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Ending Ecoservices Payments Does Not Crowd Out Lab-in-the-Field Conservation

Lina Moros, María Alejandra Vélez, Alexander Pfaff, and Daniela Quintero

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Keywords: lab-in-the field experiment; pro-environmental behavior; payment for ecosystem services; incentives; Colombia

JEL Codes: Q01, Q52, Q57, Q58

* Lina Moros (corresponding author: l-moros@uniandes.edu.co), Universidad de los Andes, School of Management, Bogotá, Colombia. María Alejandra Vélez, Universidad de los Andes, Economics Department, and Centro de Estudios en Seguridad y Drogas. Alexander Pfaff, Duke University, Sanford School of Public Policy, Durham, North Carolina. Daniela Quintero, Universidad de los Andes.

Ending Ecoservices Payments Does Not Crowd Out Lab-in-the-field Forest Conservation

Lina Moros* + (a), María Alejandra Vélez + (b), Alexander Pfaff (c), Daniela Quintero (d)

(a) * Corresponding author: Professor, Universidad de los Andes, School of Management, Calle 21 # 1-20, Bogotá, Colombia. l-moros@uniandes.edu.co

(b) Professor, Universidad de los Andes, Economics Department and Director CESED (Centro de Estudios en Seguridad y Drogas), Cra. 1 #18a-12, Bogotá, Colombia. mavelez@uniandes.edu.co

(c) Professor, Duke University, Sanford School of Public Policy, 201 Science Dr, Durham, United States. alex.pfaff@duke.edu

(d) Researcher, Universidad de los Andes, Cra. 1 #18a-12, Bogotá, Colombia. dm.quintero45@uniandes.edu.co

(+) These authors contributed equally to the work

Abstract

Payment for ecosystem services (PES) programs are proliferating globally but not always with significant impact. Unlike protected areas (PAs), PES compensate suppliers of ecoservices, increasing local acceptance. Yet, some worry that PES could reduce conservation in the long run, if the introduction of financial incentives "crowds out" or diminishes prior conservation behavior. We implemented a decision experiment with farmers in rural Colombia to study the effects of temporary PES. We find no crowding out if a PES is introduced then ended. Contributions after PES fall back to pre-PES levels, at worst, and if anything, they are higher. Comparisons to controls without PES strengthen these findings, which can inform policy design.

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1. Introduction

Payment for ecosystem services (PES) programs have been proliferating around the globe. For instance, Salzman et al. (2018) report on 550 active programs, with an estimated US$36-42 billion in annual transactions. From the global perspective, there is increasing interest in achieving Reductions in Emissions from Deforestation and forest Degradation (REDD+). From a local perspective, unlike protected areas (PAs) PES compensate those who provide the ecosystem services. That can increase acceptance and participation among rural dwellers.

To date, PES have not always had significant impact in increasing flows of ecoservices, for many reasons. Payments can be too low to significantly shift the incentives. For example, payments may not cover the costs of shifts to desired land uses. Payments also can fail to target threats, enrolling parcels that would host the same land use – and ecoservices – with or without PES. Further, on environmentally threatened rural frontiers, monitoring and sanctioning are costly, both financially and politically, which undermines conditionality in payments and, thus, their impacts. Here, we consider one more challenge for PES, i.e., that introduction then removal of external financial incentives can leave individuals' contributions below the prior conservation level.

Using lab-in-the-field experiments, we consider what happens if programs end, as most do. Payments are costly for the purchasers, who would prefer, naturally, to pay only temporarily. They may hope that some incentivized "green" practices will become preferred behaviors for services providers over time so that payments are no longer needed, e.g., silvo-pastoral practices may increase profit (Pagiola, Honey-Rosés and Freire-González, 2016). In stark contrast to such hopes of the payers, however, scholars and practitioners have suggested that PES programs, like other external incentives, might lead the ecoservice suppliers' preferences to shift against the interests of the payers. Thus, if sellers already are carrying out some green practices, it is possible those practices will decrease rather than increase if the PES "crowds out" or somehow diminishes the sellers' prior motivations for those practices (Deci, Koestner and Ryan, 1999).

There is a basis for such concern. Crowding of motivations and thus behaviors does happen. A large strand of literature in psychology (Deci et al., 1999, Ryan and Deci, 1985; 2000) and behavioral economics (Frey, 1994; Kahneman, Knetsch, and Thaler, 1986; Bowles and Polania-Reyes, 2012; Gneezy and Rustichini, 2000), with consideration of public policies (Le Grand, 2003; Titmuss, 1970; Moller et al., 2013), has said for decades that introducing extrinsic incentives can displace intrinsic motivations (*motivational crowding*) and, thereby, also reduce pro-social or environmental behaviors (*behavioral crowding*). Bowles (2008) and Bowles and Polania-Reyes (2012) have noted a lack of "separability," in that incentives and "moral sentiments" appear to interact, so that their combined effect is not the sum of their separate effects (Bowles, 2008, p.1606). Early experimental evidence, in various domains, has shown that in some cases external incentives undermine ethical motives, while in only a

herfew cases have incentives reinforced and enhanced ethical motives (see Bowles, 2008; Rode, Gómez-Baggethun, and Krause, 2015 and the review in Bowles and Polania-Reyes, 2012).

In the context of conservation, recent studies offer a nuanced perspective on this interaction (Akers and Yasué, 2019 for a review). Focusing on Engel's (2016) "devil in the details", all discursive, institutional, design, and implementation conditions affect outcomes of PES, in terms of motivations and behavior. PES could even crowd in pro-social or environmental behavior after payments, if a program facilitates interpersonal communication and reinforces pre-existing trust (Andersson et al., 2018), provides non-monetary and collective benefits (Agrawal, Chhatre and Gerber, 2015; Kaczan et al., 2017; Moros, Vélez and Corbera, 2019), bolsters feelings of autonomy and social relatedness (Grillos et al., 2019), or promotes asset-building activities which restore transformed ecosystems (Calle, 2020; Pagiola, Honey-Rosés and Freire-González, 2016; 2020). See Annex 1 for additional summaries of such literature.

Why do payments to individuals or entire PES programs end? The reasons can vary. For example, eligibility shifts in Colombia, due to a new stakeholder, resulted in removal of over 130 PES participants. Armed conflict has also affected implementation in Colombia, by interrupting payments (Moros, 2019). In Ecuador, the SocioBosque PES was paused for two years due to financial limitations (Etchart et al., 2020). A Ugandan program was planned to end after two years (Jayachandran et al., 2018). In México, hundreds of early participants were not renewed due to reductions in PES budgets or changes in criteria (Izquierdo-Tort, 2020).

What happens if payments end? We implemented a decision experiment in the field in Colombia, which recently launched a new PES National Regulation (Ministerio de Ambiente 2017 Law 870) and may significantly expand PES programs nationwide by adding at least 1,000,000 hectares in new PES programs by 2030 (DNP, 2017). Even at this ambitious scale, the initiative will have to exclude some farmers. And, at this scale, eventually it must end at least some of the payments, given budget restrictions. Our research will inform policy design by exploring the behavioral consequences of removing participants from incentive programs.

Our study captures details and challenges for an ongoing conservation scheme in Colombia called "miPáramo!", launched in Norte de Santander in 2018 to promote forest conservation in the *páramo* of Santurbán, a key ecosystem for water provision and regulation in northeast Colombia (as well as a disputed area, due to gold-mining potential). Currently, the program is discussing the introduction of monetary incentives to support conservation. However, they fear payments might negatively affect intrinsic motivations and pro-environmental behavior.

Our lab-in-field experiments, however, find no behavioral crowding out when payments are started then ended. If anything, forest contributions in our experiment increase from pre-PES to post-PES, i.e., perhaps are crowded in. Even when that increase is not statistically

significant, in light of limited observations, this implies post-PES forests equal to pre-PES. Regressions comparing to our controls without PES support all of these findings. Thus, relative to recent literature about the ending of conservation payments programs (e.g., Kaczan, Swallow and Adamowicz, 2019, Salk, Lopez and Wong, 2017; Grillos, Botazzi, Crespo, Asquith and Jones 2019), we add clear experimental evidence against behavioral crowding out. Randomized control trials in the context of PES (e.g., Jayachandran et al. 2018; Pynegar et al. 2019; Wiik et al. 2018) have not explored this particular removal effect, with the exception of Grillos et al. (2019), which reports an increase in pro-environmental values after a PES program ended.

The rest of the paper is as follows. Section 2 describes the setting where we carried out our lab-in-the-field experiment. Section 3 describes our methods, including the game that we created for this express purpose. Section 4 provides descriptive statistics and Section 5 our results. Finally, Section 6 offers some discussion, including consideration of the policy implications.

