53	$479.231 (n=13)
Collective payment by voting n=32	56.25	51.2	12.50	28.12	15.62	12.50	28.12	3.12	$428.125 (n=24)

Appendix 16. Histograms of motivations per type of payment in the experiment







Appendix 17. Robustness check (economic experiment)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
VARIABLES	Intrinsics	Intrinsics	Intrinsics	Intrinsics	Intrinsics	Guilt/Regret	Guilt/Regret	Guilt/Regret	Guilt/Regret	Guilt/Regret	Socials	Socials	Socials	Socials	Socials
Collective payment	-0.206	-0.215	-0.272	-0.304	-0.372	-0.259	-0.274	-0.307	-0.337	-0.377	**0.795****	**0.780****	**0.832****	**0.831****	**1.021*****
	(0.414)	(0.417)	(0.426)	(0.438)	(0.445)	(0.394)	(0.400)	(0.403)	(0.405)	(0.413)	(0.362)	(0.363)	(0.367)	(0.367)	(0.376)
Individual payment	-0.339	-0.379	-0.396	-0.529	-0.576	-0.395	-0.327	-0.333	-0.403	-0.424	0.332	0.375	0.453	0.440	0.602
	(0.403)	(0.407)	(0.414)	(0.424)	(0.427)	(0.382)	(0.386)	(0.387)	(0.391)	(0.393)	(0.349)	(0.356)	(0.360)	(0.361)	(0.371)
Premium price payment	**-0.965****	**-0.916****	**-0.891****	**-0.958****	**-0.999****	**-0.921****	**-0.919****	**-0.943****	**-0.999*****	**-1.019*****	0.310	0.331	0.421	0.409	0.558
	(0.391)	(0.393)	(0.399)	(0.410)	(0.412)	(0.374)	(0.375)	(0.379)	(0.382)	(0.383)	(0.351)	(0.351)	(0.355)	(0.354)	(0.362)
Collective by voting	-0.551	-0.557	-0.470	-0.445	-0.500	-0.228	-0.309	-0.294	-0.300	-0.341	0.498	0.412	0.551	0.578	0.757*
	(0.442)	(0.444)	(0.455)	(0.469)	(0.474)	(0.436)	(0.441)	(0.449)	(0.451)	(0.459)	(0.398)	(0.402)	(0.409)	(0.410)	(0.418)
Individual by voting	**-0.997****	**-1.045****	**-1.166****	**-1.226****	**-1.229****	-0.188	-0.191	-0.211	-0.290	-0.299	0.258	0.200	0.274	0.236	0.328
	(0.504)	(0.509)	(0.522)	(0.531)	(0.531)	(0.513)	(0.517)	(0.523)	(0.526)	(0.527)	(0.448)	(0.456)	(0.465)	(0.462)	(0.468)
Sex		-0.437*	-0.410	-0.279	-0.251		-0.0551	-0.0320	0.00664	0.0229		-0.253	-0.282	-0.227	-0.273
		(0.250)	(0.256)	(0.262)	(0.264)		(0.242)	(0.245)	(0.247)	(0.249)		(0.226)	(0.230)	(0.232)	(0.233)
Age		0.00605	0.0124	0.0110	0.00823		**0.0264*****	**0.0248*****	**0.0246*****	**0.0231****		**0.0226*****	**0.0216*****	**0.0207****	**0.0276*****
		(0.00769)	(0.00910)	(0.00931)	(0.00982)		(0.00762)	(0.00903)	(0.00904)	(0.00949)		(0.00713)	(0.00815)	(0.00815)	(0.00877)
incomplete			0.458	0.675	0.668			-0.364	-0.253	-0.260			0.0223	0.113	0.162
			(0.457)	(0.466)	(0.466)			(0.470)	(0.474)	(0.475)			(0.415)	(0.420)	(0.422)
Primary school complete			-0.112	0.272	0.305			-0.437	-0.322	-0.307			0.220	0.324	0.306
			(0.396)	(0.411)	(0.412)			(0.436)	(0.441)	(0.442)			(0.371)	(0.377)	(0.380)
Highschool not finished			0.608	0.742	0.696			-0.469	-0.445	-0.476			0.272	0.336	0.444
			(0.532)	(0.539)	(0.541)			(0.553)	(0.552)	(0.556)			(0.477)	(0.479)	(0.481)
Highschool finished			-0.180	-0.00440	-0.00837			-0.293	-0.216	-0.221			-0.345	-0.282	-0.267
			(0.495)	(0.499)	(0.500)			(0.519)	(0.522)	(0.522)			(0.460)	(0.461)	(0.464)
More than highschool (university, graduate)			**1.152****	**1.463****	**1.482****			-0.110	-0.0261	-0.0199			0.182	0.261	0.292
			(0.573)	(0.586)	(0.587)			(0.548)	(0.549)	(0.550)			(0.491)	(0.491)	(0.492)
Has cut down the forest?				**-1.208*****	**-1.230*****				**-0.489***	**-0.501***				-0.421*	-0.399
				(0.275)	(0.277)				(0.271)	(0.272)				(0.251)	(0.252)
Want children to become farmers?					0.261					0.144					-0.595**
					(0.290)					(0.281)					(0.268)
Observations	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257

