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Analysis

Payment for Environmental "Self-Service": Exploring the Links Between Farmers' Motivation and Additionality in a Conservation Incentive Programme in the Bolivian Andes

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ABSTRACT

Neoclassical economic interpretations of Payment for Environmental Services (PES), which assume that participants weigh up costs and benefits, are making room for more complex analyses. However, there is still little evidence of how PES programmes interact with existing motivations to conserve, the extent to which funded conservation is additional, and the likely permanence of changes. We categorized the outcome of contracts aiming to reduce cattle grazing in riparian forest (n = 428) and deforestation (n = 912) by Bolivian farmers in terms of whether they were unsuitable, non-compliant, non-additional, or additional (the holy grail of PES programmes) and explored the relationship between farmers' reported motivations and the extent to which the conservation funded was additional. Up to 39% of contracts to exclude cattle, and 14% to prevent deforestation appear to be additional. Where participation is motivated by the instrumental values of nature (such as provision of clean water) contracts to exclude cattle from riparian forest are more likely to represent additional conservation. We suggest that the programme is partly acting as what we term 'payment for environmental self-service'; i.e. the external incentives enable changes in behaviour motivated by farmers' perceptions of environmental benefits they receive from the management changes incentivized.

1. Introduction

Payments for Environmental Services (or the equivalent term Payment for Ecosystem Services; Wunder, 2015) (PES) have been presented as an efficient and effective approach to conservation (Engel and Palmer, 2008; Wunder et al., 2008) and are widely promoted and implemented (Ezzine-de-Blas et al., 2016; Grima et al., 2016). However there has been growing criticism that such market-mechanisms for conservation can result in unhelpful commodification of nature and can lead to crowding-out of existing motivations to conserve (Bowles, 2008; Rode et al., 2015). These criticisms have resulted in increasing academic interest in land users' motivations to participate in conservation programmes and the role that conditional positive incentives such as those provided by PES programmes can play (Moros et al., 2017; Muradian et al., 2010). Researchers have long been concerned about the additionality of conservation funded through PES (Pattanayak et al., 2010; Sánchez-Azofeifa et al., 2007) and there is evidence that many programmes pay for conservation that would have happened anyway rather than incentivizing real change in land use (Börner et al., 2017; Daniels et al., 2010; García-Amado et al., 2013). Where changes are made, there are concerns about the permanence of such changes after the programme ends (Engel et al., 2008; Pagiola et al., 2016; Tacconi et al., 2013; Börner et al., 2017). Despite interest in motivations to participate in PES and awareness of the importance of additionality and permanence to PES effectiveness, there is little research explicitly linking the motivation of those participating in a PES programme and the additionality or permanence of the conservation funded.

The factors influencing household participation in a PES project were first considered in detail by Pagiola and colleagues in 2005. Their model (Pagiola et al., 2005) emphasises that for a household to participate they must first be eligible (for example by owning land which meets the PES criteria), they must want to participate (which the authors assume is primarily based on the profitability of the PES programme), and they must be able to participate (which will be affected by factors such as their level of experience and the technical difficulty of the practices which PES seeks to incentivize). However as the way PES is conceptualized has shifted from its initial roots in neoclassical economics to more explicitly acknowledging the importance of the social context of decisions to participate (Gómez-Baggethun et al., 2009; McAfee and Shapiro, 2010; Muradian et al., 2010); motivation

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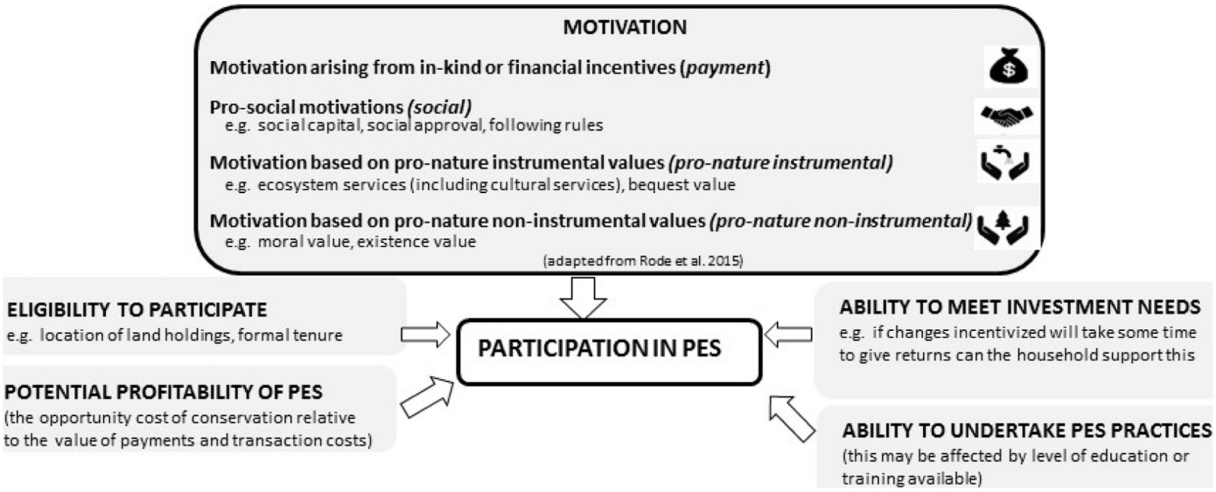

Fig. 1. Conceptual framework highlighting the factors influencing participation in a PES programme (based on Pagiola et al., 2005) with particular focus on the role of different categories of motivation.
(Adapted form Rode et al., 2015).

deserves a central role in the model explaining participation in PES (Fig. 1). Motivation can be defined as 'to be moved to do something' (Ryan and Deci, 2000). The literature demonstrates that while payments do play a role in motivating behaviour change in PES, pro-social and pro-nature motivations are also important (Rode et al., 2015).

Pro-social motivations include possible gains in social capital through cooperation with others (García-Amado et al., 2013) and there is evidence that these influence people's willingness to engage with conservation (D'Adda, 2011). People may also be motivated to join a programme due to the prevailing rules or social norms (Corbera et al., 2009; Vatn, 2010). For example; once participants have signed up to a PES, the rules which underpin the contract may be part of the motivation to comply and enact the conservation (Kolinjivadi et al., 2014). Pro-nature motivations include those based both on the instrumental and non-instrumental values of nature (Rode et al., 2015). People may participate in a PES programme because of perceived instrumental benefits they may receive from the environmental services (whether provisioning, supporting, regulating or cultural services) now or in the future (bequest value; Fisher, 2012; García-Amado et al., 2013). For example, farmers in a PES programme in Colombia were more willing to participate if they perceived long term environmental benefits to themselves (Hayes, 2012). Finally, some people will participate because they have a moral commitment to nature conservation or value the very existence of the relevant ecosystem (Kenter et al., 2015; Luck et al., 2012; Muradian, 2013; Van Hecken and Bastianensen, 2010); such motivations are based on non-instrumental values of nature (Fig. 1).

Payments for Watershed Services are a category of PES programmes that involve a relationship between multiple users of the same watershed. Payment for watershed services programmes were initially conceptualized as downstream users incentivising sustainable land use practices upstream to secure their access to water quality and quantity (Wunder and Albán, 2008). In practice, payments for watershed services are very diverse, embedded in institutional relations among multiple private and public stakeholders, and use a range of financial and non-financial incentives (Boisvert et al., 2013; Martin-Ortega et al., 2013). In 2003, a Bolivian NGO, *Fundación Natura Bolivia* (*Natura*), launched a form of Payment for Watershed Services in the Bolivian highlands to establish reciprocal relationships between environmental service users (Municipal Governments, Water Cooperatives and international donors) and upstream farmers and cattle-owners (Asquith et al., 2008). The programme, now known as *Watershared*, has never used the terminology of market transactions but refers to the contracts as Reciprocal Watershed Agreements (*Acuerdos Reciprocos por Agua*). *Watershared* aims to conserve biodiversity and improve water quality by incentivising farmers to prevent forest conversion and exclude cattle from riparian forest. > 210,000 ha belonging to 4500 families are under *Watershared* agreements (Asquith, 2016).