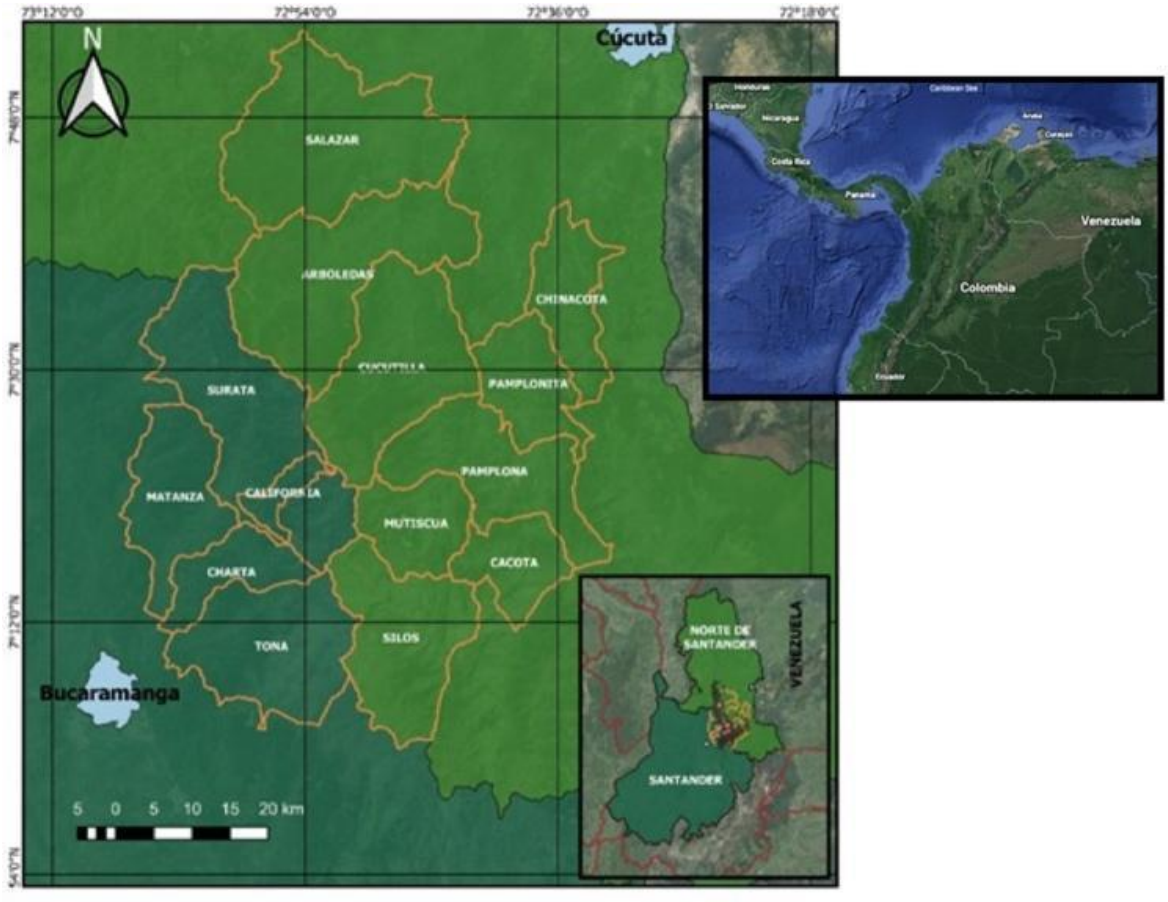

Figure 1. Municipalities with miPáramo in Norte de Santander (Google Earth Platform 2020 map).

2. Setting

Research was conducted in the municipalities of Pamplona, Cácota, Cucutilla and Mutiscua, within the department of Norte de Santander, northeast Colombia. These municipalities are all part of the buffer area that delimits the *páramo* or Andean highland wetland of Santurbán. This is an important ecosystem that features several agricultural production systems, as well as small-scale mining, plus some conservation practices. It supplies water to multiple cities (Duarte-Abadía and Boelens, 2016). Generally, this region has seen multiple environmental conflicts due to the establishment of large-scale mining operations and agricultural practices within ecologically sensitive areas, such as the *páramo* (Duarte-Abadía and Boelens, 2016).

To protect this ecosystem, *miPáramo!* is a public-private initiative to promote deployment of resources for conserving *páramo* forests (Figure 1) and promoting sustainable productive practices. The program was launched with the support of the *Alianza BioCuenca*, which links public and private institutions for conservation. To date, *miPáramo!* has 1,072 active participants in nine municipalities of Norte de Santander and Santander. The participants in our experiments are active or potential participants in the *miPáramo!* Program. Field assistants of *miPáramo!* supported the recruitment of participants as well as the organization of experimental sessions.

3. Methods

To examine PES removal, we used a framed field experiment based on Moros et al. (2019), focusing on tensions between conservation and agricultural expansion (Kaczan et al., 2017; Midler et al., 2015; Narloch, Pascual and Drucker, 2012). We piloted it in October 2019 with 40 students at Universidad de Los Andes and 40 rural farmers in Norte de Santander (we do not use the pilot data in the analyses). This helped to train research assistants and adjust protocols.

Data for analysis was collected during October and November 2019 in four municipalities (Table 1). We invited farmers in the miPáramo initiative plus other potential beneficiaries to participate in our experiment and survey. A local contact in each municipality phoned local farmers, inviting each to engage in an experimental session at a specific date, time and place in the municipality. The number of sessions per municipality depended on the number of potential participants. Participants were randomly allocated over sessions in a municipality.

Table 1. Experimental observations

Municipality	*# of participants*
Pamplona	52
Cácota	60
Mutiscua	128
Cucutilla	68
TOTAL	308

After the experiments, we asked each participant to answer our post-experimental survey that included socio-demographic questions concerning the farmer, productivity of their farms, their environmental motivations to preserve forests, and their emotions during the experiment (full protocol in Annex 2). Here, we focus on just the behavioral and socio-demographic data.

3.1 Sessions

Fifteen experimental sessions were conducted, in Spanish, with the support of six research assistants. The sessions were conducted in the municipality's local library or community hall and lasted about three hours. Sessions had a minimum of 16 participants and a maximum of 24.

At the beginning of each session, an informed-consent document was provided to all and read out loud to explain the activity and ask if each farmer would like to participate. For those who opted to participate, a research assistant read the instructions out loud (same person in all sessions). A practice round was done before forming the experimental groups at random. Before the games, we asked participants about the number of water sources on their lands. The data were used to implement a removal rule for some treatments, as explained below. [1]

3.2 Forest-Conservation Game

Each participant was randomly assigned to a group of four. In each round (t), each person (i) was allocated four units of land and decided whether to conserve the forest (f) or plant crops (c). For every unit of land that she assigned to forest (X_f), each participant received \$200 pesos. For every unit of land that she assigned to crops (X_C), each participant received \$600 pesos. For every unit assigned to forest by other members in a group, each participant received \$200 pesos, i.e., each participant gained from every forest unit in her group, including her own. Private gain from one's own forest, though, was much lower than that for

[1] We planned another field phase to get more data per treatment to increase statistical power for our tests but the region experienced a wave of violence in late 2019 and early 2020. After that, due to COVID-19, it was not possible to do more experiments. Our resulting relatively small sample size reduces our ability to detect smaller impacts. However, our results suggest further research directions which deserve to be examined.

crops, as is currently the case in the Norte de Santander region and in other regions with high risk of deforestation.

This implies the payoffs below, where $\sum k\, X_{fk}$ is the units of forest due to the other members (k) of one's group and *m* captures the non-monetary benefits from conservation, including social preferences and environmental motivations. Manipulating this − from 1a to 1d – emphasizes the costs and benefits of choosing forest on one's own land. In [1d], we see that the choice of a forest unit on one's own land forfeits $400:

$$\pi_{it} = \$600x_{cit} + \$200x_{fit} + (\$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\,(X_{fit}) \quad [1a]$$

$$\pi_{it} = \$600(4 - x_{fit}) + \$200x_{fit} + (\$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\,(X_{fit}) \quad [1b]$$

$$\pi_{it} = \$2.400 - \$600x_{fit} + \$200x_{fit} + (\$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\,(X_{fit}) \quad [1c]$$

$$\pi_{it} = \$2.400 - \$400x_{fit} + (\$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\,(X_{fit}) \quad [1d]$$

The participants were randomly assigned to control group (CG) and treatment groups (TG). In CG, a participant played the game for 12 rounds, deciding in each round how many units of land to allocate to forest in light of the payoffs (see [1a-d] above and table in Annex 3). For example, if one participant decided to allocate 3 units of land to crops and 1 to forests, while the other members of her community conserved 7 units of forest in total, her earnings would be $\$600(3) + \$200(1 + 7) = \$\,3{,}400$. Rewriting that to focus on the disincentive to choose forest, even though it helps others, $\$2400 - \$400(1) + \$200(7) = \$\,3{,}400$. In principle the *m* term in [1a-d] could push one towards allocating some units of land to forest.

