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9 **On the role of social equity in payments for ecosystem services in Latin America: a**  
10 **practitioner perspective**

11 BOSCO LLISO<sup>\*1,2</sup>, UNAI PASCUAL<sup>1,3,4</sup> & STEFANIE ENGEL<sup>2</sup>

12 \* Corresponding author: [bosco.lliso@bc3research.org](mailto:bosco.lliso@bc3research.org);

13 <sup>1</sup>Basque Centre for Climate Change, Scientific Campus of the University of the Basque Country (UPV-EHU), Leioa, Bilbao, Spain;

14 <sup>2</sup>Alexander von Humboldt-Professorship of Environmental Economics, Department of Economics, University of Osnabruck, Germany

15 <sup>3</sup>Ikerbasque, Basque Foundation for Science, Bilbao, Spain;

16 <sup>4</sup>Centre for Development and Environment, University of Bern, Mittelstrasse 43, 3012 Bern, Switzerland

17

18 **Abstract**

19 One of the main debates surrounding payments for ecosystem services (PES) is to what extent should PES  
20 design focus on social equity concerns. While much of the debate is centered around theoretical  
21 arguments, here we focus empirically on the question of whether there are trade-offs between social-  
22 environmental effectiveness and social equity in PES design and implementation. Towards this end, we  
23 use a survey targeted at 61 PES practitioners in 12 Latin American countries, where equity is treated in a  
24 multidimensional way, not only including distributional concerns but also elements of recognition and  
25 procedure, reflected across a set of 15 indicators. Results suggest that PES which practitioners describe  
26 as being more equitable are also perceived to be more successful in jointly achieving the social-  
27 environmental goals of the PES program they are involved with. This suggests that from a practitioner  
28 perspective a concern for social equity may be advocated for not only from a normative stance (“because  
29 it is the right thing to do”), but also for instrumental reasons (“because it may contribute to PES success”).

30 **Keywords:**

31 PES; equity; recognition; procedure; distribution; Latin America

32 **Highlights:**

- 33
- 34 • PES that practitioners perceive to be more socially equitable in design and implementation are  
35 better able to achieve their intended social-environmental goals.
  - 36 • According to practitioners, increasing equity in PES does not necessarily require a tradeoff with  
37 environmental effectiveness.
  - 38 • Social equity in PES is seen as a multidimensional concept by practitioners, beyond purely  
distributive aspects.

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2 None

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1 **1. Introduction**

2 Payments for ecosystem services (PES) represent voluntary agreements meant to compensate individuals  
3 or communities for supplying socially valuable ecosystem services (ES) (Engel, 2016; Engel et al., 2008).  
4 The ever-growing number of PES programs being implemented in developing countries (Schomers and  
5 Matzdorf, 2013) has raised hopes that, under the right conditions, this policy instrument may be able to  
6 provide ‘win-win solutions’ to both environmental and social problems (Muradian et al., 2013). This has  
7 generated much debate regarding whether and to what degree PES should consider non-environmental  
8 concerns such as poverty and social equity (Pascual et al. 2014).

9 The literature on this topic is yet to reach a consensus. From the moment that PES became the  
10 ‘new kid on the block’, some scholars began advocating that PES should focus on delivering ES in the most  
11 cost-effective and efficient way possible, leaving social concerns to other types of policy instruments that  
12 were better suited to the task (e.g., Wunder, 2005; Kinzig et al., 2011). This line of thinking contends that  
13 a focus on equity may imply trade-offs which can reduce the environmental effectiveness of PES (e.g.  
14 Halpern et al., 2013; Jindal et al., 2013; Martin Persson and Alpizar, 2013). Others argue instead that the  
15 existence of trade-offs between environmental effectiveness and equity (sometimes framed as pro-poor  
16 outcomes) depend on the context, and that it may be reasonable to address hurdles to participation of  
17 poor landholders in PES design for equity reasons (Grieg-Gran et al., 2005; Pagiola et al., 2005; Zbinden  
18 and Lee, 2005; Ren et al., 2018). A growing body of research goes even further to suggest that perceived  
19 inequity and unfair PES processes can actually undermine the environmental outcomes of PES (Pascual et  
20 al., 2010, 2014; Miller et al., 2012; Corbera and Pascual, 2012; Grima et al., 2016; Börner et al., 2017). The  
21 underlying idea behind this position is that because participating in PES is (generally) voluntary, programs  
22 that are perceived to be fair and equitable are more likely to motivate participation and adherence to  
23 their objectives by increasing their legitimacy in the eyes of participants (e.g., Corbera et al., 2007;  
24 Muradian et al., 2010). Thus, considering equity aspects in PES design and implementation is hypothesized  
25 to be conducive to improving not only the social, but also the environmental outcomes of PES (Liu and  
26 Kontoleon, 2018). More recently, it appears these diverse schools of thought are beginning to converge  
27 on the shared view that, especially in the Global South, social equity considerations are an ineludible  
28 component in the design of PES, which should still reflect basic economic design principles (Wunder et al.,  
29 2018; Andeltová et al., 2019). Nevertheless, a need for more empirical evidence to test these competing  
30 hypotheses has repeatedly been noted (Halpern et al., 2013; Calvet-Mir et al., 2015; Wegner, 2016;  
31 Blundo-Canto et al., 2018).

32 Here we aim to contribute to the aforementioned debate. We surveyed on-the-ground  
33 practitioners on their perceptions regarding the trade-offs or synergies between equity considerations in  
34 PES and the attainment of the programs’ goals. As central actors in the design and implementation of PES  
35 programs, practitioners’ perceptions are often key in determining the way in which PES programs  
36 proceed, are redesigned, or even discontinued. Thus, there is great value to be had by understanding  
37 these perceptions in detail. Following this approach, we aim to shed light on whether more equitable PES  
38 programs are seen to be more or less successful by those who are closest to designing and implementing

1 them. Given that “success” can be interpreted in a myriad of ways, in this study we use a pragmatic,  
2 operational approach: we asked PES practitioners the degree to which their PES program had managed  
3 to accomplish its intended social and environmental goals. It is important to note that despite the close  
4 connection between equity and social goals, we treat the two as distinct because we consider all PES to  
5 unavoidably have equity impacts depending on their design and implementation, while not all PES  
6 programs are necessarily designed with explicit social goals (e.g. reducing unemployment or creating  
7 alternative sources of income for rural inhabitants).