We evaluate the role played by different categories of motivation (motivation based on payments, pro-social motivations, and motivations based on pro-nature instrumental and pro-nature non-instrumental values) in incentivizing farmers' participation in *Watershared*, the extent to which farmers acting on different reported motivations provide additional conservation, and the likely permanence of this conservation when contracts expire. We argue that the programme is partly acting as what we term 'payment for environmental self-service' in that the external incentives enable changes in behaviour motivated by farmers' perceptions of environmental benefits they and their community receive from the management changes incentivized. In other words, pro-nature instrumental motivations are important in motivating behaviour change.

2. Methods

2.1. Description of the Study Site

The Rio Grande catchment in the eastern Bolivian Andes covers 57′000 km^2. Although the area has quite high average rainfall (nearly 900 mm across the area), water is a limiting factor for agriculture in the dry season. Most people rely on unimproved water sources often taken from outtakes in the forest. In order to protect the watershed, and also the local forests which are highly biodiverse (Myers et al., 2000) the Santa Cruz government created the Río Grande Valles Cruceños Natural Integrated Management Area (Spanish acronym ANMI-VG-RC) in 2007 (Decree N°059/07). In 2011, a local NGO, *Fundación Natura Bolivia* (*Natura*), started to apply the *Watershared* programme in the area (Fig. 2).

The *Watershared* programme provides in kind incentives (a free choice of beehives, fruit seedlings, irrigation tubing, construction material, and barbed wire) to upstream farmers who commit to following certain land use restrictions on contracted land. There are three levels of contract which vary in terms of what land is eligible and what restrictions are placed on land owners (see summary in the appendix A). For a level 1 contract (which covers only forested land, within 100 m of a river), farmers receive 100 USD worth of in-kind incentives (at market value) at signing plus $10 worth per hectare annually. No cultivation is permitted within the contracted area and cattle must be excluded. Level

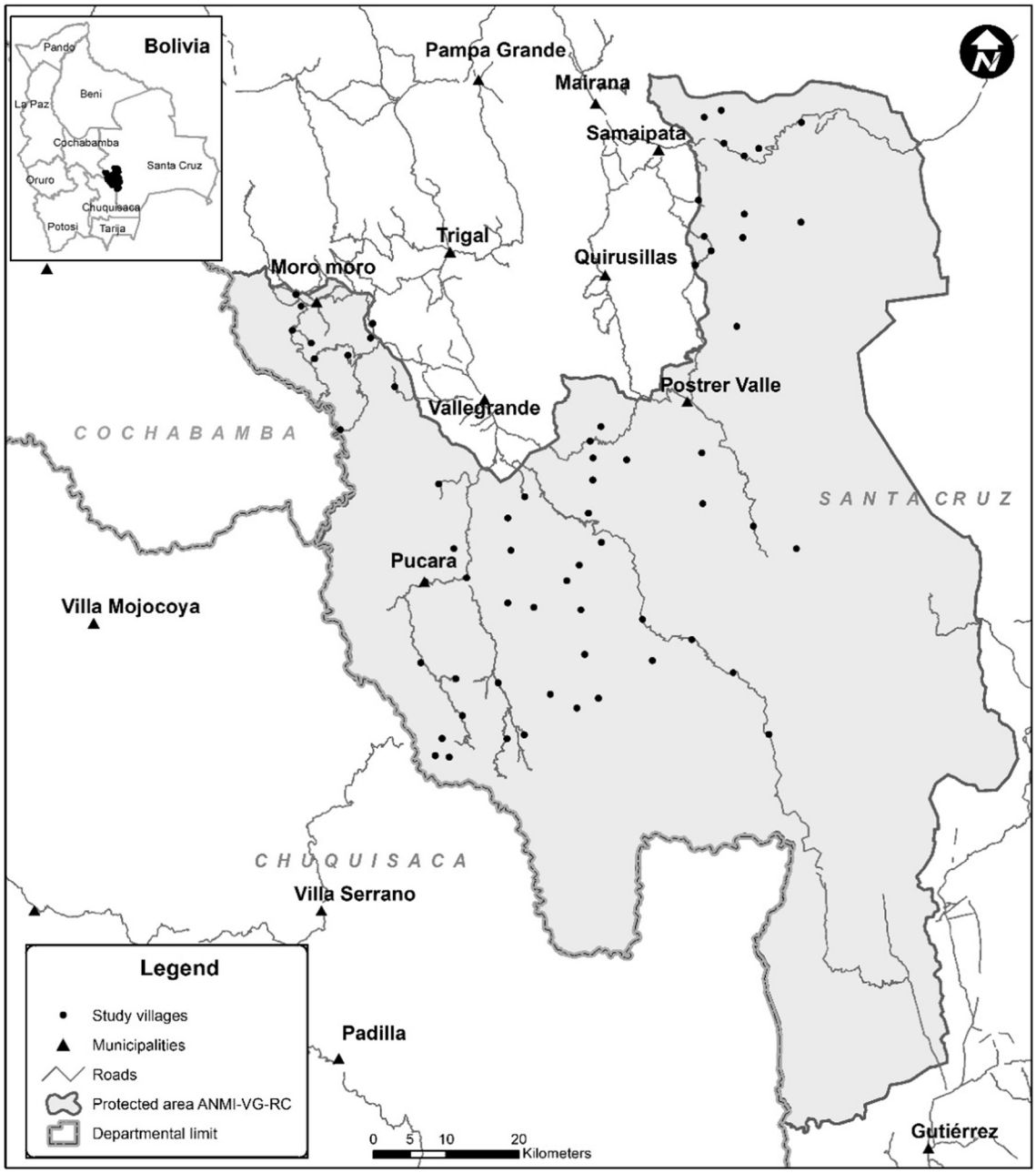

Fig. 2. The Río Grande Valles Cruceños Natural Integrated Management Area (Spanish acronym ANMI-RG-VC) and the 67 villages participating in the *Watershared* programme.

two contracts apply on similar land to level 1 and also require no clearance but farmers are not required to remove cattle immediately. The payment is 3 USD per hectares. Level 3 contracts apply to forested and shrub land not along the banks of rivers. While clearance for cultivation is forbidden, cattle rearing is acceptable. The payment is 1 USD per hectare. Contracts are for three years but are renewable. An earlier study (Grillos, 2017) investigated uptake of the programme by farmers in the area, concluding that social factors, as well as barriers to entry, may have influenced take-up. Funding for the incentives comes from a combination of local municipalities, payments by water users into water funds, and Natura's international donors.

Natura conduct annual monitoring of each parcel under level 1 or level 2 and record signs of the presence of cows or clearance to verify farmers' compliance (Natura, 2014). Level 3 contracts are monitored using remote sensing. Extreme cases of non-compliance have resulted in the incentives being taken back and redistributed to the community.