3.3 Treatments: payments & removals

Our treatments (TG) involve three sequenced stages of four rounds each: (1) a baseline with no PES; (2) the introduction of PES for all; and (3) partial or total removal of payments. In the second stage, we vary whether the payment is based on individual forest or, instead, a function of group conservation. Either way, in the third stage, groups face one of three types of PES removal: total removal (TR), i.e., all groups in a session were removed from PES, as when a PES program ends; or two types of partial removal (PR), where the majority of the groups in a session were removed from PES, as when budgets or criteria mandate exclusion. Partial removal was either random (PRR) or based upon the number of water sources (PRW). Participants learned removal rules before round 9. For PRW, groups with fewer water sources (averaged across members) were removed, as when a real PES program targets those farmers who could have greater total negative impacts upon water quality based upon their land-use decisions (Moros, 2019). Table 2 presents all of these treatments, with their observations by treatment.

Table 2. Summary of treatments, stages and observations

	Treatment	Definition	Stage 1 (rounds 1-4)	Stage 2 (rounds 5-8)	Stage 3 (rounds 9-12)	n
	NO PES	Control Group (CG)	BL for all	BL for all	BL for all	44
IND - PR	IND-PRR	Individual Payment with Partial Removal, removing Randomly some groups	BL for all	Individual PES for all	Individual PES for only some groups in the session (denoted as NE)	40
	IND-PRW	Individual Payment with Partial Removal, removing some groups based on the number of water sources in their group	BL for all	Individual PES for all	Individual PES for only some groups in the session (denoted as NE)	40
IND-TR		Individual Payment with Total Removal	BL for all	Individual PES for all	NO PES for all	40
COL-PR	COL-PRR	Collective Payment with Partial Removal, removing Randomly some groups	BL for all	Collective PES for all	Collective PES for only some groups in the session (denoted as NE)	44
	COL-PRW	Collective Payment with Partial Removal, removing some groups based on the number of water sources in their group	BL for all	Collective PES for all	Collective PES for only some groups in the session (denoted as NE)	60
COL-TR		Collective Payment with Total Removal	BL for all	Collective PES for all	NO PES for all	40

All payments introduced in the 2nd stage were framed as if an environmental organization (EO) was interested in paying for conservation of forests in the community. The additional private payoff was a further $450 gain to participant (i) for each unit of her forest (Annex 4 shows the payoff table). The expressions below summarize the new individual earnings. It is clear below in [2a] and [2b] that now it is beneficial to choose land in forest. We might then expect all land to be put in forest:

$$\pi_{it} = \$2.400 - \$600 x_{fit} + (\$200 + \$450) x_{fit} + (\$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\,(X_{fi}) \quad [2a]$$

$$\pi_{it} = \$2.400 + \$50 x_{fit} + (\$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\,(X_{fi}) \quad [2b]$$

In the collective payment, we effectively imitated the linear payment, just using a lump sum. Participants were paid based on the group's forest conservation. The EO offered an additional payment of $1,800 to each participant if her group managed to conserve 16 units of forest. This is achieved by 4 units of forest each, so $1800 each equals 4 units in forest each at $450, as in [3]. That implies a difficult coordination for a group, (harder than many actual thresholds), because it could be achieved only if each member of the group allocated all 4 units of land to forest, i.e., zero to crops; Annex 5 lays out the entire payoff table for this collective variation. Each member had to be confident in fellow group members to allocate all 4 units of land to forest:

$$\pi_{it} = \$2.400 - \$400 x_{fit} + \left(\$1.800 \text{ if } \sum X_f = 16\right) + \$200 \sum_{k=1}^{3} k\, X_{fk}) + \mathrm{m}\left(X_{fi}\right) \quad [3]$$

4. Descriptive Statistics

4.1 Checking Randomization

Table 3 offers descriptive statistics by treatment, pooling removal rules (water vs. random) because we did not find robust differences between the two (Table 4) and denoting removed groups with "R" versus non-removed "NR". Average age was ~50 years, except in collective total removal (~40). Gender shares varied. For education, the control group (No PES) had the least education and the collective total removal group had the most. For income, the individual partial removal NR participants had the highest incomes ($2,245,000 COP), while individual total removal group had the lowest ($514,000 COP). The control (No PES) had the highest percentage of people who had cleared forest before (47%), while the individual partial removal NR group had the lowest share (17%). Finally, the individual total removal group had the highest share for receiving conservation payments in real life (30%), with the individual partial removal non-removed group (NR) having the lowest share (17%).

Table 3.
Descriptive statistics of control variables and t-tests between CG's and TG's, correcting for multiple testing using Bonferroni

Treatment	Obs.	Age (Years)	Gender (1=female)	Education (years)	Income (K pesos)	Have Cut? (1=yes)	Been Paid? (1=yes)
COL-PR_R	68	50.18**	0.309	6.368**	764.9	0.235***	0.176
COL-PR_NR	36	53.56	0.333	6.500**	683.3	0.194***	0.194
COL-TR	40	39.15***	0.525***	8.600***	603.5	0.125***	0.125**
IND-PR_R	56	52.21	0.554***	6.554***	740.2	0.339***	0.179
IND-PR_NR	24	51.50	0.500***	7.958***	2,145***	0.167***	0.167
IND-TR	40	51.95	0.400	6.050	514.3	0.450	0.300**
NO PES	44	53.05	0.318	5.409	485.2	0.477	0.205

*** p<0.01, ** p<0.05 Indicating differences against NO PES group.

Table 4. Differences in differences comparing Stage 3 [S3] and Stage 1 [S1] for partial removal treatments (correct for multiple tests using Bonferroni)

	R	W	RANDOM (R)		WATER (W)		RANDOM	WATER				
Treatment	Obs.	Obs.	Mean S3	Mean S1	Mean S3	Mean S1	Diff. R S3 vs. S1	Diff. W S3 vs. S1	Diff. R vs. Diff. W	St.Err.	t-value	p-value
COL-PR_R	28	40	1.661	1.848	1.794	1.594	-0.188	0.2	-0.388	0.202	-1.9	*0.059
COL-PR_NR	16	20	3.078	1.672	3.288	1.763	1.407	1.525	-0.119	0.316	-0.4	0.71
IND-PR_R	28	28	2	1.688	1.705	1.42	0.313	0.286	0.027	0.229	0.1	0.907
IND-PR_NR	12	12	2.729	1.521	2.833	1.771	1.209	1.063	0.146	0.474	0.3	0.761

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

There are statistically significant differences in Table 3. Notably, the collective total removal (COL-TR) and individual partial removal NR (IND-PR-NR) treatments display differences versus No PES. We control for these differences in the regression analyses presented below.

4.2 Comparing Rules for Partial Removal

In Stage 3, participants could face partial removal (PR), where the majority of groups in the session were removed randomly (PRR) or based upon the number of water sources (PRW). We conduct a t-test and do not find robust statistically significant differences in comparing the average number of forest units in Stage 1 and Stage 3 for different removal rules (water vs. random), as in Table 4 (see Annex 6 for a detailed figure with all of the treatments, including for water vs. random). Only the removed individuals in the partial removal group with collective payments show some differences at a 10% significance level, but this is not significant in a regression (Annex 7). Although we acknowledge that differences across removal rules could arise with more data, we present results pooling all the partial removals.

4.3 Comparing With versus Without Payments

Figure 2 shows, across rounds for each treatment, the average units of land allocated to forest by round (i.e., our measure of conservation contributions) − pooling the two rules for partial removal (i.e., based on number of water sources on one's land versus random) but within any partial-removal treatment differentiating groups that were removed (R) or not (NR). It includes the control group without PES. Recall that the payments (individual or collective) were introduced in Round 5, and then the PES were partially or totally removed in Round 9.

Right off the bat, the positive contributions in Figure 2 in Stage 1 show some form of intrinsic motivations being played out, given that there are positive contributions being made to forests even without payments. However, as expected, the introduction of PES payments in stage 2 increases contributions (see our statistical tests of these differences in Table 4). Not surprisingly, given the very challenging requirements of full contribution by all members to achieve collective compliance, collective-group performances appear to be more variable (see analogous results in Moros et al., 2019). Generally, and very much in keeping with the related public-goods-experiments literature, we see a downward trend in contributions in the No PES control and a somewhat downward trend in contribution in Stage 2 for all treatments.