## 9 **2. Equity in Latin American PES programs**

10 Past efforts to shed light on the PES equity-effectiveness debate have often resorted to analyzing social  
11 equity in relatively binary terms (e.g. equitable or inequitable) due to the heterogeneity of the data that  
12 can be obtained from published case studies (Calvet-Mir et al., 2015). However, there is an increasing  
13 awareness that equity has multiple complementary dimensions that must all be considered, including  
14 recognition, procedural, and distributional equity (McDermott et al., 2013; Pascual et al., 2014; Friedman  
15 et al., 2018). Distributional equity focuses on the economic aspects of equity and is concerned with the  
16 allocation of costs, risks and benefits (McDermott et al., 2013). Procedural equity is the political dimension  
17 of equity and encompasses the decision-making process of PES design and implementation (Pascual et al.,  
18 2014). Recognition can be seen as the cultural dimension of equity, ensuring that the values and identities  
19 of all stakeholders are taken into account and respected (Martin et al., 2016). However, a recent review  
20 of the conservation literature has shown that distributional equity has received a disproportionate  
21 amount of academic attention at the expense of procedural equity and recognition (Friedman et al.,  
22 2018). To avoid this pitfall, in this paper we consider all three dimensions of equity in tandem.

23 The scope of this paper covers PES programs in 12 different Latin American countries, where the  
24 number of PES programs has been steadily growing since the 1990s (Schomers and Matzdorf, 2013). Due  
25 to the region’s history and the rising frequency of social-environmental conflicts<sup>1</sup> (Rodríguez et al., 2019),  
26 a wide range of equity concerns come into play when designing and implementing PES. For example, Latin  
27 America is the world’s most unequal region with regard to land ownership (Benra and Nahuelhual, 2019).  
28 This, along with other factors, such as displacement of entire communities that are victims of armed  
29 conflicts (Engel and Ibañez, 2007), has contributed to many people working on small plots of land that  
30 they often hold no formal titles to. Thus, PES design must consider issues such as to what extent to target  
31 smallholders (Jindal et al., 2013) or whether people with uncertain land tenure will be excluded or allowed  
32 to participate (Bremer et al., 2014). PES implementation has also had to deal with a heterogeneous  
33 landscape of peoples and cultures in the region. For example, specific equity considerations come into  
34 play when PES are being implemented in indigenous communities (Lliso et al., 2020). Indeed, PES  
35 programs have been found to have varying impacts on indigenous groups: from helping to empower them  
36 (Denham, 2017) to bypassing them almost entirely (Reed, 2011). Without deliberate attention to these

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<sup>1</sup> The Environmental Justice Atlas database (ejatlas.org) shows 29% of all registered environmental justice conflicts taking place in Meso and South America.

1 types of equity concerns, preexistent power dynamics are likely to lead to powerful stakeholders steering  
2 PES programs for their own benefit at the expense of marginalized communities (Rodríguez de Francisco  
3 and Budds, 2015).

### 4 5 **3. Methods**

#### 6 **3.1 Survey design**

7 Previous meta-analyses have noted the challenge of measuring the impact of social equity considerations  
8 on the environmental effectiveness of PES given the heterogeneity of available information (e.g. Brouwer  
9 et al., 2011; Locatelli and Vignola, 2009; Martin-Ortega et al., 2012; Calvet-Mir et al., 2015). This is due to  
10 several factors: firstly, key information gaps and a generalized lack of baseline information in the available  
11 case studies often make it impossible to adequately assess the success of PES programs; secondly,  
12 depending on the social-environmental context of each PES, certain equity concerns may have seemed  
13 more relevant or salient to the authors of the case studies, and thus received specific attention, while  
14 others were either ignored or received only a passing mention.

15 In order to overcome this hurdle, we designed a survey targeting dozens of PES practitioners that  
16 would allow us to systematically obtain homogenous information across multiple equity indicators as well  
17 as environmental and social outcomes. We make no claims as to the exhaustiveness of our list of equity  
18 indicators, but do believe that it represents a good approximation of the types of equity concerns that are  
19 relevant for the Latin American context. We also acknowledge that compared to more in-depth case study  
20 analyses, this type of equity-effectiveness assessment across a heterogeneous set of PES programs offers  
21 a lower level of granularity with regard to the specific equity concerns that may be most salient in a given  
22 local context. However, its strength is that it can help uncover new findings by simultaneously drawing  
23 upon data from a wide range of different PES programs.

24 For the purpose of our study we defined a PES practitioner as someone who had participated in  
25 the design and/or implementation of a PES program. Our respondents included practitioners working for  
26 governments, NGOs, and private companies that had experience designing and managing PES schemes.  
27 PES practitioners represent a key nexus between policy makers, funders, providers and beneficiaries of  
28 ecosystem services and are knowledgeable about the contextual features and complexity of the process  
29 of establishing PES on the ground. Their role within PES programs has been found to be a key determinant  
30 of PES success or failure (Leimona et al., 2015), but despite this their views have largely not been explicitly  
31 accounted for (see Namirembe et al. (2017) and Santos de Lima et al. (2019) for some notable exceptions).

32 Given our focus on practitioners, we limit the scope of the equity impacts of PES to the design  
33 and implementation phases of the programs themselves, as these are the phases of PES that they have  
34 experience with. However, it is important to recognize that equity concerns can play a key role in steps  
35 prior to the actual rollout of PES programs. For instance, there has been much debate regarding the way  
36 in which the use of the ecosystem services (ES) concept (Barnaud and Antona, 2014), and of PES in  
37 particular (Hausknot et al., 2017), frames human-nature relationships in purely instrumental terms that  
38 may not necessarily resonate with local worldviews. In this way, their use may impose external

1 rationalities—e.g. via the commodification of nature (Kolinjivadi, 2019; Tadaki et al., 2015)—with the  
2 ethical and equity implications that this entails. Therefore, despite the continued relevance of this debate,  
3 we limit the focus of this study to the equity impacts of PES after this policy instrument has already been  
4 chosen for use, rather than further upstream in the process (Hausknot et al., 2017; Spangenberg et al.,  
5 2014), where the decision of whether PES is an appropriate tool or not is made.

6 We administered an online questionnaire<sup>2</sup> in three languages: Spanish, English and Portuguese.  
7 It included a broad list of questions concerning issues around perceived equity and effectiveness as well  
8 as more descriptive PES program characteristics (e.g. what specific ES were targeted). The survey format  
9 used a combination of quantitative and qualitative type questions associated with Likert scales, multiple  
10 choices, and open answers to collect different kinds of data. Respondents were reminded on several  
11 occasions that their responses would be anonymous. We also urged respondents to be as honest as  
12 possible given that the results could be used to improve upon the design of future PES. Additionally, to  
13 check for potential biases in their responses, we included a question that asked whether the  
14 environmental impacts of the program had been measured or verified empirically. We use this question  
15 to check whether PES programs that had actually measured the impacts were more or less likely to provide  
16 positive evaluations of their PES program.