2.2. Data Collection

We worked in the 81 communities in which *Watershared* has been implemented since 2010. These communities vary in size from 1 to > 100 households. We conducted exploratory field work in April and May 2015 to get a comprehensive understanding of local land use dynamics and implementation of the programme on the ground. We then returned between October 2015 and March 2016 to conduct household surveys. Surveys were conducted in Spanish on Android tablets by 12 trained enumerators using the Open Data Kit software (https://opendatakit.org/), usually with the household head. PB and DC attended a significant sub-set of interviews. Our sampling frame was a complete list of households in each community prepared by *Natura* when they started working in the area in 2010 and included both those who had enrolled in the programme and those who chose not to (n = 2680). This paper includes data from 507 households who we

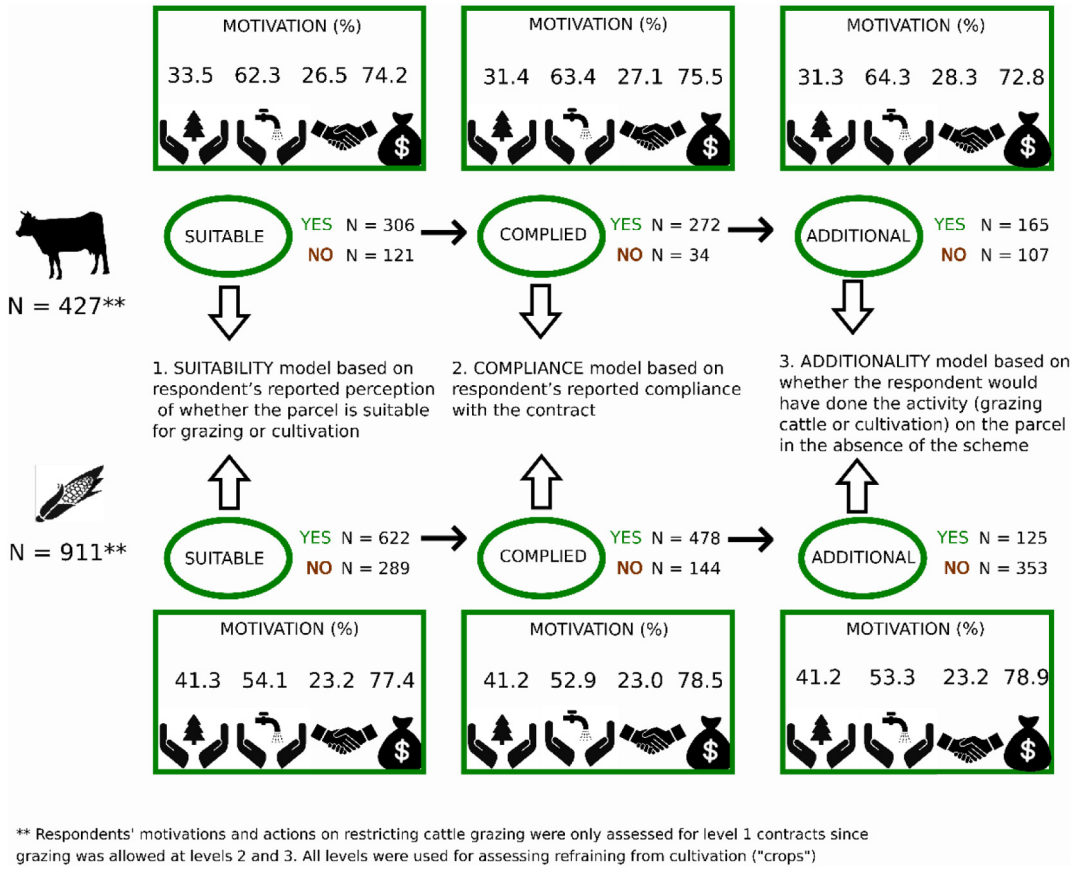

Fig. 3. Outline of model hierarchy showing the number of parcels included for our three sets of models predicting 1) suitability of land enrolled, 2) compliance with conservation contracts, and 3) additionality of the contracts. Each model is a binomial model where '1' represents the "positive" outcome (suitability, compliance, and additionality). Models were run separately for cattle grazing (level 1 contracts only) and crops (all contracts). The distribution of motivations reported is shown for each set of models (classification of motivations is: pro-nature non-instrumental, pro-nature instrumental, social and payment; see Fig. 1).

interviewed who had enrolled in the programme and therefore had *Watershared* contracts on at least one parcel of their land. Households may have more than one parcel of land under a conservation contract.

The survey included questions about why the household had joined the programme, the type of incentives they selected and the way the programme was implemented by detailing the practices of land use before and during the contract. Detailed questions were asked about all level 1 parcels the household had under *Watershared* contracts and, if this was < 5 contracts, their level 2 and 3. The enumerator had a GIS map overlaid on google earth open on a tablet computer during the interview to help focus the discussion on specific land parcels under discussion.

The interviews covered details of 912 contracted land parcels belonging to the 507 participants. However, owing to some questions left unanswered, some of our analysis is based on 911 land parcels, and some on 912. We also conducted key informant interviews with 10 people to estimate the effort expended by farmers to use barbed wire to fence their land (Fig. B1). The survey instruments (and full data set) are archived with the UK data archive (Bottazzi et al., 2017).

2.3. Classification of Enrolled Parcels

Because all contracts prohibit cultivation (as a significant aim of *Watershared* is to reduce deforestation), but only level 1 contracts prohibit cattle grazing, we classified each parcel for which we have data ($n = 912$) in terms of cultivation, and only level 1 contracts ($n = 428$) in terms of cattle exclusion. We classified each parcel into one of four 'additionality' categories based on the responses by the household head: unsuitable (a parcel which the farmer did not consider suitable for cultivation or cattle grazing but which was enrolled in a contract paying the land owner not to do that activity), non-compliant (a parcel where cultivation or cattle grazing was carried out against the rules of the *Watershared* contract), non-additional (a parcel where cultivation or cattle grazing was not carried out, but where the household reported they would not have used the parcel in that way even in the absence of the contract), and additional (a parcel where respondents reported that in the absence of the contract they would have cultivated or grazed cattle but they do not because of the *Watershared* contract). Only parcels suitable for cattle/grazing could be considered as compliant or non-compliant, and only compliant parcels could be considered additional or non-additional (Fig. 3). Because we cannot detect spill-over (land use being displaced from contracted land to other land which is not under contract; Alix-Garcia et al., 2012), our estimates of additionality should be considered a maximum value.

We acknowledge that self-reported data on land use has limitations (respondents may, for example, be unwilling to admit enrolling unsuitable land in the programme or non-compliance of contracts). However it would not have been possible to achieve an independent classification of enrolled parcels because detailed local knowledge of the land, its accessibility, the household economy, are all needed to classify land as suitable or not and only the household can say what they would have done in the absence of the contract. Our field team worked hard to emphasise that information provided in the survey was confidential and there would be no consequences from responses given in the survey. We do have independent data on non-compliance with which to compare our survey responses concerning non-compliance (probably the most sensitive of our questions). The levels of non-compliance reported in our surveys are similar to that detected by *Natura*

technicians during their monitoring (Natura, 2014) giving us confidence. Finally, we would argue that by using self-reported data to classify land parcels we are identifying the extent to which parcels under conservation are considered additional by respondents. The perception of participants in the difference an intervention has caused is a valid question for impact evaluators (Woodhouse et al., 2015).

To explore the permanence of conservation funded by the programme we asked respondents what a parcel will be used for after the programme has finished. The answers included a range of options but for simplicity these were binned into categories reflecting whether the conservation will be continued or not.

2.4. Ethics and Conflict of Interests

This research was assessed under the Bangor University Research Ethics Framework. There is the potential for conflict of interest as *Natura* were involved in the research but are also the implementers of the *Watershared* programme which is the focus of our research. However, the survey was designed, managed and the data cleaned and analysed by the Bangor University team and although enumerators paid by *Natura* conducted the bulk of the interviews in the household survey, they were trained by authors of this paper who have no prior affiliation with *Natura*.

2.5. Data Analysis

2.5.1. Classification of Household Motivation

To explore the relationship between additionality categories and respondents' motivation we classified respondents' motivations to join the programme using the question from the survey "Why did you join the programme?". Responses were binned into categories representing the typology of motivations represented in Fig. 1. These are motivation arising from the in kind incentives (payment), pro-social motivations based on conforming to norms or building social capital (social), motivation arising from the perception that conservation can provide valuable ecosystem services (pro-nature instrumental), and motivation based on moral values or existence value of nature (pro-nature non-instrumental). The question was multiple answer but respondents were also asked for their top motivation.