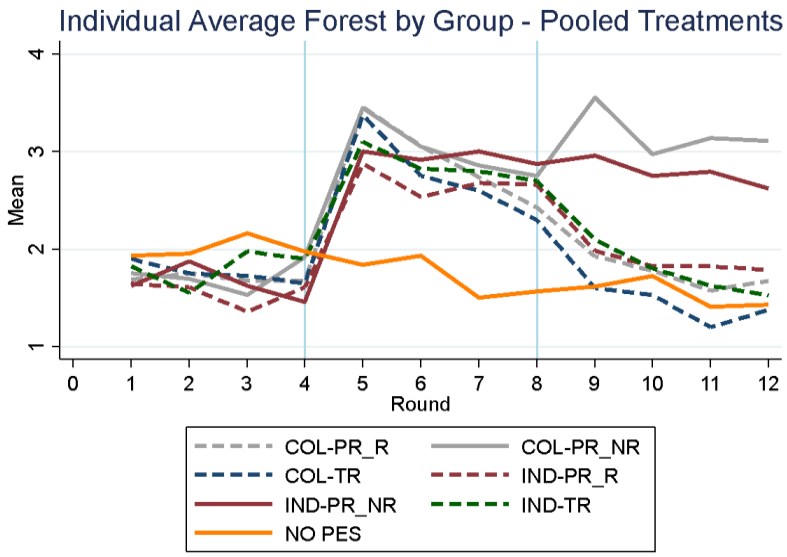

Figure 2.
Individual Average Forest by Group – All treatments

Payments continue to be effective for those not removed in stage 3, though. In fact, round 9 significantly increased conservation compared to round 8 for COL-PR_NR (from 2.75 to 3.55 p=0,005), though that was not the case within IND-PR_NR (from 2.875 to 2.95 p=0.80), and in neither case are the contributions in round 9 significantly different from those in round 5. However, for the case of collective payments, which had had a downward drift in Stage 2, the stage 3 "re-start" effectively left stage 3 looking like stage 2, as is true of the individual payments. Then, in clear contrast, contributions drifted down for those removed from payments. See Table 5.

Table 5
T-tests comparing differences between Stage 1 and Stage 2 within each TG, correcting for multiple testing using Bonferroni.

Treatment	Obs.	Mean Stage 2	Mean Stage 1	diff.	St.Err.	t-value	p-value
COL-PR_R	272	2.919	1.698	1.22***	0.109	11.25	0
COL-PR_NR	144	3.028	1.722	1.306***	0.146	8.95	0
COL-TR	160	2.756	1.756	1***	0.152	6.6	0
IND-PR_R	224	2.688	1.554	1.134***	0.105	10.85	0
IND-PR_NR	96	2.948	1.646	1.302***	.176	7.4	0
IND-TR	160	2.857	1.813	1.044***	0.123	8.45	0
NO PES	176	1.71	2.006	-0.295**	0.132	-2.25	.025

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

5. Results

We reference two indicators of crowding out: within-subject comparison of stages 1 and 3, for treated groups, i.e., a purely temporal difference (tests in Table 6); and between-subject comparisons, or difference-in-differences, comparing trends for treated to those for controls. That matters because contributions fall over time within the control, as seen in Figure 2 above.

Table 6: T-tests comparing Stage 1 and Stage 3 for removed, total removal, and NO PES, correcting for multiple testing using Bonferroni.

Treatment	Obs.	Mean Stage 3	Mean Stage 1	diff.	St.Err.	t-value	p-value
COL-PR_R	272	1.739	1.698	0.041	0.103	0.4	0.696
COL-TR	160	1.425	1.757	-0.331**	0.137	-2.45	0.016
IND-PR_R	224	1.853	1.554	0.299***	0.114	2.65	0.009
IND-TR	160	1.763	1.813	-0.05	0.139	-0.35	0.718
ALL (4)	816	1.713	1.693	0.021	0.06	0.35	0.73
NO PES	176	1.546	2.006	-0.46***	0.128	-3.6	0.001

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

For treated participants, Figure 2 shows a decrease in units of forest for removed participants in Stage 3 (dotted lines), when compared with Stage 2. However, that is not at all surprising. As a first order, if payments induce contributions (Stage 2 vs. Stage 1), then we might expect that the removal of those incentives could be expected to once again lower the contributions. Without some dynamic argument, such as‘crowding, Stage 3 is expected to equal Stage 1.

Moving to that post-versus-pre-PES comparison, we did not find evidence of crowding out with or even without comparison to the control, all of which can be seen clearly in Figure 2. All treatments but one stay flat or even rise over time (Stage 3 vs. Stage 1). For the one that fell over time, it fell less than the drop over time for the No PES controls. Thus, we do not see crowding out. If anything, we possibly observe crowding in for some treatments.

To further examine these differences, we conduct an individual-level panel regression. With 308 participants and 12 rounds, we have 3,388 observations in total. In Table 7, we use land units allocated to forest as the dependent variable and a random-effects-by-individual Tobit to account for the fact that the 12 rounds are likely to be correlated for any given subject. Column (1) has no controls, column (2) adds socio-demographic controls, and column (3) adds “group forest in the previous round” as a control, to take game dynamics into account.

Table 7: Testing for crowding-in or out

VARIABLES	Model 1	Model 2	Model 3
Dummy Stage2	-0.396**	-0.396**	-0.378**
	(0.162)	(0.162)	(0.181)
Dummy Stage3	-0.630***	-0.630***	-0.561***
	(0.162)	(0.162)	(0.182)
COL-PR_R	-0.414*	-0.272	-0.224
	(0.248)	(0.245)	(0.261)
COL-PR_NR	-0.369	-0.250	-0.194
	(0.288)	(0.284)	(0.303)
COL-TR	-0.294	0.060	0.012
	(0.280)	(0.284)	(0.302)
IND-PR_R	-0.608**	-0.501**	-0.493*
	(0.258)	(0.255)	(0.273)
IND-PR_NR	-0.434	-0.196	-0.171
	(0.327)	(0.328)	(0.351)
IND-TR	-0.255	-0.225	-0.219
	(0.280)	(0.273)	(0.291)
COL-PR_R _ST2	2.249***	2.246***	2.029***
	(0.211)	(0.211)	(0.241)
COL-PR_NR _ ST2	2.427***	2.425***	2.191***
	(0.248)	(0.248)	(0.281)
COL-TR _ ST2	1.931***	1.930***	1.845***
	(0.238)	(0.238)	(0.269)
IND-PR_R _ ST2	1.958***	1.955***	1.835***
	(0.216)	(0.216)	(0.247)
IND-PR_NR_ ST2	2.298***	2.302***	2.132***
	(0.279)	(0.279)	(0.315)
IND-TR_ ST2	1.802***	1.804***	1.629***
	(0.234)	(0.234)	(0.265)
COL-PR_R _ST3	0.641***	0.641***	0.525**
	(0.207)	(0.207)	(0.233)
COL-PR_NR _ ST3	3.034***	3.033***	2.702***
	(0.252)	(0.251)	(0.290)
COL-TR_ST3	0.154	0.155	0.199
	(0.234)	(0.234)	(0.262)
IND-PR_R_ ST3	1.039***	1.038***	0.933***
	(0.215)	(0.215)	(0.245)
IND-PR_NR_ ST3	2.271***	2.274***	1.993***
	(0.278)	(0.278)	(0.318)
IND-TR_ ST3	0.566**	0.566**	0.460*
	(0.233)	(0.233)	(0.262)
Age		0.010**	0.011**
		(0.005)	(0.005)

Gender		-0.063	-0.083
		(0.132)	(0.132)
Education		-0.025	-0.025
		(0.017)	(0.017)
Household Income		-0.000	-0.000
		(0.000)	(0.000)
Cut-down forest before		0.308**	0.321**
		(0.145)	(0.145)
Previous Payment		0.131	0.125
		(0.160)	(0.160)
Group forest previous round			0.057***
			(0.011)
Constant	2.017***	1.480***	1.012***
	(0.194)	(0.369)	(0.387)
Observations	3,696	3,696	3,388
Number of exp_id	308	308	308

Standard errors in parentheses

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

We compare the changes over time for the treated participants, after versus before treatments, with changes over time for controls that never received treatment (No PES). We use dummies for treatments (separating removed from not), and stages, then interact treatments and stages.

Overall, there are no significant differences in Stage 1 for treatments, compared to No PES (with one exception, i.e., IND-PR_R), once we control for the socioeconomic characteristics. Also, we see that all of the treatments increased their conservation contributions in Stage 2, with no difference across treatments in conservation contributions (per post-estimation tests).

The interactions of Stage 3 with the various treatments are of particular interest. Looking at COL-PR_R -ST3 and IND-PR_R-ST3, in Table 7's model 3, for collective and individual removal, we find no evidence of crowding out. Both coefficients are positive and statistically significant, indicating more conservation when compared with the control group in Stage 1. Thus, if anything, we have potential behavioral crowding-in among removed participants. For the cases with total removal, IND-TR-ST3 is positive and significant at 10%, while there is no effect of COL-TR-ST3 − clearly not suggesting any crowding out, for either treatment.

6. Discussion

This paper set out to explore what happens after PES, in terms of conservation contributions, using a lab-in-the-field experiment in rural Norte de Santander, Colombia. We find no

evidence of crowding out when incentives are removed for some or all. In fact, our results suggest some form of crowding in, if anything, as contributions were higher after PES than before.