17 By reaching out directly to PES practitioners, we circumvent the challenge of acquiring spotty,  
18 hard-to-obtain, or inexistent baseline data (Salzman et al., 2018), as most PES programs have failed to  
19 carry out baseline analyses against which to measure changes in ES (Pattanayak et al., 2010; Naeem et al.,  
20 2015), and even when they do, they are not always made publicly available. Our results should thus be  
21 interpreted as conveying information about the impact of equity on PES social-environmental outcomes  
22 from the practitioners' perspective. This perspective, while subjective, is important to consider as it is  
23 central for the continuation, redesign or termination<sup>2</sup> of PES programs. This is because PES practitioners  
24 are key actors in the 'institutional bricolage'<sup>3</sup> (Cleaver, 2012; Van Hecken et al., 2015) process involved in  
25 the deployment of PES programs on the ground. With firsthand experience of the way that their PES  
26 program was patchworked together—including the challenges that had to be surmounted and the  
27 compromises that had to be reached—they are uniquely positioned to observe the ways in which the PES  
28 program helped to break, or perpetuate, inequitable relations among stakeholders in pursuit of the  
29 program's goals (Ishihara et al., 2017; Cleaver and Whaley, 2018).

30 The survey was administered between November 2016 and May 2017 using two dissemination  
31 strategies: firstly by enlisting the help of key actors that distributed the survey through their networks  
32 (e.g. through the IPBES Latin America regional group); and secondly, using the 'snowball technique',  
33 whereby at the end of the questionnaire we invited respondents to share the link to the survey with other

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<sup>2</sup> Accessible online: <https://forms.gle/qA9AFG7nfYBh9fNH8>

<sup>3</sup> "The adaptive processes by which people imbue configurations of rules, traditions, norms, and relationships with meaning and authority. In so doing they modify old arrangements and invent new ones but innovations are always linked authoritatively to acceptable ways of doing things" (Cleaver, 2012:45).

1 PES practitioners in Latin America<sup>4</sup>. We obtained responses from 61 PES practitioners in 12 countries with  
2 experience across 45 different PES programs. 93% of respondents stated that their PES were still  
3 functioning, 5% that their program had ended, and 2% (only one instance) that it had been cancelled  
4 prematurely. The oldest PES program in the sample was started in 1994 (Mexico) and the newest in the  
5 2016 (Colombia). We treat instances where respondents had experience with the same PES program but  
6 in separate locations or phases of the project (e.g. pilot phase vs. full implementation) as separate data  
7 points given that their experiences were different.

### 8 9 **3.2 Development and analysis of indices**

10 While analyzing social equity in PES is a complex endeavor often requiring in depth qualitative methods,  
11 mostly associated with single or comparative case studies (e.g. Corbera et al., 2007b; Büscher, 2012;  
12 Gross-Camp et al., 2012; Martin et al., 2014b; Porras and Blackmore, 2014; Rodríguez de Francisco and  
13 Budds, 2015; Bétrisey et al., 2018), we approach the topic from a more quantitative perspective in order  
14 to try to systematize some key information across a large set of PES cases.

15 Using Likert-type data to conduct regressions and other parametric analyses is only  
16 recommended when using scales (i.e. *groups* of questions) rather than individual Likert items (i.e.  
17 *individual* questions) (Carifio and Perla, 2008, 2007). For this reason, we group the Likert items into  
18 synthetic indices to represent the multidimensional nature of social equity (e.g. McDermott et al., 2013;  
19 Pascual et al., 2014; Zafra-Calvo et al., 2019) (c.f. Table 1). We classify the equity indicators into the  
20 following equity-related (E) indices: “recognition of marginalized actors” (E<sub>R</sub>), “fair procedures in decision-  
21 making” (E<sub>P</sub>) and “equitable distribution of benefits” (E<sub>D</sub>). The index for recognition includes equity  
22 indicators that look at how vulnerable and marginalized actors in particular were taken into account in  
23 the design of PES and whether their local norms, practices and knowledge were accounted for. The  
24 marginalized actors that the questionnaire covered included income-poor farmers with land, landless  
25 workers, customary land users (farmers without formal land tenure), women, and indigenous  
26 communities. The index for procedural equity covers indicators related to questions about whether  
27 meaningful efforts were made to encourage participation of a diversity of local actors in the design and  
28 implementation of the PES. The index for distributive equity measures satisfaction with payments,  
29 whether the PES increased or decreased economic equity, and whether participants were able to decide  
30 the types of compensation they would receive from delivering ES and the best way to distribute such  
31 compensation within the local community. We also create an aggregated index that includes all three  
32 equity indices which referred to here as “multidimensional equity” (E<sub>M</sub>). Lastly, indices for “environmental  
33 outcomes” (O<sub>E</sub>) and “social outcomes” (O<sub>S</sub>) are also calculated to reflect the degree to which PES had  
34 accomplished their intended goals as assessed by practitioners.

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<sup>4</sup> This approach prevents us from knowing what the final response rate as we do not know how many people received the survey. Random sampling was not possible given that the majority of PES programs in Latin America are small-scale and have not been reported in the peer-reviewed literature (Wunder et al., 2008). Thus, although our study provides useful insights, we do not claim statistical representativeness.

1 **Table 1.** Survey questions included in each of the equity and outcome indices. The indices are calculated averaging the scores of the components.