2.5.2. Approach to Analysis

Models assessing additionality categories of the two main conservation objectives of the *Watershared* contracts (preventing cattle grazing in riparian forest, and preventing expansion of cultivation) were constructed for these two outcomes separately since parcels of land could represent additional conservation for either outcome independently. Hierarchical logistic models were applied to model additionality categories owing to their implicit hierarchical structure (only a parcel which was suitable could be compliant and only one which was compliant could be additional).

Some households had a number of parcels of land under conservation. Therefore, the models (conducted using parcels as the unit of analysis) had repeated measures as modelling was based on the question "Why did you join the programme?" which was asked at household level. However, owing to the low number of repeats compared to the full data set (507 households, 911 data points), explicit inclusion in models was not feasible. Further, out of all households with more than one contract (240 with a combination of contract levels and 65 with level 1 contracts only), 175 and 33 respectively had parcels falling into more than one additionality category, implying a degree of independence between "repeated" measures.

For the question "Why did you join the programme?", respondents both reported multiple-answer data (noting any motivation that applied) and their top choice of motivation. This presented a number of options for analysis. Multiple-answer data present a special case of non-independence in statistics whereby combinations of choices can be more meaningful than individual choices (Bilder and Loughin, 2014); in our case, for example, respondents who joined the programme for both payment and pro-nature instrumental reasons may plausibly have different additionality outcomes to respondents who joined the programme for payment reasons only. Equally, respondents who chose the same reasons to join the programme but had different top reasons to join may also plausibly have different additionality outcomes. These considerations resulted in three modelling approaches – using all motivations to join as independent predictors ("ALL"), collapsing all motivations to join into one factor with all unique combinations of motivations across the respondents ("MULT"), and using top reason only ("TOP").

Without a priori expectations as to which out of the three modelling approaches was most appropriate, we applied all and selected between models using the Akaike Information Criterion or, where models were nested (see below for more explanation), using the R anova function with the Chi-square test. In models for cultivation, where multiple levels of contract were included, level of contract was added as a predictor. However, here, motivations were non-randomly distributed between levels and therefore analysis was split between using level-only, and motivations-only, as predictor. The two were subsequently compared using AIC and the model with the lower score was selected for further testing.

2.5.3. Model Building and Evaluation

The best-performing basic model (whether using all motivations to join as independent predictors [ALL], collapsing all motivations to join into one factor with all unique combinations of motivations across the respondents [MULT], or using top motivation only [TOP]) was identified using AIC. As long as this model was significantly better performing than the null (intercept-only) model, we built on this by testing whether adding any of the other predictors (e.g. adding top reasons [TOP] to a model based on incorporating all reasons to join as independent predictors [ALL]) resulted in a significantly better model. The best model, therefore, could be any one of the basic models, or a combination.

The coefficients between individual factor levels were compared for significance using the glht function in package multcomp (Hothorn et al., 2008). We applied Tukey's test for all-pair comparisons and significant contrasts ($p < 0.05$) were interpreted as indicating negative vs positive relationships with the response. For convenience, all p values from glht tests are indicated as p_{glht}. glht was also used to evaluate differences in odds of response between factor levels (motivation x is n times more likely to lead to outcome z than motivation y).

Effect sizes of significant predictors were approximated with simple Chi-square tests where appropriate (in our case, how many contracts were more or less likely to have a selected outcome given a motivation). Chi-square test results were retained where $p < 0.05$ (Table C.1).

Model performance in classification, reflecting the adequacy of the predictors in informing the outcome (Faraway, 2006) was tested by using the proportion of 1 s in the model data frame as a threshold above which a predicted response probability would be classed as a 1 (suitable, compliant, additional), and under and equal to which a predicted response would be classed as a 0 (unsuitable, noncompliant, nonadditional). Overall classification strength was computed as % correctly classified 0 s and 1 s in the model data frame, 1 classification strength as % correctly classified 1 s out of all real 1 s, and 0 classification strength as % correctly classified 0 s out of all real 0 s (Table C.2).

All analysis was undertaken using R version 3.4.1 (R Core Team, 2017). R code and data are available at https://doi.org/10.6084/m9.figshare.5977720.

3. Results

3.1. Summary Statistics of Reported Motivation to Join the Programme and the Way in Which the Incentives Were Used

The most popular motivation for joining the programme was the

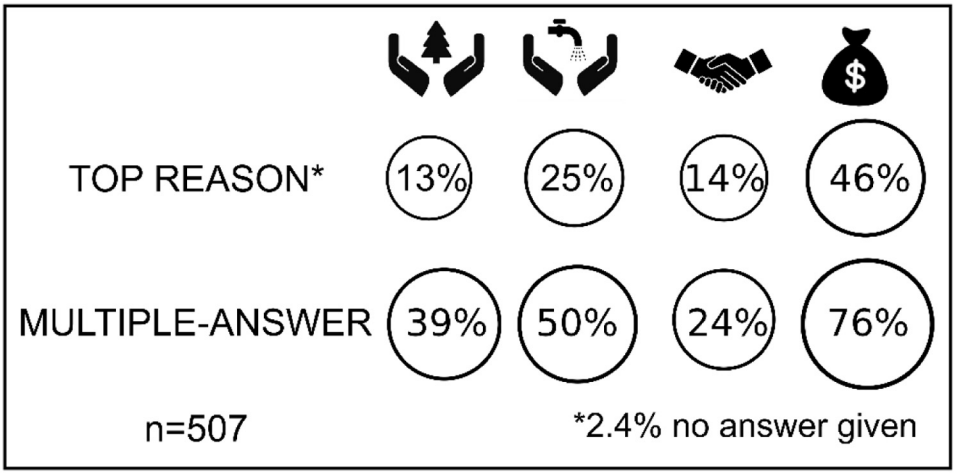

Fig. 4. Distribution of households' (n = 507) top motivation to join the programme and motivations reported when given the opportunity for multiple answers (sums to > 100%). Classification of motivations is: pro-nature non-instrumental, pro-nature instrumental, social and payment (see Fig. 1).

anticipation of the payments (Fig. 4); suggesting the direct incentives played an important role in motivating farmers to join the programme. However for 25% of participants, pro-nature instrumental reasons were their top motivation for participating in the programme (and 50% of respondents reported this as one of their motivations).

What farmers select from the incentives offered also tells us something about their motivations. Farmers were free to select multiple incentives among a set of five categories: bee-keeping materials; water infrastructure (irrigation tanks or tubing); construction material (cement, tin roofing); fruit trees; or barbed wire. The most popular preference by far was for barbed wire; chosen by 79% of households (Table B.1). Households used the barbed wire in different ways (Table B.2) but home and property improvement (50%) was the most common application, closely followed by protecting water resources by fencing out cattle (48%). Only 10% reported doing nothing with the material they received. Putting barbed wire to use requires significant effort in terms of labour; key informant interviews suggest that < 25% of the cost of implementing 100 m of barbed wire is the cost of the wire itself meaning farmers incurred a significant personal cost by selecting barbed wire and using it to protect water resources (see Fig. B.1).

3.2. The Proportion of Contracts Representing Additional Conservation, and Likely Permanence of the Conservation Incentivized

Not all land enrolled in the *Watershared* programme was considered suitable by farmers for the activities (cattle grazing or cultivation of crops) which the programme was aiming to reduce (Fig. 5). Such unsuitable land, which cannot contribute to achieving the conservation objectives of the programme, represents 28% of contracts to exclude cattle (representing 30% by area), and 32% of contracts to prevent cultivation across all levels (18% by land area). Where suitable land is enrolled but the terms of the contracts are not complied with, conservation objectives also cannot be met; non-compliance occurred in 8% of contracts to exclude cattle (9% by area), and in 16% of contracts to prevent cultivation (28% by land). Households may have enrolled suitable land and complied with the contract, but they would not have carried out the activity the programme aimed to reduce on that land anyway (for example because they have enough land for their production needs). Such non-additional conservation occurred in 25% of contracts to exclude cattle (30% by area), and in 39% of contracts to prevent cultivation (42% by area). The most important additionality category from the perspective of effective conservation is 'additional' (i.e. conservation which wouldn't have happened in the absence of the programme). Our estimates suggest that 39% of contracts to exclude cattle (31% by area), and 14% of contracts to prevent cultivation (13% by area), represent additional conservation. Summing across both conservation targets (excluding cattle and preventing cultivation) suggests that 22% of contracts (representing 13% of the area under contracts) represent additional conservation (see Fig. 5).