These results, with participants typical of rural PES programs – including some PES participants − lean against warnings about reductions in intrinsic motivation and, thus, decreases in pro-environmental behaviors after an incentive is introduced and then removed (Ezzine-de-Blas, Corbera and Lapeyre, 2019; Rode et al. 2015; Cárdenas, 2000). Some report a "no pay, no care" view among some former participants, once a PES program ends (Fisher, 2012). Yet, our results fit better with recent evidence of crowding in (see Akers and Yasué, 2019 for a review). We find this despite some potential here for fairness-based rejections.

We acknowledge concerns that lab experiments do not predict behaviors outside of the lab. However, evidence from lab experiments has raised questions, in some cases, about what is predicted by microeconomic models. Further, while people of course vary greatly around the globe, our lab-in-the-field experiments are conducted with rural populations for whom the impacts from actual PES introduction and removal are highly relevant. Finally, while lab and actual behaviors are not always the same, key gradients have been found to be consistent when they have been compared (e.g., Rustagi et al. 2010; Fehr and Leibbrandt 2011),

Thus, we believe our results can inform the PES debate. Overall, they show that participants do not conserve less forest when PES is removed, compared with their behavior before PES and compared to controls who did not get payments, although contributions trend down over time. In other words, we find no evidence of crowding out when an incentive is created, then removed.

One possible explanation for this lack of any negative residual or backlash behavior could be simple "recognition or gratitude" (Bowles, 2008). In previous, qualitative studies, we have found that, when the state's presence is generally weak, PES participants may perceive such payments positively, even after removal, since they are a form of long-awaited recognition by the state (Moros, 2019), i.e., a good thing while it lasts − and perhaps a fair redistribution of the costs of conservation. If payments are removed, participants return to conservation contributions at or above their pre-PES levels. Further qualitative study of participant perceptions may add to our understanding.

Since crowding stories are about extinguishing prior intrinsic motivations, it is also worth highlighting that all our groups made positive contributions in Stage 1, which suggests that they had some intrinsic motivations. Removal of incentives may not have been strong enough to erase these initial motivations. However, possible interactions of incentives, motivations and behaviors are sufficiently interesting that our further research will focus more on the motivations *per se*.

Perhaps in the case of environmental markets, i.e., somebody being willing to pay for forest, payments could have a positive "frame-shifting effect" (Bowles, 2008, Ezzine-de-blas et al., 2019). Crowding out hypotheses presume that market framing can signal self-interest, yet framing might work the other way, too. The existence of PES may make the interdependence of the socioeconomic and ecological systems more salient, signaling that there is wider support for sustaining these interactions, and prompting pro-environmental behaviors (see Lliso et al., 2020, as well as Bernal-Escobar, Engel, and Midler, in prep., for some further discussion concerning such framing effects).

We should also distinguish contexts, including the reasons for PES removal. Some programs are finite by design (e.g., Uganda), which might mean that people who sign up are well aware and remain grateful if payments end as expected. Other programs end or have discontinuities in payments due to implementation challenges or politics (e.g., Ecuador and México) and those rationales could induce different reactions. Still other PES programs may adjust over time as a matter of public policy, e.g., a shift in political focus or in eligibility criteria, as in the case of Cundinamarca in Colombia. Reactions again might differ and require further research.

Stepping back, almost all of these considerations suggest that, in design and implementation, those promoting PES might want to pay considerable attention to communications with the potential participants, including local perceptions about who implements the PES and why. Legitimacy and trust affect local responses. Local community organizations also matter and may affect individuals' motivations and behaviors. All these elements require study. Our findings are consistent with potential crowding in − yet the devil remains in the details.

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References

Agrawal, A., Chhatre, A., & Gerber, E. R. (2015). Motivational crowding in sustainable development interventions. The American Political Science Review, 109(3), 470-487. DOI: 10.1017/S0003055415000209

Akers, J. F., & Yasué, M. (2019). Motivational Crowding in Payments for Ecosystem Service Schemes. Conservation & Society, 17(4), 377-389. DOI: 10.4103/cs.cs_18_90

Andersson, K. P., Cook, N. J., Grillos, T., Lopez, M. C., Salk, C. F., Wright, G. D., & Mwangi, E. (2018). Experimental evidence on payments for forest commons conservation. Nature Sustainability, 1(3), 128-135. https://doi.org/10.1038/s41893-018-0034-z

Bernal-Escobar A., Engel, S and E. Midler. Beyond a market discourse: is framing one solution to motivational crowding effects in payments for ecosystem services? (In preparation)

Bowles, S. (2008). Policies designed for self-interested citizens may undermine" the moral sentiments": Evidence from economic experiments. Science, 320(5883), 1605-1609. DOI: 10.1126/science.1152110

Bowles, S., & Polania-Reyes, S. (2012). Economic incentives and social preferences: substitutes or complements? Journal of Economic Literature, 50(2), 368-425. http://www.aeaweb.org/articles.php?doi=10.1257/jel.50.2.368

Calle, A. (2020). Can short-term payments for ecosystem services deliver long-term tree cover change?. Ecosystem Services, 42, 101084. https://doi.org/10.1016/j.ecoser.2020.101084

Cardenas, J. C. (2000). How do groups solve local commons dilemmas? Lessons from experimental economics in the field. Environment, Development and Sustainability, 2(3-4), 305-322. https://doi.org/10.1023/A:1011422313042

Chervier, C., Le Velly, G., & Ezzine-de-Blas, D. (2019). When the implementation of payments for biodiversity conservation leads to motivation crowding-out: a case study from the Cardamoms forests, Cambodia. Ecological Economics, 156, 499-510. https://doi.org/10.1016/j.ecolecon.2017.03.018

Dayer, A. A., Lutter, S. H., Sesser, K. A., Hickey, C. M., & Gardali, T. (2018). Private landowner conservation behavior following participation in voluntary incentive programs: Recommendations to facilitate behavioral persistence. Conservation Letters, 11(2), e12394. DOI: 10.1111/conl.12394

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. Psychological Bulletin, 125(6), 627-668.

Departamento Nacional de Planeación - DNP. (2017). Documento CONPES 3886: Lineamentos de Política Y Programa Nacional de Pago Por Servicios Ambientales Para La Construcción de Paz-Colombia. https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/3886.pdf

Duarte-Abadía, B., & Boelens, R. (2016). Disputes over territorial boundaries and diverging valuation languages: The Santurban hydrosocial highlands territory in Colombia. Water International, 41(1), 15-36. DOI: 10.1080/02508060.2016.1117271

Engel, S. (2016). The devil in the detail: a practical guide on designing payments for environmental services. International Review of Environmental and Resource Economics, 9(1-2), 131-177. DOI: 10.1561/101.00000076

Etchart, N., Freire, J. L., Holland, M. B., Jones, K. W., & Naughton-Treves, L. (2020). What happens when the money runs out? Forest outcomes and equity concerns following Ecuador's suspension of conservation payments. World Development, 136, 105124. https://doi.org/10.1016/j.worlddev.2020.105124

Ezzine-de-Blas, D., Corbera, E., & Lapeyre, R. (2019). Payments for environmental services and motivation crowding: towards a conceptual framework. Ecological Economics, 156, 434-443. https://doi.org/10.1016/j.ecolecon.2018.07.026

Fehr, E., and A. Leibbrandt. 2011. A Field Study on Cooperativeness and Impatience in the Tragedy of the Commons. Journal of Public Economics 95 (9): 1144–55. https://doi.org/10.1016/j.jpubeco.2011.05.013

Fisher, J. (2012). No pay, no care? A case study exploring motivations for participation in payments for ecosystem services in Uganda. Oryx, 46(1), 45-54. DOI: 10.1017/S0030605311001384

Frey, B. S. (1994). How intrinsic motivation is crowded out and in. Rationality and Society, 6(3), 334-352. https://doi.org/10.1177/1043463194006003004

Gneezy, U., & Rustichini, A. (2000). Pay enough or don't pay at all. The Quarterly Journal of Economics, 115(3), 791-810. http://www.jstor.org/stable/2586896.

Grillos, T., Bottazzi, P., Crespo, D., Asquith, N., & Jones, J. P. (2019). In-kind conservation payments crowd in environmental values and increase support for government intervention: A randomized trial in Bolivia. Ecological Economics, 166, 106404. https://doi.org/10.1016/j.ecolecon.2019.106404

Handberg, Ø. N., & Angelsen, A. (2019). Pay little, get little; pay more, get a little more: A framed forest experiment in Tanzania. Ecological Economics, 156, 454-467. https://doi.org/10.1016/j.ecolecon.2016.09.025

Izquierdo-Tort, S. (2020). Payments for ecosystem services and conditional cash transfers in a policy mix: Microlevel interactions in Selva Lacandona, Mexico. Environmental Policy and Governance, 30(1), 29-45. https://doi.org/10.1002/eet.1876

Jayachandran, S., De Laat, J., Audy, R., Pagiola, S. P., & Sedano Santamaria, F. (2018). Evaluating the permanence of forest conservation following the end of payments for environmental services in Uganda (No. AUS0000379, pp. 1-22). The World Bank.