Dimension/ index		Equity indicators/Likert items
<b>Multidimensional equity (E<sub>M</sub>)</b>  <i>Encompasses: E<sub>R</sub>, E<sub>P</sub> &amp; E<sub>D</sub></i>	Recognition of marginalized actors (E <sub>R</sub> )	1. Degree to which measures were taken to reduce or avoid negative impacts on vulnerable actors 2. Degree to which local or traditional norms, customs and knowledge influenced the PES 3. Degree to which potential impact on vulnerable actors was considered 4. Degree to which vulnerable actors were able to participate in design process 5. Recognition of traditional land-use rights (without formal titles) for participants
	Fair procedures in decision-making (E <sub>P</sub> )	6. Degree to which the PES avoided being affected by preexisting power dynamics 7. Ease for ES providers to communicate with PES practitioners to obtain information and share concerns 8. Degree to which public participation mechanisms were used to elicit participation from ES providers 9. Degree to which problems and conflicts have been addressed and resolved 10. Degree to which ES providers participated in the decision-making process
	Equitable distribution of benefits (E <sub>D</sub> )	11. Degree of satisfaction of ES providers with the payments they received 12. Effect of the PES on social or economic equity between the participants and non-participants 13. Effect of the PES on social or economic equity among the participants 14. Degree to which ES providers decided how payments would be distributed among themselves 15. Degree to which ES providers decided the type of payment or compensation (cash or in-kind)
<b>PES outcomes</b>	Environmental outcomes (O <sub>E</sub> )	16. Success of the PES in providing the targeted ecosystem services 17. Degree to which the PES met its environmental goals and targets
	Social Outcomes (O <sub>S</sub> )	18. Impact of the PES on the livelihoods of vulnerable ES providers 19. Degree to which the PES met its social goals and targets

2 Note: The following questions were averaged together before creating the indices to avoid double-counting, as they had correlations greater than 0.7: 1 and 3; 7 and 8; 8 and

3 10; 14 and 15.



1 The development of the indices involves a three-step process. First, Likert items that are related  
2 to specific equity dimensions or outcomes are classified together in the groups seen in Table 1. Second,  
3 as that the responses to some of the equity-related questions within a single index are highly correlated  
4 given that they cover issues that occasionally overlap (e.g. the degree to which the impact on marginalized  
5 actors was *considered* during the design, and whether *specific measures were actually implemented* to  
6 reduce negative impacts on these marginalized actors) we average the scores of items that have a  
7 correlation greater than or equal to 0.7 to avoid double counting. Third, we average the remaining items  
8 to create a final score per index. The practice of averaging groups of Likert items is usually followed when  
9 measuring and analyzing abstract concepts (Sullivan and Artino, 2013) such as equity. The internal  
10 consistency of these indices is confirmed by calculating their Chronbach's alpha<sup>5</sup>.

11 We analyze the indices for the equity and outcome variables using an ordinary least square (OLS)  
12 model to test the relationship between the three equity dimensions as independent variables and the PES  
13 outcomes as dependent variables. We include three dummy variables to control for (i) whether the PES  
14 had measured environmental impacts empirically (e.g., through a commissioned study) or alternatively  
15 whether the environmental outcomes reported were based only on the practitioners' judgement, (ii) if  
16 the PES was implemented at the national scale, and (iii) whether the PES had received public funds. The  
17 first dummy variable controls for potential biases in practitioners' responses, as despite our efforts to  
18 control for this (e.g. by making the survey anonymous) it is possible that the impacts of PES that have not  
19 been measured objectively might be exaggerated or underplayed. The dummy variables associated with  
20 the spatial scale and public finance are included as there is evidence that national and publicly financed  
21 PES, which are often controlled by governments, are more likely to have competing environmental and  
22 social objectives (Wunder et al., 2008).

23 We assume a linear relationship and test four models:

$$O_E = \beta^E_M E_M + \beta^E_M E^E + \beta^E_N E^N + \beta^E_P E^P + \alpha^E + \epsilon \quad (1)$$

$$O_E = \beta^E_R E_R + \beta^E_P E_P + \beta^E_D E_D + \beta^E_M E^E + \beta^E_N E^N + \beta^E_P E^P + \alpha^E + \epsilon \quad (2)$$

$$O_S = \beta^S_M E_M + \beta^S_M M^S + \beta^S_N N^S + \beta^S_P P^S + \alpha^S + \epsilon \quad (3)$$

$$O_S = \beta^S_R E_R + \beta^S_P E_P + \beta^S_D E_D + \beta^S_M M^S + \beta^S_N N^S + \beta^S_P P^S + \alpha^S + \epsilon \quad (4)$$

24 where  $O_E$  and  $O_S$  are the dependent variables and represent environmental and social outcomes of the  
25 PES program, respectively;  $E_M$ ,  $E_R$ ,  $E_P$ , and  $E_D$ , are the explanatory variables and represent the indices for  
26 *multidimensional equity, recognition, procedure, and distribution*, respectively;  $\beta^i_M$ ,  $\beta^i_R$ ,  $\beta^i_P$ ,  $\beta^i_D$  ( $i=E, S$ ) are  
27 their respective regression coefficients;  $M$  is a dummy variable to control whether the PES conducted a  
28 study to measure ES change;  $N$  indicates if the PES was implemented on the national scale;  $P$  indicates  
29 whether the PES used public funding;  $\alpha^i$  is the intercept, and  $\epsilon^i$  is the random error term. Models (1) and

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<sup>5</sup> The alphas ( $\alpha$ ) for all the indices range from 0.67 to 0.88. As a rule of thumb alphas greater than 0.7 are considered good. For our purposes we consider that given the few items included in our groupings, an alpha of 0.67 is acceptable as having few items in a group can artificially lower the score (Ryff and Keyes, 1995).

1 (3) include the multi-dimensional equity indicator, while models (2) and (4) include the three dimensions  
2 of equity separately.