Appendix 17. Cont.'

	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
VARIABLES	Payments	Payments	Payments	Payments	Payments	Fines	Fines	Fines	Fines	Fines
Collective payment	-0.553	-0.552	-0.371	-0.360	-0.349	-0.125	-0.152	0.0594	0.0554	-0.0720
	(0.401)	(0.405)	(0.418)	(0.418)	(0.427)	(0.404)	(0.406)	(0.424)	(0.425)	(0.436)
Individual payment	**-0.868****	**-0.741***	-0.707	-0.676	-0.668	0.233	0.306	0.374	0.412	0.319
	(0.420)	(0.426)	(0.436)	(0.438)	(0.442)	(0.394)	(0.397)	(0.414)	(0.417)	(0.424)
Premium price payment	-0.268	-0.313	-0.297	-0.262	-0.253	0.612	0.545	0.556	0.570	0.492
	(0.379)	(0.385)	(0.395)	(0.398)	(0.404)	(0.381)	(0.384)	(0.400)	(0.401)	(0.406)
Collective by voting	-0.313	-0.350	-0.127	-0.118	-0.106	0.126	0.0839	0.280	0.270	0.151
	(0.450)	(0.456)	(0.480)	(0.482)	(0.490)	(0.459)	(0.462)	(0.484)	(0.485)	(0.493)
Individual by voting	0.0672	0.0645	0.348	0.399	0.400	0.660	0.663	0.842	0.873	0.848
	(0.553)	(0.560)	(0.578)	(0.580)	(0.580)	(0.537)	(0.542)	(0.557)	(0.558)	(0.557)
Sex		**0.754*****	**0.736*****	**0.703****	**0.699****		**0.578****	**0.585****	**0.561****	**0.612****
		(0.273)	(0.281)	(0.284)	(0.286)		(0.254)	(0.266)	(0.267)	(0.271)
Age		0.0110	-0.00748	-0.00696	-0.00645		0.00330	-0.0204**	-0.0195**	-0.0241**
		(0.00823)	(0.0101)	(0.0102)	(0.0109)		(0.00772)	(0.00943)	(0.00947)	(0.0101)
Primary school incomplete			**-1.192****	**-1.239****	**-1.236****			-1.229***	-1.284***	-1.331***
			(0.492)	(0.496)	(0.497)			(0.452)	(0.457)	(0.459)
Primary school complete			-0.456	-0.508	-0.508			-1.090***	-1.165***	-1.155***
			(0.414)	(0.420)	(0.420)			(0.409)	(0.418)	(0.420)
Highschool not finished			-0.967*	-0.981*	-0.971*			-2.348***	-2.370***	-2.488***
			(0.567)	(0.567)	(0.571)			(0.570)	(0.571)	(0.581)
Highschool finished			**-1.726*****	**-1.767*****	**-1.764*****			-2.228***	-2.257***	-2.311***
			(0.602)	(0.606)	(0.606)			(0.545)	(0.546)	(0.549)
More than highschool (university, graduate)			**-2.062*****	**-2.080*****	**-2.079*****			-2.507***	-2.544***	-2.570***
			(0.691)	(0.691)	(0.691)			(0.642)	(0.645)	(0.647)
Has cut down the forest?				0.236	0.239				0.271	0.242
				(0.296)	(0.298)				(0.282)	(0.284)
Want children to become farmers?					-0.0429					0.418
					(0.323)					(0.310)
Observations	257	257	257	257	257	257	257	257	257	257

Appendix 18. Success rate across experimental stages

	Rate of success stage 1	Rate of success stage 2
Control group (CG)	90%	83%
Individual payment	87%	89,4%
Collective payment	89,1%	89,4%
Crop-price premium	83,1%	72,3%
Individual by voting	56%	80%
Collective by voting	85%	92,5%

Appendix 19: socio-demographic and motivations questionnaire for inhabitants of Amazon Piedmont

Questions are presented in the same order as in table 6.2.