Kaczan, D., Pfaff, A., Rodriguez, L., & Shapiro-Garza, E. (2017). Increasing the impact of collective incentives in payments for ecosystem services. Journal of Environmental Economics and Management, 86, 48-67. https://doi.org/10.1016/j.jeem.2017.06.007

Kaczan, D. J., Swallow, B. M. & Adamowicz, W.L (2019). Forest conservation policy and motivational crowding: Experimental evidence from Tanzania. Ecological Economics, 156, 444-453. https://doi.org/10.1016/j.ecolecon.2016.07.002

Kahneman, D., Knetsch, J. L., & Thaler, R. (1986). Fairness as a constraint on profit seeking: Entitlements in the market. The American Economic Review, 76(4): 728-741. https://www.jstor.org/stable/1806070

Le Grand, J. (2003). Motivation, agency, and public policy: of knights and knaves, pawns and queens. Oxford University Press on Demand.

Le Velly, G., Sauquet, A., & Cortina-Villar, S. (2017). PES impact and leakages over several cohorts: the case of the PSA-H in Yucatan, Mexico. Land Economics, 93(2), 230-257. DOI: 10.3368/le.93.2.230

Lliso, B., Pascual, U., Engel, S., & Mariel, P. (2020). Payments for ecosystem services or collective stewardship of mother earth? Applying deliberative valuation in an indigenous community in Colombia. Ecological Economics, 169, 106499. https://doi.org/10.1016/j.ecolecon.2019.106499

Maca-Millán, S., Arias-Arévalo, P., & Restrepo-Plaza, L. (2020). An experimental approach to the design of payment for ecosystem services: the role of plural motivations and values. (No. 188). Universidad del Valle-CIDSE. https://www.researchgate.net/profile/Paola_Arias-Arevalo/publication/345252942_An_experimental_approach_to_the_design_of_payment_for_ecosystem_services_the_role_of_plural_motivations_and_values/links/5fa1817992851c14bcff77d2/An-experimental-approach-to-the-design-of-payment-for-ecosystem-services-the-role-of-plural-motivations-and-values.pdf

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. Implementation Science, 6(1), 42. https://doi.org/10.1186/1748-5908-6-42

Midler, E., Pascual, U., Drucker, A. G., Narloch, U., & Soto, J. L. (2015). Unraveling the effects of payments for ecosystem services on motivations for collective action. Ecological Economics, 120, 394-405. http://dx.doi.org/10.1016/j.ecolecon.2015.04.006.

Ministerio de Ambiente y Desarrollo Sostenible. (May 25th 2017). Decreto Ley 870 de 2017: Por El Cual Se Establece El Pago Por Servicios Ambientales Y Otros Incentivos a La Conservación. Colombia. http://www.suin-juriscol.gov.co/viewDocument.asp?id=30030677#:~:text=El%20presente%20decreto%20tiene%20por,acciones%20de%20preservaci%C3%B3n%20y%20restauraci%C3%B3n.

Moller, A. C., Buscemi, J., McFadden, H. G., Hedeker, D., & Spring, B. (2013). Financial motivation undermines potential enjoyment in an intensive diet and activity intervention. Journal of Behavioral Medicine, 37(5), 819-827. DOI: 10.1007/s10865-013-9542-5

Moros, L. (2019). Payments for Ecosystem Services in Colombia: discourses, design and motivation crowding. Universitat Autònoma de Barcelona.

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/10.1016/j.ecolecon.2017.11.032

Moros, L., Corbera, E., Vélez, M. A., & Flechas, D. (2020). Pragmatic conservation: Discourses of payments for ecosystem services in Colombia. Geoforum, 108. https://doi.org/10.1016/j.geoforum.2019.09.004

Narloch, U., Pascual, U., & Drucker, A. G. (2012). Collective action dynamics under external rewards: experimental insights from Andean farming communities. World Development, 40(10), 2096-2107. https://doi.org/10.1016/j.worlddev.2012.03.014

Pagiola, S., Honey-Rosés, J., & Freire-González, J. (2020). Assessing the Permanence of Land-Use Change Induced by Payments for Environmental Services: Evidence From Nicaragua. Tropical Conservation Science, 13, 1-15. https://doi.org/10.1177/1940082920922676

Pagiola, S., Honey-Rosés, J., & Freire-González, J. (2016). Evaluation of the permanence of land use change induced by payments for environmental services in Quindío, Colombia. PloS One, 11(3), 1-18. https://doi.org/10.1371/journal.pone.0147829

Pynegar, E.L., Jones, J.P.G., Gibbons, J.M. & Asquith, N.M. (2018) The effectiveness of payments for ecosystem services at delivering improvements in water quality: lessons for experiments at the landscape scale. PeerJ, 6, e5753.

Rode, J., Gómez-Baggethun, E., & Krause, T. (2015). Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence. Ecological Economics, 117, 270-282. http://dx.doi.org/10.1016/j.ecolecon.2014.11.019. https://doi.org/10.1016/j.ecolecon.2014.11.019

Rustagi, D. Engel, S., Kosfeld, M. (2010) Conditional Cooperation and Costly Monitoring Explain Success in Forest Commons Management. Science 330, 961. DOI: 10.1126/science.1193649.Ryan, R. & Deci, E. (1985). Intrinsic Motivation and Self-Determination in Human Behavior. New York: Plenum.

Rustagi, D. Engel, S., Kosfeld, M. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. Contemporary Educational Psychology, 25(1), 54-67. http://www.ncbi.nlm.nih.gov/pubmed/10620381.

Salk, C., Lopez, M. C., & Wong, G. (2017). Simple incentives and group dependence for successful payments for ecosystem services programs: evidence from an experimental game in rural Lao PDR. Conservation Letters, 10(4), 414-421. https://doi.org/10.1111/conl.12277

Salzman, J., Bennett, G., Carroll, N., Goldstein, A., & Jenkins, M. (2018). The global status and trends of Payments for Ecosystem Services. Nature Sustainability, 1(3), 136-144. https://doi.org/10.1038/s41893-018-0033-0.

Titmuss, R. (1970). The Gift Relationship: From Human Blood to Social Policy. London: Allen and Unwin.

Vollan, B. (2008). Socio-ecological explanations for crowding-out effects from economic field experiments in southern Africa. Ecological Economics, 67(4), 560-573. https://doi.org/10.1016/j.ecolecon.2008.01.015

Wiik, E., d'Annunzio, R., Pynegar, E., Crespo, D., Asquith, N., & Jones, J. P. G. (2019). Experimental evaluation of the impact of a payment for environmental services program on deforestation. Conservation Science and Practice, 1(2), e8. https://doi.org/https://doi.org/10.1111/csp2.8

Annexes

Annex 1. Literature on Motivational/Behavioral Crowding Out and/or In

Authors	Country	Crowding	Method	Out?	In?
1. Vollan (2008)	South Africa and Namibia	Behavioral	Lab-in-the-field experiment: Common Pool Resources game	No evidence	No evidence
2. Agrawal, Chhatre and Gerber (2015)	India	Motivational	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	Behavioral	Lab-in-the-field experiment: public goods game with threshold	Collective payments crowd out social norms	Individual payments crowd in social norms
4. Chervier, Le Velly and Ezzine-de-Blas. (2019)	Cambodia	Motivational	Quasi-experimental Matching with non-participants	Participants reported more money related reasons to protect forests and were more likely to break rules after payments ceased	No evidence
5. Handberg and Angelsen (2019)	Tanzania	Behavioral	Lab-in-the-field experiment: Public goods game	No evidence	No evidence