3  
4 **4. Results**

5 **4.1 Descriptive results**

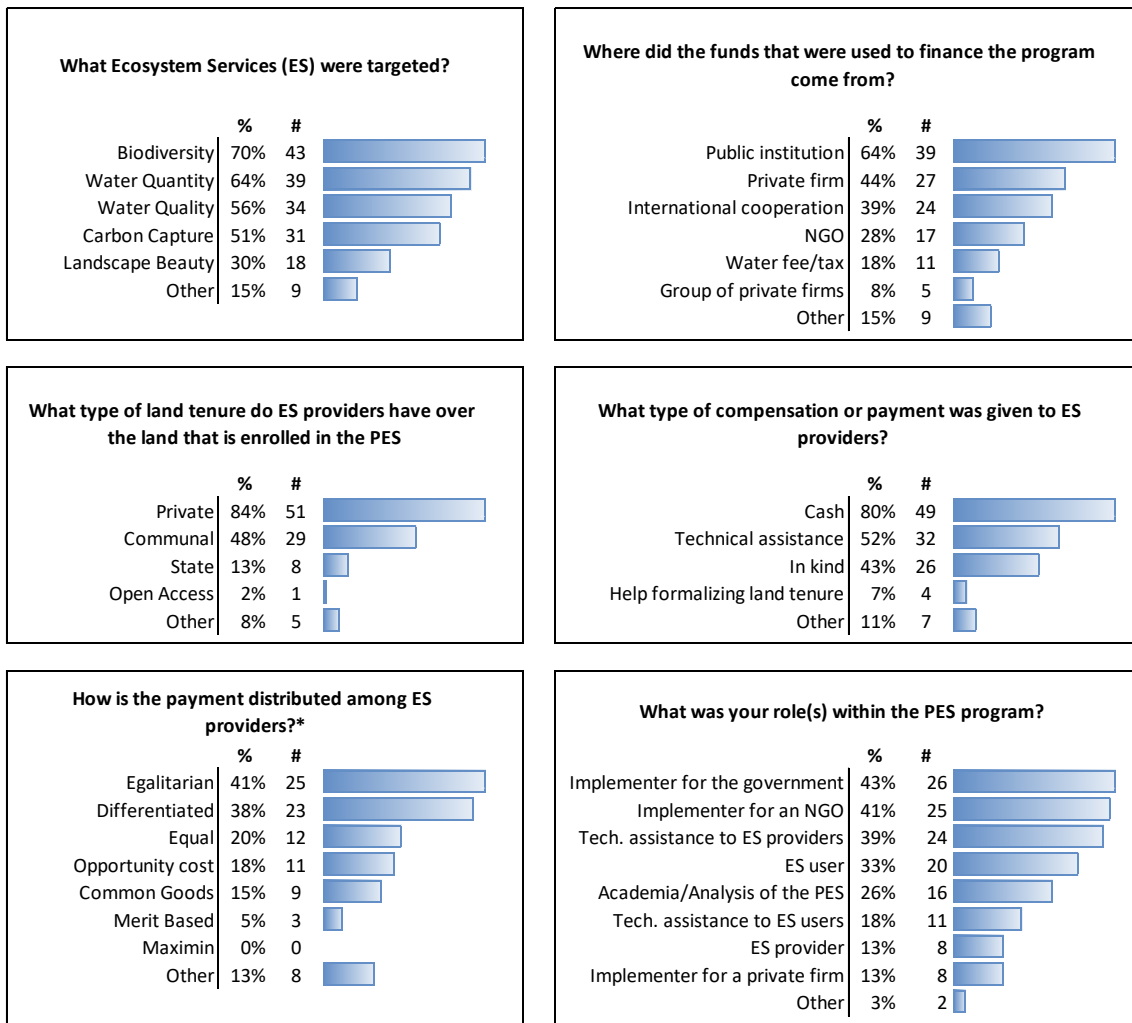
6 Figure 1 shows the location of the PES programs in our sample, their scale, and how the roles of  
7 respondents within the PES were distributed. As we describe in more detail in Figure 2, the PES programs  
8 in the sample represent a wide range of design characteristics (Figure 2).

9



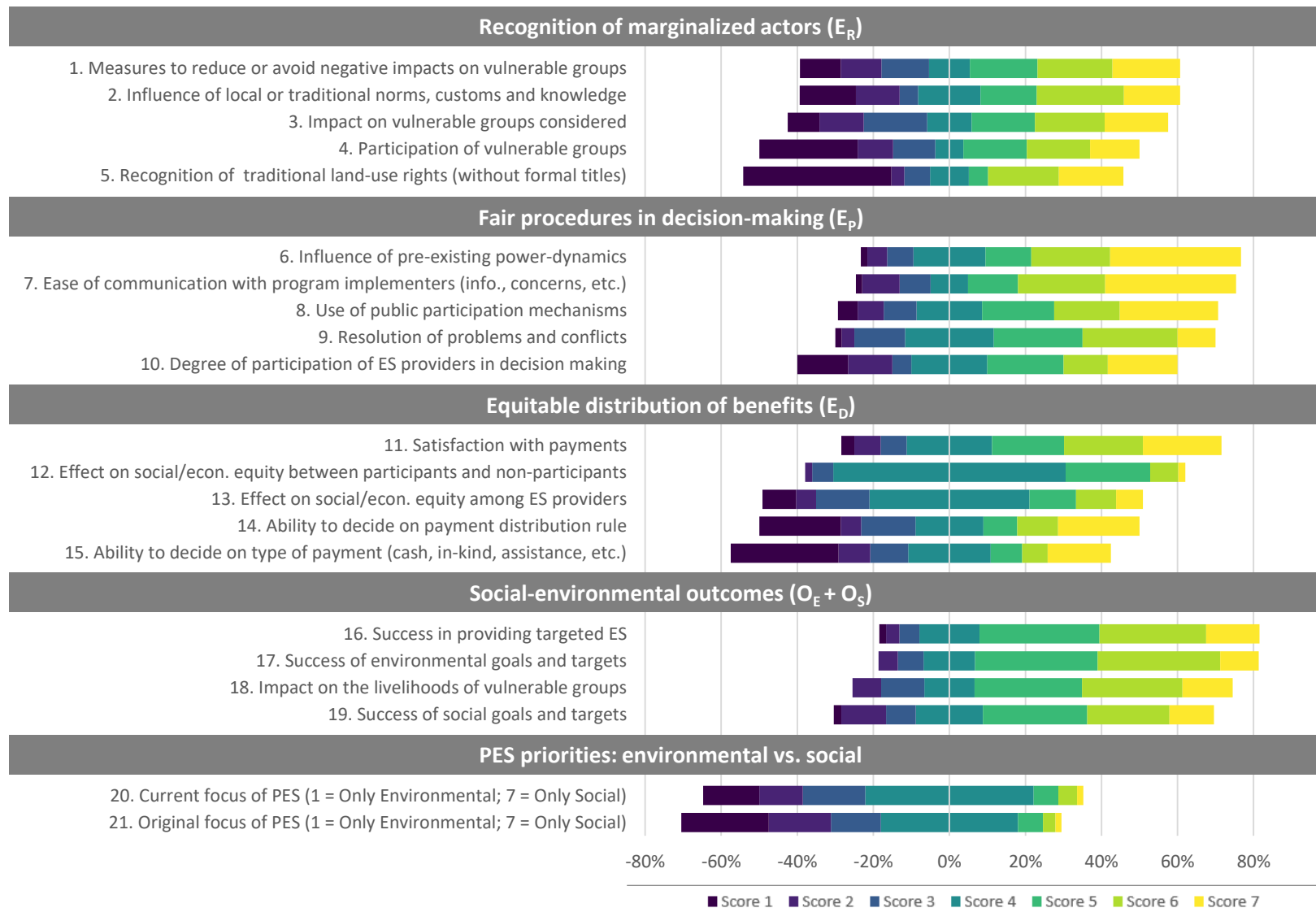
10

11 **Figure 1.** Location of the 45 sampled PES programs across 12 Latin American countries.