The permanence of the conservation incentivized by the programme beyond the time when contracts expire is not possible to assess completely due to missing data (Fig. 6). Out of those who responded, > 60% intend to continue conservation either through not grazing cattle on level 1 land, or through not cultivating land in any contract level. However, the proportion continuing conservation is not equally distributed across all additionality categories. Conservation is less likely to be continued on contracts which were additional than other categories (apart from non-compliant where we expect a very low proportion to continue conservation as they have already broken the terms). This makes sense as to be classed as additional, the contract must be land which the household would use for the activity the programme seeks to disincentivize. For only 30% of contracts classified as providing additional conservation in terms of excluding cattle (32% for contracts preventing deforestation) do farmers suggest they would continue in the absence of the payments.

3.3. The Extent to Which Motivation to Join the Programme Influences the Additionality of Contracts

Model performance was acceptable considering the noise inherent in summarising social, multiple-answer data. However, misclassification was common in all models and effect sizes were quite small (Tables C.1, C.2). The extent to which each of the four categories of motivation to join the programme (payment, social, pro-nature instrumental and pro-nature non-instrument) positively or negatively predicts the suitability of land enrolled by households, compliance with the terms of the contract, or the additionality of conservation funded on that land is summarised in Fig. 7.

3.3.1. Predicting the Extent to Which Households Enrol Suitable Land in the Programme

Suitability of parcels for both cultivation and grazing was predicted by a presence of pro-nature instrumental motivations and absence of pro-nature non-instrumental motivations (Fig. 7; $p_{glht} = 0.0077$, $p_{glht} = 0.0015$, respectively). The odds of suitable land being enrolled by people with pro-nature instrumental motivations were 2.4× (for cultivation) and 4× (for grazing) higher than pro-nature non-instrumental motivations, respectively. In the case of cultivation, the likelihood that suitable land was enrolled in the programme depended on level of contract and were lowest for level 1 contracts (2 vs 1 $p_{glht} = 0.007$, 3 vs 1 $p_{glht} < 0.001$, 3 vs 2 $p_{glht} = 0.011$). The odds of enrolled land being suitable were ca 4× and 2× higher for level 3 than levels 1 and 2, respectively.

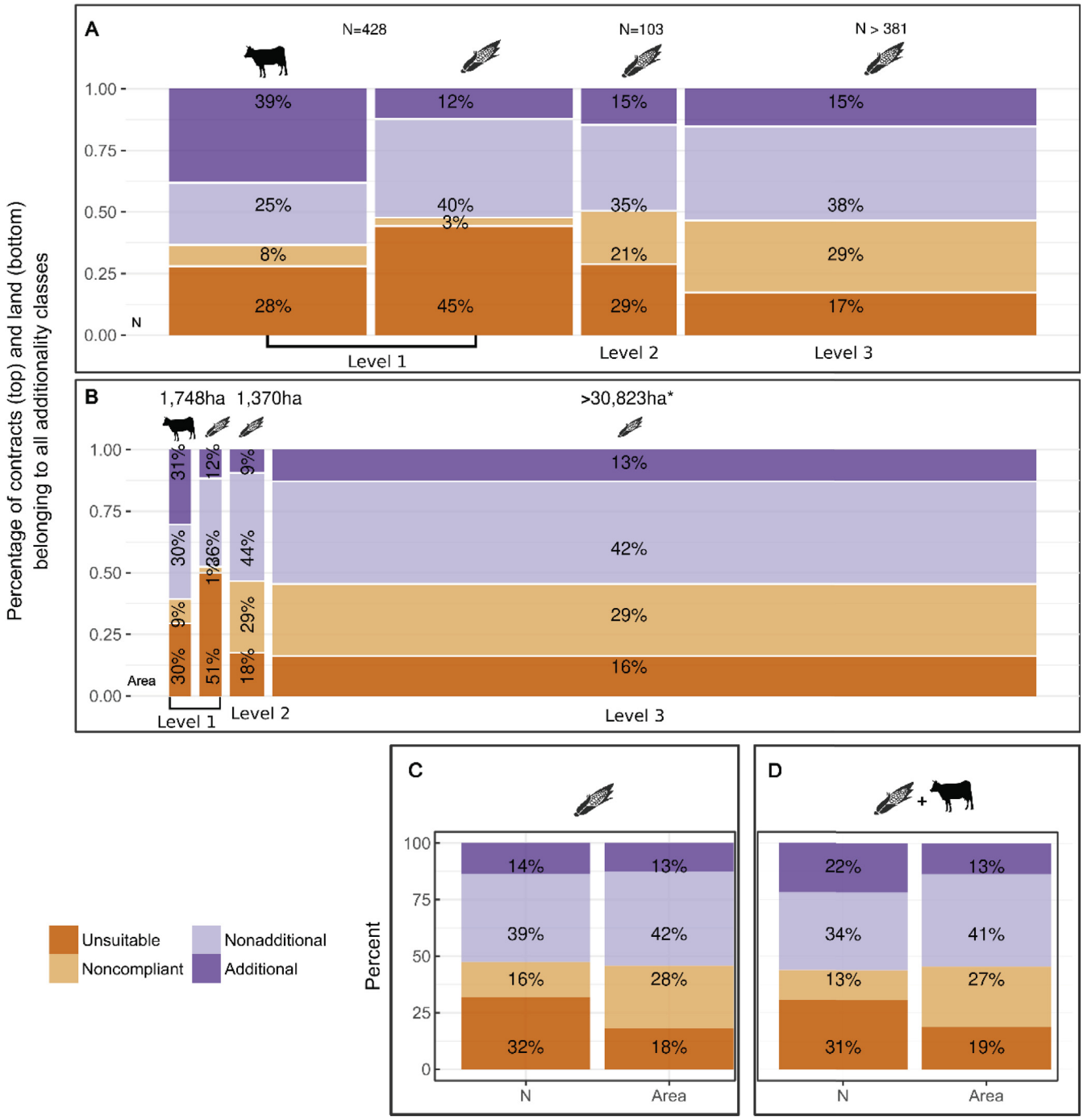

Fig. 5. The distribution of additionality categories by contract levels is shown by number of contracts (A) and land area (B). The width of the columns represents the relative number (A) or area (B) in each contract level. Data for level 1 contracts is presented separately for exclusion of cattle grazing and cultivation of crops. The distribution of additionality categories by both number and land area for contracts aiming to prevent cultivation summed across all levels (C), and all contracts combined (D) are also shown. *Not all level 3 contracts were included in the survey, therefore the true number and land area of level 3 contracts is higher.

3.3.2. Predicting the Extent to Which Households Comply With the Contract on Land They Enrol

Households where the respondent reported being motivated to join the programme by the payments were less likely to comply with the requirement to keep cattle out of their level 1 land (Fig. 7; $p = 0.012$). The top performing model predicting compliance with the requirement not to cultivate included only the level of the contract (Fig. 7). Compliance was higher on level 1 contracts than levels 2 and 3 ($p_{glht} < 0.001$; levels 2&3 were not significantly different to each other). However this model using level as the predictor of compliance only slightly outperformed the model based on motivations to join the programme (square brackets Fig. 7) which suggested that the odds of being compliant are 2× higher for those motivated by pro-nature instrumental motivations than by payments ($p_{glht} = 0.034$).