6. Kaczan, Swallow and Adamowicz (2016)	Tanzania	Behavioral	Lab-in-the-field experiment: Dictator game	No evidence	No evidence
7. Salk, López and Wong (2017)	Lao PDR	Behavioral	Lab-in-the-field experiment: Common pool resources game	No evidence after incentive removal	No evidence after incentive removal
8. Andersson, K. P., Cook, N. J., Grillos, T., Lopez, M. C., Salk, C. F., Wright, G. D., & Mwangi, E. (2018)	Bolivia, Indonesia, Peru, Tanzania and Uganda	Behavioral	Lab-in-the-field experiment: Common pool resources game	No evidence after incentive removal	Users conserved more after incentive removal, especially when they were able to communicate
9. Etchart, N., Freire, J. L., Holland, M. B., Jones, K. W., & Naughton-Treves, L. (2020)	Ecuador	Behavioral	Quasi-experimental: Matching combined with fixed effects panel regression analysis	In areas of high deforestation risk	In areas of low deforestation risk
10. Pagiola, S., Honey-Rosés, J., & Freire-González, J. (2016)	Colombia	Behavioral	Household survey to PES participants and control groups before and after	No evidence after incentive removal	In an asset building PES program
11.Pagiola, S., Honey-Rosés, J., & Freire-González, J (2020)	Nicaragua	Behavioral	Household survey to PES participants before and after; detailed	No evidence after incentive removal	In an asset building PES program

			land-use maps		
12.Calle (2020)	Colombia	Behavioral	Satellite images before and after	No evidence after incentive removal	When comparing silvo-pastoral farms relative to the surrounding landscape
13. Grillos, T., Bottazzi, P., Crespo, D., Asquith, N., & Jones, J. P. (2019)	Bolivia	Motivational	Randomized Control Trial	No evidence after incentive removal	Crowding in of pro-environmental values
14. Moros, L. Corbera, E. Vélez, M. (2019)	Colombia	Behavioral and motivational	Lab-in-the-field experiment: public goods game with threshold	Crowding out of intrinsic motivations when premium price is introduced	Crowding in of social motivations when collective payment is introduced. Crowding in of conservation behaviors with individual and collective payments
15. Jayachandran, S., De Laat, J., Audy, R., Pagiola, S. P., & Sedano Santamaria, F. (2018)	Uganda	Behavioral	Randomized Control Trial	No evidence after incentive removal	No evidence of crowding-in but slower rate of deforestation among former PES participants
16. Le Velly, G., Sauquet, A. & Cortina-Villar, S. (2017)	Mexico	Behavioral	Satellite images and community surveys	Potential lack of permanence of the PES program	No evidence after incentive removal

17. Maca-Millán, S., Arias-Arévalo, P. & Restrepo-Plaza, L. (2020)	Colombia	Motivational	Lab-in-the-field experiment: Threshold public good game & post-experiment survey	Crowding-out after incentive removal	Potential crowding-in if PES programs integrate plural motivations and values

Annex 2. Survey Protocol and Informed Verbal Consent

Post-motivations Survey

We appreciate your participation in this activity and in this survey. After this survey you will receive your total earnings.

How many properties (plots of land) do you have?

Where do you live? Town_____ Property_____ Other_____

What town do you live in?

How long have you lived there?

What size is the most important property for you in economic terms?*

Do you have forest in any of your properties?

How much forest area does it have?*

Have you or someone in your home cut down forest on any of your properties since you acquired it?

How much have you logged in total? (unit options: block, hectare, other)

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

I would take care of forests only if I am paid to do so

Do you have cattle?

How many heads?

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

I would feel guilty if I clear the forests

Do you have crops?

How much area do you have in crops?*

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

I enjoy when I take care of forests

From your main property (the most important in economic terms) you:

a) Have promise or sales papers but there is no title deed

b) Have possession but have no title deed

c) Have a title deed but is NOT registered in the registry office

d) Have a title deed and it is registered in the registry office

e) Other

f) Don't know, don't report

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

I don't see what I can obtain by conserving the forest

Including yourself, would you tell me how many people live in YOUR household?

What is your highest level of education?

What is the highest level of education attained by a member of your household?

Mark down Female __or Male__ according to biological sex

How old are you?

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

I'm the type of person who doesn't clear the forest

How much is your household income monthly?

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

□I feel proud for taking care of forests

Are you a member of any organization or productive association?

You would say that the people in YOUR town:

a) help each other a little
b) help each other a lot
c) don't help each other

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

□I would take care of forests only if I am paid to do so

What's your occupation?

What economic activity generates the highest income for you?

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

□I would regret it if I clear the forests

Do you belong to MiParamo project?

Did you answer the MiParamo characterization survey?

If not, who answered the survey?

In which stage of the MiParamo project is your property?

Have you participated in any conservation incentive program where you have received any payment - in cash or in kind - for activities related to forest conservation or water sources?

What type of payment? Cash_____ In-kind_____ both_____

If cash: how much? how many times?

If in-kind: what have you received? How many times?

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

□I would be criticized by my neighbors if I clear the forests

Now, we are going to ask you some questions about how you felt during the activity. (The set of emotions where randomly read to the participant from top to bottom or bottom-up)

What emotions did the activity generate in you? Answer using a scale between o and 4, where 0 means "You did NOT at all experience the emotion" and 4 means "You FULLY experienced that emotion"

a) Rage
b) Frustration
c) Injustice
d) Surprise
e) Envy
f) Joy
g) Happiness

I'm going to read you a sentence. I ask you to please tell me if you agree with that sentence using the following scale: 1 is NO, 2 is A LITTLE, 3 is YES, OK, 4 is COMPLETELY AGREED

□I do not cut down the forests because of fear of fines that might be imposed by environmental authorities

In the third part of the game, payments were suspended for some groups. Did you belong to a group where there was suspension of payments?

***Note: The following questions were asked to participants in sessions where the treatments with removal were allocated.**

In the third part of the activity, payments were suspended for some groups or all groups. How fair do you think the suspension of payments from the environmental organization was? Answer using a scale between 1 and 4, where 1 means "Not fair" and 4 means "Completely fair"

What emotions did the removal from the payment generate in you? Answer using a scale between 0 and 4, where 1 means "You did NOT at all experience the emotion" and 4 means "You FULLY experienced that emotion"

a) Rage
b) Frustration
c) Injustice
d) Surprise
e) Envy
f) Joy
g) Happiness

To what scale did the removal from the payments affect your decisions during the activity? Answer using a scale between 1 and 4, where 1 means "It did not at all affect my decisions" and 4 means "It completely affected my decisions"

Thank you very much for your participation.

*For these questions, the measurement unit of each answer was verified.

Informed Verbal Consent (translation from Spanish).

You have been invited to participate in this exercise as part of a research project related to sustainable productive practices.

The objective of this activity is to understand how people make their decisions. Therefore, we will learn from what you decide. This activity lasts three hours. Your answers will be anonymous, which means that when we analyze your answers they will not be associated to your name.

This activity does not imply any risk to you. In fact, this exercise could benefit you with the earnings you obtain. Your earnings depend on the decisions you make and the decisions made by the other members of your group. The earnings of this activity are between $ 20,000 and $ 50,000 pesos.

Your decisions as well as your earnings are private. Your participation is absolutely voluntary. You can leave at any time without any justification. However, if you withdraw before finishing the activity, we cannot pay you what you have earned.

We use cash because we want to recreate real-life situations in which the decisions you make have an economic cost for you. The cash you receive today is yours and only the research team will know the exact amount you earned.

I, XXX, professor at XXX, certify this information will be used in a responsible manner for academic and educational purposes. I also certify that each participant will receive the earnings obtained during the activity in cash.

Annex 3. Payoff Table, Baseline

Mi decisión		4 unidades de bosque y 0 en cultivos	3 unidades de bosque y 1 en cultivos	2 unidades de bosque y 2 en cultivos	1 unidades de bosque y 3 en cultivos	0 unidades de bosque y 4 en cultivos
Bosque de los demás	**0**	$ 800	$ 1,200	$ 1,600	$ 2,000	$ 2,400
	1	$ 1,000	$ 1,400	$ 1,800	$ 2,200	$ 2,600
	2	$ 1,200	$ 1,600	$ 2,000	$ 2,400	$ 2,800
	3	$ 1,400	$ 1,800	$ 2,200	$ 2,600	$ 3,000
	4	$ 1,600	$ 2,000	$ 2,400	$ 2,800	$ 3,200
	5	$ 1,800	$ 2,200	$ 2,600	$ 3,000	$ 3,400
	6	$ 2,000	$ 2,400	$ 2,800	$ 3,200	$ 3,600
	7	$ 2,200	$ 2,600	$ 3,000	$ 3,400	$ 3,800
	8	$ 2,400	$ 2,800	$ 3,200	$ 3,600	$ 4,000
	9	$ 2,600	$ 3,000	$ 3,400	$ 3,800	$ 4,200
	10	$ 2,800	$ 3,200	$ 3,600	$ 4,000	$ 4,400
	11	$ 3,000	$ 3,400	$ 3,800	$ 4,200	$ 4,600
	12	$ 3,200	$ 3,600	$ 4,000	$ 4,400	$ 4,800