**Figure 2.** Characteristics of the sampled PES programs and practitioners' profiles. Responses were not mutually exclusive so percentages do not add to 100%. (\*) Definitions of the payment distribution rules were provided in the questionnaire and largely follow those used in Pascual et al. (2010)

We find that 80% of the PES programs in our sample target more than one ES, most frequently biodiversity and water quantity. About two thirds of the programs receive public funding, but private funding is used in 44% of the sampled PES programs. Although the majority of the PES programs (84%) target privately held land, close to half of them also include land under common property rights. 80% of the PES reward participants with cash and 43% offer in kind compensation. The way in which payments are distributed is quite heterogeneous, but the most common distribution rules were a fixed rate per land unit ("egalitarian") or a payment "differentiated" by the type of activity performed (e.g. restoration vs. conservation). The PES practitioners that responded to the survey held a variety of roles in the programs, most commonly as implementers for governments or NGOs.



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**Figure 3.** Diverging stacked bar chart showing survey scores for each seven-point Likert item. The width of the colored bars represents the frequency of the score (from 1 to 7). Low scores (red) represent low equity and high scores (green) represent high equity.

1 Figure 3 presents a stacked bar chart, used to synthesize the results of Likert scales. The figure  
2 shows the distribution of scores—from 1 to 7—for each item, where a higher score (in yellow) represents  
3 a more equitable outcome and a lower score (in dark blue) represents a less equitable outcome. Because  
4 the results associated with each surveyed item are centered on the midpoint of the scale (i.e. a score of 4  
5 out of 7), how far a bar is to the right or left indicates that most PES scored better or worse, respectively,  
6 on that equity indicator.

7 As other PES reviews have also found (e.g., Adhikari and Agrawal, 2013; Calvet-Mir et al., 2015),  
8 PES practitioners in our sample reported that environmental objectives are met more frequently than  
9 social ones, although overall they seem mostly satisfied with both types of outcomes given their  
10 responses. 75% of them gave a high score (above 4 points on the Likert scale) to their environmental goal  
11 success (question 16) compared to 12% who gave a low score (below 4 points on the Likert scale). Looking  
12 at the perceived success of the social goals (question 19), 61% of respondents perceived this was relatively  
13 high, vis-à-vis 22% who thought it was low.

14 These results suggest that in general PES practitioners have a rather optimistic outlook on the  
15 positive social-environmental impacts of PES. This can be compared to a more critical perspective by  
16 scholars. For example, Bond and Mayers (2010) find that while there is little evidence of PES doing actual  
17 harm to the poor, their ability to improve livelihoods is quite limited. Empirical studies on the  
18 environmental impacts of PES are also mixed (Alix-Garcia et al., 2015, 2012; Arriagada et al., 2012; Börner  
19 et al., 2017; Jayachandran et al., 2017; Pattanayak et al., 2010; Robalino and Pfaff, 2013). It is possible  
20 that the comparatively positive perception shared by practitioners may be partly attributable to a bias in  
21 their self-evaluations. However, given that there is nevertheless a high level of heterogeneity in the  
22 reported degree to which different PES programs met their goals, we believe that their responses provide  
23 valuable information on the relative degrees of success. Additionally, because practitioners are generally  
24 more embedded in and familiar with the local context than academics are, it is possible that they may be  
25 perceiving subtler positive impacts of PES that may go unnoticed or unmeasured by external assessments.  
26 One example of this is illustrated by the following quote, which identifies the positive impact that PES had  
27 not only on the farmers that were receiving payments, but also on the local municipal water agency:

28  
29 *“The main success has been to sensitize both rural and urban people to the importance of forest*  
30 *cover. [...] The other main success was to change the mind and structure of the municipal water*  
31 *agency, which previously was focused mainly on dams and tubes. [Before the PES program] they*  
32 *didn’t pay attention to the forests around their infrastructure.” (Respondent #1)*  
33

34 The results for question 20 (c.f. Figure 3) indicate that while approximately half of the PES  
35 programs in the sample prioritize environmental goals over social ones, the other half considers both to  
36 be equally important (score of 4). In fact, by comparing the answers of questions 20 and 21, we can see  
37 that over time PES programs tend to incorporate additional social objectives (Table 2). Although there are  
38 indications in the literature that publicly funded PES are more likely to allow social goals to be introduced

1 over time into the scope of the program (e.g., Wunder et al. 2008), our data shows that privately financed  
 2 PES are not immune to this phenomenon (Table 2).

3

4 **Table 2.** Shift in the type of objectives over time

	Publicly funded	Privately funded
More environmental objectives were added over time	10%	14%
More social objectives were added over time	33%	27%
No change	56%	59%
Total	100%	100%

5

6 The equity dimension whose indexed components routinely received relatively low scores was  
 7 the recognition of marginalized actors (E<sub>R</sub>). The relatively low score of this equity index highlights the risk  
 8 that negative impacts to marginalized actors may go under the radar during PES design. For example, one  
 9 survey respondent from Mexico noted some locals which were not eligible to receive payments through  
 10 their PES program were nevertheless still negatively affected by new restrictions imposed on forest use  
 11 in the region:

12

13 *“The PES program made it so that the local inhabitants could not access the PES area to obtain*  
 14 *forest resources such as firewood for their homes, forcing them to use other forest areas [...] and*  
 15 *increasing the effort (distance/load exertion) of the locals that were excluded from the program”*  
 16 *(Respondent #6)*

17

18 In line with much of the literature (see e.g., Pagiola et al. 2005), our data indicate that the  
 19 marginalized actors whose livelihoods are improved the most by participating in PES programs are poor  
 20 farmers who have formal titles over their land. On the other hand, farmers without formal land titles  
 21 appear to be much more frequently excluded from participation, often because there is a legal  
 22 requirement for formal ownership. In addition, the data aligns with the literature that another group of  
 23 actors for whom negative livelihood impacts are particularly common is landless workers, who rarely  
 24 receive direct benefits from PES, and whose employment may be threatened by ‘use-restricting’ PES  
 25 (Wunder, 2005).

26

27 Relative to the rest, the scores given to the questions concerning fair procedures in decision-  
 28 making (E<sub>P</sub>) were the highest on average. These questions covered procedural concerns in both the design  
 29 and implementation of the PES programs. Half of the respondents consider that the participation of ES  
 30 providers in the design of the PES program was high (scores above 4).