3.3.3. Predicting the Extent to Which Parcels Enrolled in Contracts Represents Additional Conservation

The motivations of those whose contracted land represents additional conservation was different for contracts classed as additional in terms of excluding cattle, and preventing cultivation (Fig. 7). For cattle, the odds

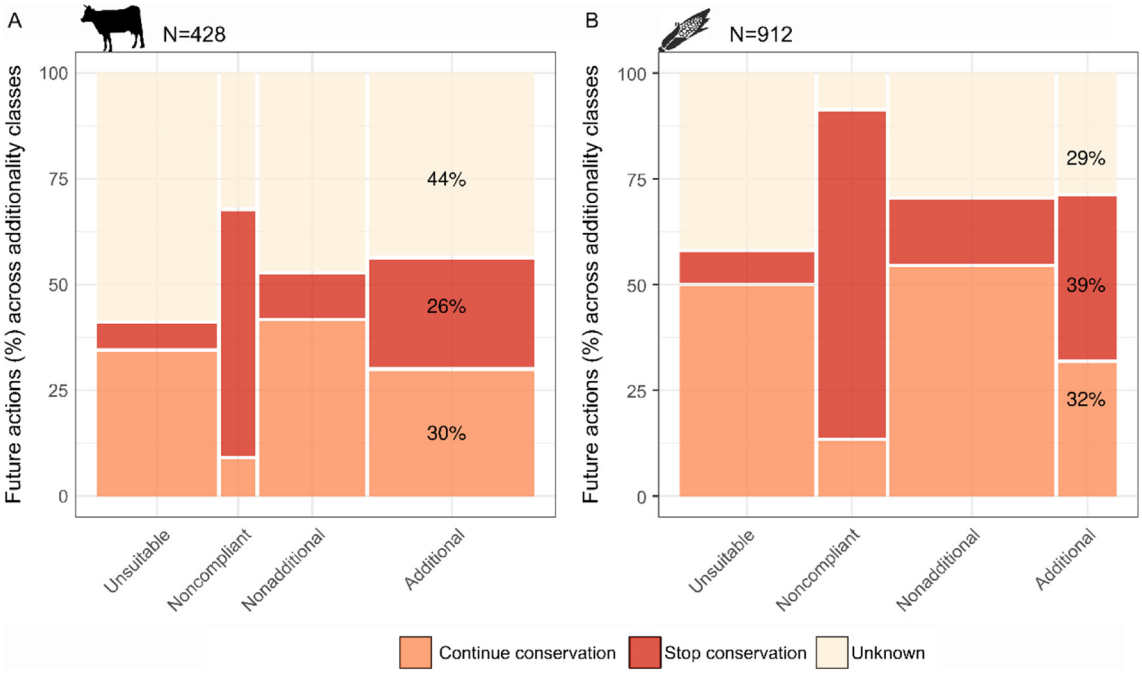

Fig. 6. Respondents' plans for future use of contracted land presented by additionality class, and classified into continuing conservation, stopping conservation and unknown. Contracts concerned with preventing cultivation (B) have an additional category which represents putting cattle on level 2 or 3 land (as this is not against the terms of the contract). The width of the bars represents the proportion of contracts in each additionality category.

of contracts being additional were 8× higher when both the payments and pro-nature instrumental motivations were the reasons for joining the programme rather than pro-nature non-instrumental motivations ($p_{glht} = 0.013$). We had data on motivations from a separate question (why did you choose this level of contract). When we used motivations from this question in our additionality model, the same results emerged, suggesting the pattern is clear with regards to conservation from cattle (see Appendix D). For cultivation, only pro-nature non-instrumental motivations were significant ($p = 0.013$), and, in contrast to the results for cattle, pro-nature non-instrumental motivations increased the probability that land enrolled represented additional conservation.

4. Discussion

4.1. What Motivates Participation in the Watershared Programme?

Analysing people's motivation to do something is always challenging as people may not be willing to share their motivations, they may not have a full understanding of their own motivations (Helm, 2007), and of course motivations are seldom simple but result from a combination of complementary interests (Bremer et al., 2014; Figueroa et al., 2016). In this paper we use both self-reported motivations and evidence from what in-kind incentives households select, to piece together people's motivation for participating in the *Watershared* programme and implementing the environmental behaviour it seeks to incentivize: not converting forest land to cultivation and preventing cattle from grazing in riparian forests.

Many studies have found that motivations in PES programme do not come directly from the material incentives (Figueroa et al., 2016; Hayes, 2012; Rode et al., 2015; Van Hecken and Bastianensen, 2010). Several strands of evidence suggest that farmers' decisions to enrol land in the *Watershared* programme is not driven exclusively, or even primarily, by the direct incentives provided by the programme. Firstly, while 76% of respondents mention the payments as one of the reasons they joined the programme, < 50% give this as the top reason. The compensation provided is also of relatively low value; only $10 a

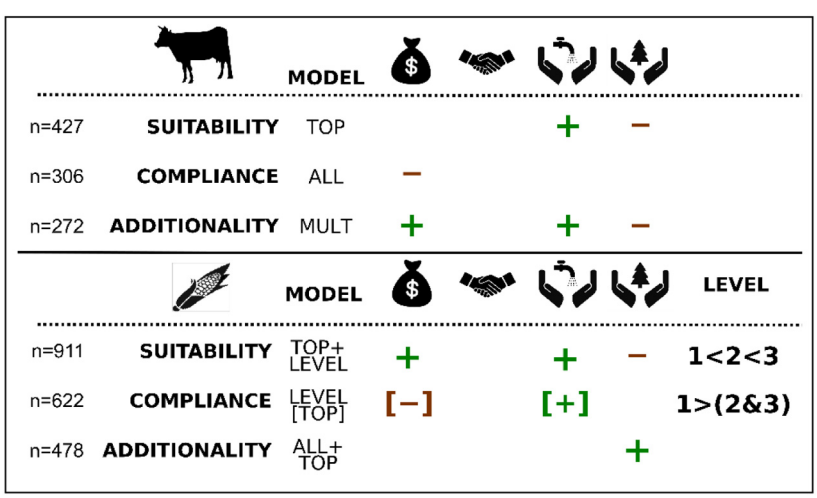

Fig. 7. Results for the selected models exploring the predictors of contracts being suitable (suitable land rather than unsuitable land enrolled), compliant (terms of the contract being followed or not), or additional (would have been conserved anyway in the absence of the programme or not) for both contracts to exclude cattle (🐄) and prevent cultivation (🌽). Significant predictors are entered in as + (positively associated with outcome), − (negatively associated with outcome), < / > (less or more likely to be associated with the outcome). Square brackets around ± indicate alternative model's results (see text for details).

hectare plus a one off payment of $100 for joining the programme for the highest level (level 1). According to estimates from our interviews in the area, annual crops production can produce as much as $1000/ha (although this is a gross figure not accounting for inputs such as labour and of course not all land is suitable for annual crops).

Nearly a quarter of participants gave pro-social motivations as one of the reasons to participate (and 14% gave it as their top reason). Specific examples of pro-social motivations mentioned include access to training, networking and recognition by the community. A study in Nicaragua found that knowledge exchange with other farmers was a major motivation for participation in a PES programme (Van Hecken and Bastianensen, 2010), however in our case, social motivations seemed less important, as they were the least frequent reason for joining and also did not contribute to conservation outcomes.

It is clear that what Rode et al. (2015) has classified as pro-nature motivations play a significant role in motivating participants in the *Watershared* programme. There is a strong narrative in farmers' justifications for their engagement in the programme that instrumental values of nature (specifically conserving water used by themselves and their community) play a significant role in motivating participation in the *Watershared* programme. Twenty five percent of farmers gave pro-nature instrumental motivations as their top reason for joining the programme (50% mentioned it as one of their motivations). Looking at what incentives farmers selected, and how they choose to implement it, also supports interview responses that pro-nature instrumental motivations were important to farmers.