Biophysical and productive characteristics of the farm and productive uses of the land
¿Cuál es el tamaño de este predio?
¿Tiene café? (SI o NO)
¿Qué área tiene de café?
unidades
¿A quién le vende el café?
¿Tiene caña? (SI o NO)
¿Qué área tiene de caña?
¿Tiene pastos? (SI o NO)
¿Qué área tiene de pastos?
¿Tiene otros cultivos? (SI o NO)
¿Qué área tiene de otros cultivos?
¿Tiene bosque? (SI o NO)
¿Qué área tiene de bosque?
¿Tiene rastrojo? (SI o NO)
¿Qué área tiene de rastrojo?
¿Tiene ganado? (SI o NO)
¿Cuántas cabezas?
Socioeconomic characteristics of the household
¿Hace cuántos años vive en esta finca?
¿Cuál es la situación legal de ESTE predio? (Escoger una)
• Tiene escritura y ESTÁ registrada en la oficina de registro
• Tiene escritura pero NO está registrada en la oficina de registro
• Tiene escritura pero NO SE si está registrada en la oficina de registro
• Tiene escritura pero está en proceso de sucesión
• Tiene promesa o papeles de compraventa pero no hay escritura
• Tiene posesión pero NO se tiene papeles
¿Hasta qué año estudió?
¿Cuál es su edad?
¿Me puede decir cuántas personas viven en esta finca?
Para cada persona que vive en la finca preguntar:
Sexo
Edad
¿Hasta qué año estudió?
¿Cuánto es el ingreso de su hogar mensualmente? (Mencionar que el hogar es la gente que vive en su casa y que el ingreso del hogar es la suma de todos los ingresos que puedan tener los miembros del hogar)
¿Le gustaría que sus hijos se dedicaran a las labores del campo? (si ya tienen una profesión: ¿Le hubiera gustado?)
Social capital and social networks
¿Usted es miembro de alguna organización o asociación productiva? (SI, NO, ¿Cuál?)

Usted diría que la gente de esta vereda:
• Se ayudan mucho
• Se ayudan poco
• No se ayudan
Income sources
¿Qué cultivo le genera más ingresos a su hogar? (Seleccionar uno)
• Café
• Caña
• Otro
• Ninguno
¿Cuáles de estas actividades fueron fuentes de ingreso para su hogar en el último año? [Marcar solo las opciones que fueron fuente de ingreso]
• Cultivos en mi predio para vender
• Madera o leña en mi predio para vender
• Madera o leña del bosque por fuera de mi predio para vender
• Ganado en mi predio
• Trabajo de jornalero en actividades agrícolas
• Por cuenta propia: construcción/industria/comercio/servicios
• Por salarios en construcción/servicios domésticos/industria/comercio /servicios/gobierno/educación
• Pensiones
• Plata que le mandan familiares o amigos desde afuera del país
• Programas del gobierno
• Otros
Motivations
Le voy a leer unas frases. Le pido que por favor me diga si está de acuerdo con esa frase usando la siguiente escala: 1 es NO, 2 es UN POCO, 3 es SI, DE ACUERDO, 4 es TOTALMENTE DE ACUERDO.
Disfruto cuando no tumbo el bosque
Soy del tipo de gente que no tumba el bosque
Me arrepiento si tumbo el bosque
Me siento culpable si tumbo el bosque
La gente más cercana a mí se molestaría conmigo si tumbo el bosque
Mis vecinos me criticarían si tumbo el bosque
Yo cuido el bosque SOLO si me pagan por hacerlo
Yo no tumbo el bosque por miedo a las multas que me pueda poner la autoridad ambiental
No veo qué puedo ganar conservando el bosque
Deforestation behavior
¿Usted o alguien de su hogar ha tumbado bosque desde que llegó a su predio? (SI o NO)