Annex 4. Payoff Table, Individual Payment

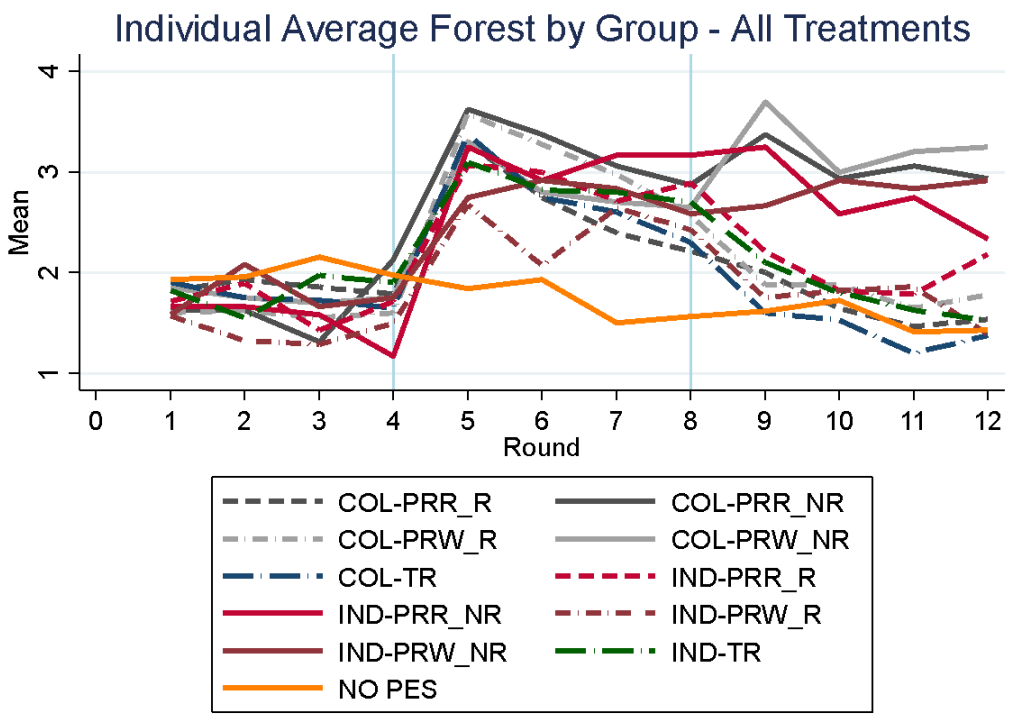
Mi decisión		4 unidades de bosque y 0 en cultivos	3 unidades de bosque y 1 en cultivos	2 unidades de bosque y 2 en cultivos	1 unidades de bosque y 3 en cultivos	0 unidades de bosque y 4 en cultivos
Bosque de los demás	**0**	$ 2,600	$ 2,550	$ 2,500	$ 2,450	$ 2,400
	1	$ 2,800	$ 2,750	$ 2,700	$ 2,650	$ 2,600
	2	$ 3,000	$ 2,950	$ 2,900	$ 2,850	$ 2,800
	3	$ 3,200	$ 3,150	$ 3,100	$ 3,050	$ 3,000
	4	$ 3,400	$ 3,350	$ 3,300	$ 3,250	$ 3,200
	5	$ 3,600	$ 3,550	$ 3,500	$ 3,450	$ 3,400
	6	$ 3,800	$ 3,750	$ 3,700	$ 3,650	$ 3,600
	7	$ 4,000	$ 3,950	$ 3,900	$ 3,850	$ 3,800
	8	$ 4,200	$ 4,150	$ 4,100	$ 4,050	$ 4,000
	9	$ 4,400	$ 4,350	$ 4,300	$ 4,250	$ 4,200
	10	$ 4,600	$ 4,550	$ 4,500	$ 4,450	$ 4,400
	11	$ 4,800	$ 4,750	$ 4,700	$ 4,650	$ 4,600
	12	$ 5,000	$ 4,950	$ 4,900	$ 4,850	$ 4,800

Annex 5. Payoff table for collective payment ($1,800)

Mi decisión		4 unidades de bosque y 0 en cultivos	3 unidades de bosque y 1 en cultivos	2 unidades de bosque y 2 en cultivos	1 unidades de bosque y 3 en cultivos	0 unidades de bosque y 4 en cultivos
Bosque de los demás	**0**	$ 800	$ 1,200	$ 1,600	$ 2,000	$ 2,400
	1	$ 1,000	$ 1,400	$ 1,800	$ 2,200	$ 2,600
	2	$ 1,200	$ 1,600	$ 2,000	$ 2,400	$ 2,800
	3	$ 1,400	$ 1,800	$ 2,200	$ 2,600	$ 3,000
	4	$ 1,600	$ 2,000	$ 2,400	$ 2,800	$ 3,200
	5	$ 1,800	$ 2,200	$ 2,600	$ 3,000	$ 3,400
	6	$ 2,000	$ 2,400	$ 2,800	$ 3,200	$ 3,600
	7	$ 2,200	$ 2,600	$ 3,000	$ 3,400	$ 3,800
	8	$ 2,400	$ 2,800	$ 3,200	$ 3,600	$ 4,000
	9	$ 2,600	$ 3,000	$ 3,400	$ 3,800	$ 4,200
	10	$ 2,800	$ 3,200	$ 3,600	$ 4,000	$ 4,400
	11	$ 3,000	$ 3,400	$ 3,800	$ 4,200	$ 4,600
	12	$ 5,000	$ 3,600	$ 4,000	$ 4,400	$ 4,800

Annex 6. Individual Average Forest by Group – All Treatments

[PLEASE NOTE THAT COLOR SHOULD BE USED FOR THIS FIGURE]



Annex 7. Regression including all treatments (PR and TR) and interactions

(with dummy_wr (1= water; 0= else) only for removed treatments in all stages)

VARIABLES	Model 1	Model 2	Model 3
Dummy Stage2	-0.395**	-0.395**	-0.381**
	(0.162)	(0.162)	(0.181)
Dummy Stage3	-0.629***	-0.630***	-0.568***
	(0.162)	(0.162)	(0.182)
COL-PR_R	-0.215	-0.138	-0.126
	(0.309)	(0.303)	(0.323)
COL-PR_R_WR	-0.330	-0.218	-0.165
	(0.314)	(0.307)	(0.328)
COL-PR_NR	-0.368	-0.250	-0.199
	(0.286)	(0.282)	(0.302)
COL-TR	-0.294	0.072	0.021
	(0.279)	(0.282)	(0.300)
IND-PR_R	-0.446	-0.308	-0.323
	(0.308)	(0.303)	(0.325)
IND-PR_R_WR	-0.321	-0.374	-0.343
	(0.340)	(0.330)	(0.354)
IND-PR_NR	-0.434	-0.188	-0.167
	(0.326)	(0.326)	(0.349)
IND-TR	-0.254	-0.224	-0.222
	(0.278)	(0.271)	(0.290)
COL-PR_R_ST2	1.589***	1.586***	1.437***
	(0.262)	(0.262)	(0.294)
COL-PR_R_ST2_WR	1.136***	1.137***	1.056***
	(0.272)	(0.271)	(0.303)
COL-PR_NR _ ST2	2.423***	2.421***	2.208***
	(0.247)	(0.247)	(0.281)
COL-TR _ ST2	1.929***	1.927***	1.858***
	(0.237)	(0.237)	(0.268)
IND-PR_R _ST2	2.187***	2.184***	2.064***
	(0.261)	(0.261)	(0.297)
IND-PR_R _ ST2_WR	-0.442	-0.440	-0.407
	(0.286)	(0.286)	(0.320)
IND-PR_NR_ ST2	2.295***	2.299***	2.147***
	(0.278)	(0.278)	(0.314)
IND-TR_ ST2	1.800***	1.802***	1.644***
	(0.233)	(0.233)	(0.265)
COL-PR_R _ST3	0.339	0.339	0.282

	(0.260)	(0.259)	(0.290)
COL-PR_R _ST3_WR	0.505*	0.505*	0.423
	(0.263)	(0.262)	(0.293)
COL-PR_NR _ ST3	3.030***	3.028***	2.727***
	(0.251)	(0.251)	(0.290)
COL-TR_ST3	0.154	0.154	0.203
	(0.233)	(0.233)	(0.261)
IND-PR_R_ ST3	1.053***	1.053***	0.962***
	(0.258)	(0.258)	(0.292)
IND-PR_R_ ST3_WR	-0.032	-0.032	-0.030
	(0.283)	(0.283)	(0.317)
IND-PR_NR_ ST3	2.269***	2.271***	2.015***
	(0.277)	(0.277)	(0.317)
IND-TR_ ST3	0.565**	0.565**	0.471*
	(0.232)	(0.232)	(0.261)
Age		0.011**	0.011**
		(0.005)	(0.005)
Gender		-0.085	-0.104
		(0.131)	(0.132)
Education		-0.024	-0.024
		(0.017)	(0.017)
Household Income		-0.000	-0.000
		(0.000)	(0.000)
Cut down forest before		0.308**	0.319**
		(0.143)	(0.144)
Previous Payment		0.143	0.141
		(0.159)	(0.160)
Group forest previous round			0.053***
			(0.011)
Constant	2.017***	1.447***	1.012***
	(0.193)	(0.367)	(0.386)
Observations	3,696	3,696	3,388
Number of exp_id	308	308	308

Standard errors in parentheses

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