The popularity of barbed wire (which was chosen by 79% of households) is likely to be at least partly because fencing is seen as a way of securing or strengthening property rights. In fact 50% of households reported using barbed wire to secure their property. Property rights in this region of Bolivia are somewhat informal and many people do not have clearly registered land title (Bottazzi and Rist, 2012) so fencing parcels of land can emphasise or legitimize a claim. There are a number of other examples showing how PES contracts can be used locally to support property rights (Bremer et al., 2014; Kosoy et al., 2008). This motivation is likely to be behind the selection of barbed wire by many households but a similar percentage reported using barbed wire specifically to exclude cattle from riparian forests (rather than using it elsewhere on their farms). Perceived benefits in terms of water quality seem likely to be the most important motivation for this. The choice of barbed wire, and such a high proportion using it to fence their contracted areas along rivers therefore supports questionnaire responses that significant proportions of households are engaged due to instrumental values of nature.

There are significant issues with water quality in the area as water sources are mostly unimproved and there is a strong perception (like in many Latin America rural areas; Kosoy et al., 2007) that forest conservation contributes to water quality. In the study area, the long history of NGO activity in the area promoting a link between water quality and management of upland forests (Robertson and Wunder, 2005) may contribute to this perception. There may also be local ecological knowledge underpinning this perceived link as Bolivian indigenous people, as well as farmer societies more widely, have developed a fine-tuned understanding of their environment (Boillat and Berkes, 2013).

4.2. Has the Programme Provided Additional Conservation?

The problem of ensuring that PES pays for additional conservation (which would not have occurred in the absence of the programme) has been a challenge since the concept was first developed. For example, the well-known Costa Rican PES programme designed to reduce deforestation did not result in additional conservation as the majority of farmers who enrolled land were those who would not have converted their land anyway (Pattanayak et al., 2010; Sánchez-Azofeifa et al., 2007). A number of studies have similarly demonstrated that farmers with a high proportion of uncultivable land, and therefore a low opportunity cost of conservation, are more willing to join PES programmes (Arriagada et al., 2009; Figueroa et al., 2016).

The majority of the conservation funded by *Watershared* is not additional. Firstly, farmers enrol land they know to be unsuitable for the activity the programme aims to prevent; such conservation is not additional, as the land would not have been converted even in the absence of the incentives. Secondly, a portion of contracts are non-compliant meaning that the terms of the contract are not followed. Thirdly, for a further proportion farmers admit they would not have cultivated or put cattle on the land even in the absence of the contract (perhaps because they did not currently need the land); such contracts also cannot represent additional conservation. However, where these categories are removed, 22% of all contracts (13% by area) may represent additional conservation. This figure of potentially additional conservation is higher when just the contracts to exclude cattle are considered (39% of contracts, 31% by land area). Very few studies provide estimates of the extent to which PES funds additional conservation. Our findings are somewhat comparable to findings from a Mexican forest conservation PES programme which concluded 12–15% of funded conservation was additional (Costedoat et al., 2015) but suggest somewhat higher rates of additionality overall.

4.3. Is There a Link Between a Farmer's Motivation to Join the Programme and Additionality of Conservation Funded?

It is well understood that people are driven by different motivations to join environmental programmes including PES (Bremer et al., 2014; Fisher, 2012; Kosoy et al., 2008). It is therefore interesting to know the extent to which those driven by different motivations contribute differently to outcomes. Our models suggest that motivation is an important predictor of behaviour when it comes to engagement with a PES programme. Those motivated to join the programme by pro-nature instrumental values are more likely to enrol suitable land. There is evidence that contracts are more likely to represent additional conservation in terms of keeping cattle out of riparian forests when enrolled by farmers motivated by pro-nature instrumental values of nature. This effect is not seen for the additionality of contracts preventing cultivation in forest. In this case, motivations based on pro-nature non-instrumental values (reflecting existence values, or moral values) are the most important predictors of contracts representing additional conservation. This may be because the instrumental value of keeping cattle out of rivers (in terms of impacts on water quality) is widely understood in the area, while any link between clearance of forest and locally valued environmental services is more tenuous.

Interestingly, those motivated by payments, while likely to commit suitable land, were particularly unlikely to comply with the terms of the contract.

4.4. How Permanent is the Conservation Likely to be?

PES programmes may achieve additional conservation outcomes while in operation but these might disappear once incentives are discontinued (Engel et al., 2008). This is especially likely to be the case where continued effort is required from a landowner to sustain conservation, or high demand to use conserved land exists (Engel et al., 2008; Wunder et al., 2008). Pagiola et al. (2016) found that conservation benefits in a Colombian silvopastoral project were retained after payments ended; however the programme was incentivizing farmers to switch to more productive practices. It is unrealistic to expect truly additional use-restricting conservation activities to persist when payments end (Börner et al., 2017).

The answers landowners gave to our questions on future land use showed that a significant proportion of respondents already plan to cease conservation efforts when the programme ends. Unfortunately, this is particularly true for the most valuable cases (where conservation is likely to be additional). This is unsurprising as to be classified as

additional, the farmer must have responded that they would have used the land in the absence of the programme. It is perhaps therefore to be expected that such land would be some of the most likely to later be converted when the payments cease.

There is a strong and growing literature about the extent to which using direct incentives to promote pro-environmental behaviours can undermine (crowd-out) or reinforce (crowd-in) intrinsic motivations for those behaviours (Rode et al., 2015; Moros et al., 2017). Crowding-out means that a PES programme has the potential to do more harm than good if pre-existing motivations to conserve are reduced by the monetary incentive, and the incentive cannot be continued (Chervier et al., 2017). In our study, contracts that were classified as additional but where land owners report that they will continue conservation could represent examples of 'crowding in' of intrinsic motivations to conserve (as farmers initially planned to use the land but after engaging in the PES programme they are considering keeping their land under conservation long term). On the other hand, the proportion that was categorized as non-additional but where they now say they would stop conservation after the contract could reflect 'crowding-out'. Both phenomena are seen in our data. However this is not firm evidence of motivational crowding as circumstances may have changed meaning that the suitability of land and future plans for land have changed since land was enrolled.

4.5. Characterising the Watershared PES Programme

Since Wunder published a simple definition more than a decade ago (Wunder, 2015) there has been extensive debate about the distinguishing characteristics of PES (Muradian et al., 2010; Sommerville et al., 2009; van Noordwijk et al., 2012). Muradian et al. (2010) provide a particularly helpful framework for categorising PES programmes based on 1) the importance of the economic incentive, 2) the directness of the transfer and 3) the degree of commodification. We use this framework to analyse *Watershared*. Firstly the economic incentives offered in *Watershared* are not tied to opportunity costs (Asquith, 2016) and while many participants report the payments play a role in motivating participation, this is certainly not the only motivation (our data). We therefore suggest the importance of the incentive is medium. The funding is from a combination of local government, charges on water bills, and international donors, meaning the transfer is quite direct. The degree of commodification is, as in many programmes (Corbera et al., 2009), quite low as it is based on assumptions about the relationship between land use and the provision of ecosystem services developed initially with limited empirical evidence (Pynegar, 2018).

In 2015 Wunder provided an updated definition of PES: "voluntary transactions between service users and service providers conditional on agreed rules of natural resource management for generating offsite services". *Watershared* has always avoided the terminology of PES when discussing the programme in Bolivia (Asquith, 2016). This is because they associate the term with a stark, market-based neoclassical economics definition of PES while *Watershared* emphasises reciprocity and benefit-sharing between community members (N. Asquith *pers. com*). However *Watershared* does indeed meet the updated Wunder (2015) definition as enrolment of land by farmers is voluntary, the incentives are provided conditional on farmers following the rules of the programme, and these rules are intended to generate offsite benefits (in terms of downstream water supply, carbon sequestration and biodiversity).