31

32 The literature on equity in PES has historically focused predominantly on distributional impacts  
 33 (Friedman et al., 2018). When we look at the equity in terms of the distribution of benefits, practitioners  
 overwhelmingly perceive that PES participants are satisfied with the type and level of payments they  
 receive, as illustrated by the following excerpt:

1  
2           *“Any compensation is welcomed by the [ecosystem service] suppliers who previously received*  
3           *nothing in exchange for conservation and are now being recognized for good environmental*  
4           *management of their land” (Respondent #46)*  
5

6       However, despite these high levels of satisfaction, in 20% of cases practitioners also note that the  
7       payments provide only a small complement to farmers’ income, in some cases not even fully covering  
8       opportunity costs. This seeming contradiction has been noted in the literature which posits alternative  
9       explanations for why PES beneficiaries may continue to participate in PES even when payments do not  
10      cover the opportunity costs, including cultural or intrinsic motivations (see e.g., Kosoy et al., 2007;  
11      Muradian et al., 2010; Van Hecken et al., 2017; Zabala et al., 2017). It is worth noting that the responses  
12      to questions 12 (effect on the socio-economic equity *between PES participants and non-participants*) and  
13      13 (effect on the socio-economic equity *among PES participants*) have considerably higher numbers of  
14      respondents giving scores of 4 (mid-point) than to any other question in the survey, 31% and 21%  
15      respectively. Based on the responses given by the practitioners, we interpret this as meaning that  
16      payments are often so modest as to have very little impact on income disparity. This sentiment was  
17      expressed by several PES practitioners:

18  
19           *“Poverty is the result of a broad economic and social disparity that cannot be solved through PES.*  
20           *It is also a situation that has been going on for many decades or centuries. [...] PES were not*  
21           *created to solve this problem.” (Respondent #1)*  
22

23           *“PES can help some of the poorest people live better [...] but it does nothing to solve their poverty*  
24           *or marginality.” (Respondent #16)*  
25

26           Finally, we find that decisions regarding how to distribute the payments (e.g., equal per capita,  
27           according to opportunity cost), and what type of compensation is received (e.g., cash, in-kind), are taken  
28           in a top-down manner with relatively little input from ES providers. Several respondents claimed that their  
29           hands were tied on this matter because the type of compensation and its distribution were decided  
30           independently, either by the program funders or legislators:

31  
32           *“It was a centralized decision in Parliament, using criteria from different sources” (Respondent #16)*  
33

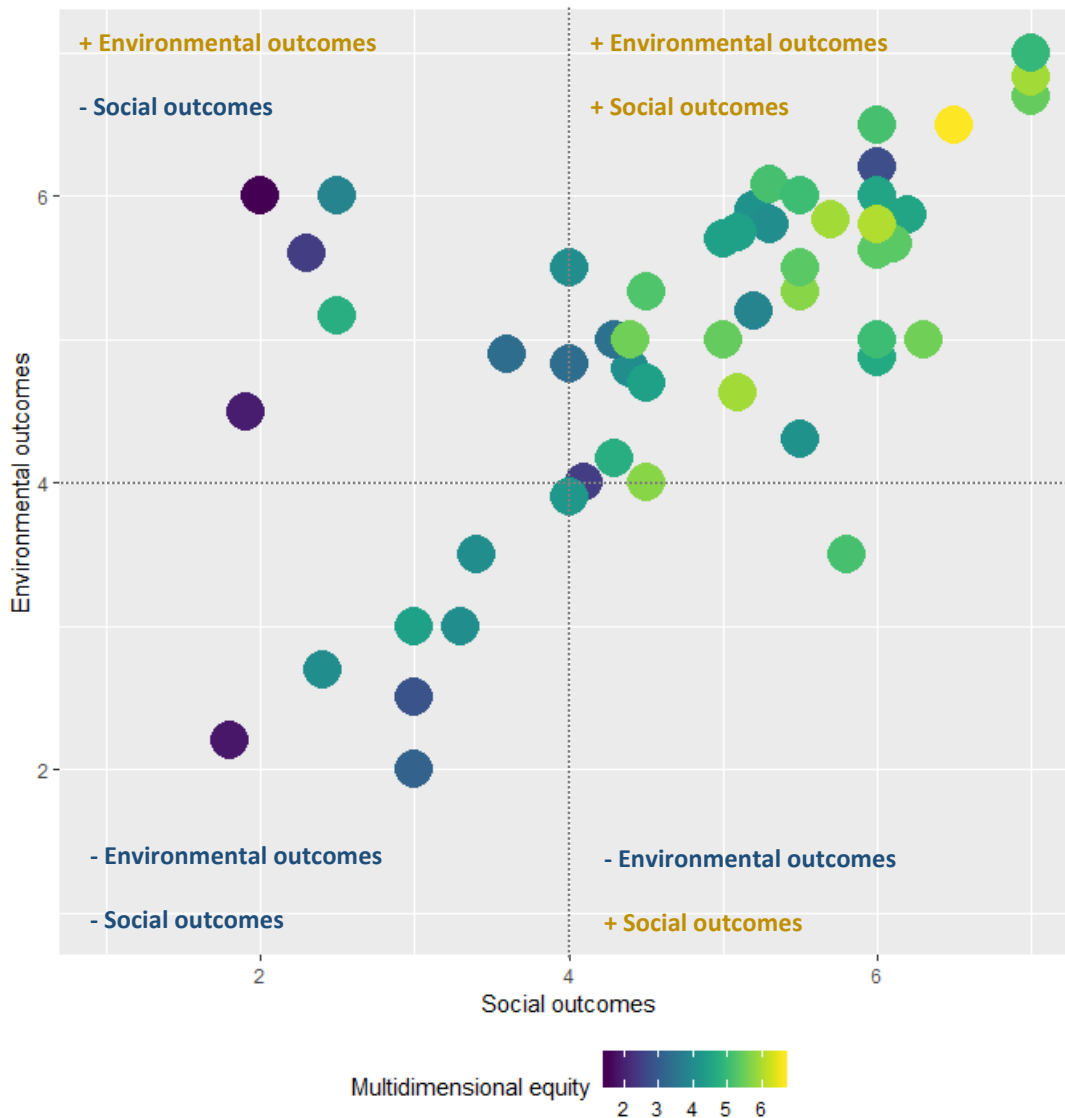
34           The cases that proved to be exceptions to this rule were generally those targeting communal lands such  
35           as the Mexican national PES (Nieratka et al., 2015), where ES providers were allowed to collectively decide  
36           how to distribute the compensation among community members.  
37

## 1 **4.2 Relationship between equity and social-environmental outcomes**

2 We now proceed to look at the relationship between equity considerations and social-environmental  
3 outcomes. Figure 4 plots each PES program in terms of the scores they were given by practitioners for  
4 environmental outcomes ( $O_E$ ) and social outcomes ( $O_S$ ). The color gradient represents the score of the  
5 global multidimensional equity ( $E_M$ ) index, which aggregates the scores associated with all the equity  
6 indicators. Yellower dots represent PES that practitioners perceived to be more equitable, and bluer dots  
7 represent less equitable PES. The scatterplot indicates that PES programs that are perceived to be more  
8 socially equitable overall also tended to receive higher social-environmental outcome scores (top-right  
9 quadrant).