4.6. Introducing the Concept of 'Payment for Environmental Self-Service'

While *Watershared* meets the widely used definition of a PES programme; we feel it is important to emphasise the role that pro-nature instrumental motivations play in decisions to participate in the programme. We have demonstrated this based on both farmers' reported motivations to join the programme and their choice of incentives when offered a range of valuable materials. We coin the term 'payments of environmental self-service' to describe this situation where the external incentive enables changes in behaviour at least partly motivated by the environmental service benefits the provider receives. This challenges the view that the service 'user' and 'provider' in a PES programme are necessarily wholly separate. In the case of *Watershared*, the motivation of up-stream users to conserve the watershed for their own water needs also contributes to them being willing to make the changes required by the programme. The incentives are therefore enabling a change compatible with existing motivations based on farmers' understanding of linkages between excluding cattle and the valued ecosystem service of clean drinking water. This may explain why the programme delivers additional conservation, even though it does not cover the opportunity costs of the changes it incentivizes.

Research on the role of existing motivations in decisions to participate in PES programme is advancing rapidly; with a recent evidence from framed field experiments (Handberg and Angelsen, 2016; Moros et al., 2017), and quasi-experimental approaches (Chervier et al., 2017). Careful consideration is needed to ensure that clumsy design of PES does not result in crowding-out of intrinsic motivations and a net reduction in pro-environmental behaviour.

5. Conclusion

The additionality of conservation funded by PES programmes has attracted a lot of attention as it is a key component of PES effectiveness. Like many PES programmes, *Watershared* is providing funding to conserve areas where no changes in management are occurring as a result of the programme. However, we show that the programme does also appear to result in conservation which is truly additional. Most interestingly, we have demonstrated that the motivations of farmers to join the programme matter as these are important predictors of the extent to which contracts represent additional conservation. Using both questionnaire responses, and considerations of what farmers choose from a list of possible incentives on offer, we conclude that the additional conservation achieved does not arise because the programme pays the opportunity cost of conservation, but because it builds on existing environmental motivations and facilitates farmers to make changes that they are already motivated to make. It is important to note that despite these intrinsic motivations playing a role, the permanence of the changes incentivized does depend on the continuation of the programme. As the number of PES-like initiatives continues to grow, understanding what predicts effectiveness becomes ever more important (Börner et al., 2017). We hope that these findings will encourage those implementing PES programmes to carefully consider local motivations, and capitalize on opportunities to promote potential environmental 'self-service' benefits from a programme.

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All R code and data used to generate figures and models for this manuscript are archived at https://doi.org/10.6084/m9.figshare.5977720.

Appendix A. Description of Watershared Contracts

Table A.1
Descriptions of the 3 types of contract in the *Watershared* payment for watershed services programme implemented by *Natura Foundation Bolivia* in the Bolivian highlands.

Level	Type of land	Agriculture permitted?	Timber extraction permitted?	Cattle rearing permitted?	Payment on signing (US$)	Annual payment (per ha)
1	Forested within 100 of a stream	No	No	No	100	10
2	Forested within 100 of a stream	No	No	Phased reduction	0	3
3	Forested, shrub or forested pasture	No	No	Yes	0	1

Appendix B. Summary Information About Uptake of Incentives, and the Application of Barbed Wire by Households

Table B.1
Distribution of first (preferred) choice of incentives over two rounds of selecting incentives from the *Watershared programme*; totals add up to > 100% due to one households potentially selecting two different preferences across the rounds.

Number	Percent	Incentive
399	79	Barbed wire
162	32	Fruit trees
81	16	Cement
45	9	Polytube
11	2	Bee box
8	2	Other

Table B.2
Respondents' use of barbed wire requested from the programme (NB 79% selected barbed wire-see Table B.1). % = total number of choices across 2 rounds of being offered and selecting incentives from the *Watershared* programme.

Nothing	Protecting forest	Home and property improvement	Protecting water
10%	10%	50%	48%

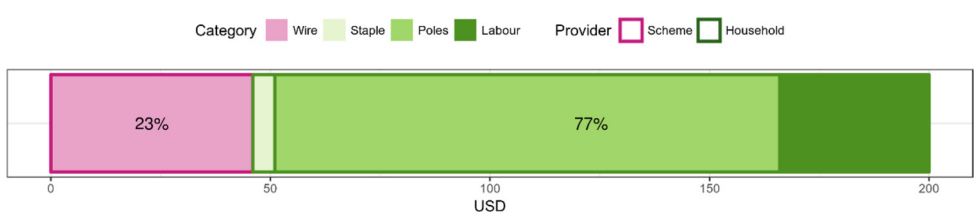

Fig. B.1. The approximate distribution in terms of investment in US$ terms for implementing 100 m of barbed wire for fencing land to exclude cattle. Only 23% of the value of the investment comes from the programme (in terms of the wire provided), the rest is provided by the farmer in terms of sourcing staples, poles and providing labour. This estimate is based on key informant interviews with 10 farmers and *Natura* technicians.

Appendix C. Model Performance Summaries

Table C.1
Chi-square tests showing significant ($p < 0.05$) numbers of cases being more or less than the expected number for a given outcome.

Category	Model outcome	Motivation/level	Observed	Expected	Difference
Cattle	Suitable	Non-instrumental	18	27	−9
Cattle	Suitable	Instrumental	102	92	10
Cattle	Additional	Non-instrumental	4	12	−8
Cattle	Additional	Instrumental + financial	69	62	7

(*continued on next page*)

Table C.1 (*continued*)

Category	Model outcome	Motivation/level	Observed	Expected	Difference
Crops	Suitable	Level 1	234	291	−57
Crops	Suitable	Level 2	73	70	3
Crops	Suitable	Level 3	315	260	55
Crops	Compliant	Financial	221	232	−11
Crops	Compliant	Instrumental	127	115	12
Crops	Compliant	Level 1	223	180	43
Crops	Compliant	Level 2 + 3	255	298	−43

Table C.2
The extent to which models predicting the conservation outcome of contracts result in correct classification. "Overall" = correct 0 and 1 out of all cases. "0" = correct 0 out of all true 0, "1" = correct 1 out of all true 1. 0 across all models stands for negative outcome, i.e. unsuitable, noncompliant, nonadditional.

Category	Model	Overall (%)	0 (%)	1 (%)
Cattle	Suitability	55	61	53
Cattle	Compliance	44	88	38
Cattle	Additionality	60	53	64
Crops	Suitability	64	69	62
Crops	Compliance	57	92	47
Crops	Additionality	57	56	61

Appendix D. Description of Extra Additionality Model for Cattle Exclusion

For level 1 contracts, additionality was also modelled against the question "Why did you choose this level". The question was avoided for cultivation owing to the considerable differences between levels in both payments (level 1 > 2 > 3) and land type (proximity to river) which would confound the answers of households with different contracts. However, because level 1 contracts are such a special case, incurring both much higher payments while subject to more rigorous monitoring, we felt that this particular question might provide more information than using only the overarching question of why join the programme. No top reason was available for choosing the level, with the exception of which model selection followed the principles outlined in Methods.

Four motivations were available based on the answers presented as options to the question "Why did you choose this level": Instrumental, non-instrumental, payment, and opportunism, the latter which encompassed reasons such as there being no other option, the household only knew this level, or the level did not involve changing practices. The former had responses very similar to those of joining the programme, namely protecting water, protecting forest, or payment.

The models MULT and ALL were only 2 AIC apart, MULT performing slightly better. The results of both models indicated a negative relationship between non-instrumental motivations and additionality. Glht identified contrasts between payment + instrumental motivations and non-instrumental motivations for MULT ($p_{glht} = 0.003$), while model summaries (Wald tests) for ALL gave non-instrumental motivations a p value of 0.004 with respect to the arbitrary intercept of no motivations. The performance of MULT gave an overall correct classification rate of 54%, correct classification of additional of 42%, and a correct classification of non-additionals of 74%.

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