10 In a handful of cases, PES programs that managed to score positively in terms of environmental  
11 outcomes were nevertheless perceived to score poorly on multidimensional equity and deliver low social  
12 outcomes (top-left quadrant). Looking closer at this cluster of PES programs we find that they tend to be  
13 characterized by being large in scale (national and regional scale programs from Costa Rica, Brazil, Ecuador  
14 and Paraguay), with only one out of eight in this quadrant being local in scale (from Argentina). When we  
15 look at cases in the lower-left quadrant (low environmental and social outcomes) we find that  
16 respondents describe factors associated with poor management of the program. However, each of these  
17 seemed to perform poorly for different reasons, including inter alia, efforts being directed at areas that  
18 were not at risk, funds being mismanaged, payments being too small to make a significant difference,  
19 perverse incentives leading to deforesting land that was not eligible, or a lack of technical expertise of PES  
20 implementers.





1  
 2 **Figure 4.** The PES schemes that practitioners perceive to have had the best social-environmental  
 3 outcomes (top-right) are also seen to be the most equitable overall.

4  
 5 Despite the heterogeneity of the sample, the data do not support the idea that an increased  
 6 concern for equity in PES design and implementation, as seen by practitioners themselves, is perceived to  
 7 be associated with inferior social-environmental outcomes, but quite the contrary. In order to control for  
 8 more nuanced aspects of such relationships, Table 3 presents the results of the OLS regressions specified  
 9 above, where the dependent variables are the indices for perceived environmental outcomes ( $O_E$ ) (models  
 10 1 and 2) and social outcomes ( $O_S$ ) (models 3 and 4).

11  
 12

1 **Table 3.** OLS regression results with equity as covariates and PES outcomes as dependent variables.

	Environmental outcomes ( $O_E$ )		Social outcomes ( $O_S$ )	
	(1)	(2)	(3)	(4)
Multidimensional equity ( $E_M$ )	0.41*** (0.13)		0.97*** (0.13)	
Recognition of marginalized actors ( $E_R$ )		0.08 (0.11)		0.32*** (0.11)
Fair procedures in decision-making ( $E_P$ )		0.005 (0.16)		0.27* (0.16)
Equitable distribution of benefits ( $E_D$ )		0.41** (0.19)		0.41** (0.19)
Dummy: ES change measured by study (M) (1=yes, 0=no)	0.55* (0.30)	0.51* (0.30)	-0.03 (0.30)	-0.05 (0.31)
Dummy: National Scale (N) (1=yes, 0=no)	0.51* (0.30)	0.56* (0.30)	0.34 (0.29)	0.36 (0.31)
Dummy: Received public funds (P) (1=yes, 0=no)	-0.27 (0.29)	-0.27 (0.31)	0.07 (0.30)	0.04 (0.32)
Constant	3.06*** (0.69)	2.79*** (0.74)	0.31 (0.70)	0.25 (0.76)
Observations	59	59	56	56
R <sup>2</sup>	0.28	0.31	0.54	0.54
Adjusted R <sup>2</sup>	0.23	0.23	0.51	0.48
Residual Std. Error	1.05 (df = 54)	1.05 (df = 52)	1.01 (df = 51)	1.04 (df = 49)
F Statistic	5.23*** (df = 4; 54)	3.86*** (df = 6; 52)	15.19*** (df = 4; 51)	9.62*** (df = 6; 49)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

2 Standard errors in parentheses. Of the original 61 responses two were dropped in all models due to  
 3 missing responses. In models 3 and 4 ("Social Outcomes") we dropped three additional observations  
 4 because respondents claimed the PES did not have social objectives and did not provide responses to the  
 5 social outcome questions.

6  
 7 When we model the effect of multidimensional equity on environmental outcomes and social  
 8 outcomes, models 1 and 3 respectively, we find a highly significant positive association in both cases. As  
 9 expected the size of the impact of multi-dimensional equity on social outcomes is larger than for  
 10 environmental outcomes. Models 2 and 4 look at equity more granularly by including the indices for the  
 11 three dimensions of equity as covariates. We find that practitioners perceive environmental outcomes as  
 12 being significantly and positively associated with an equitable distribution of benefits, whereas social  
 13 outcomes are seen as significantly and positively affected by all three equity dimensions (it should be  
 14 noted that the effect of fair procedures in decision-making is only weakly significant, which might be due  
 15 to the fact that all PES programs scored relatively highly on this equity dimension).

16 An interesting finding is that those PES programs where a study had been carried out to  
 17 empirically measure ES change are perceived as having better environmental outcomes by practitioners.  
 18 The result is somewhat comforting with respect to respondent bias: if practitioners gave biased answers,  
 19 we would have expected that particularly those PES programs where no study had been carried out to

1 objectively judge impacts would have been more likely to exaggerate positive outcomes. Yet this does not  
2 seem to be the case. Our results instead suggest that practitioners were cautious when reporting  
3 environmental impacts when these had not been measured. Surprisingly, results also indicate that PES  
4 programs operating at a national scale are perceived as being able to achieve their environmental  
5 objectives more often than PES working more locally. By contrast, social outcomes do not appear to be  
6 significantly affected by the scale. Receiving public funding does not have a significant effect on either  
7 type of perceived outcome either.

## 8 9 **5. Discussion**

10 Designing effective environmental instruments such as PES inevitably requires taking into account  
11 complex human-nature dynamics and their interactions. Ignoring them or assuming that PES can  
12 effectively tackle the environmental and social dimensions in isolation can often be counterproductive  
13 (Aldeia and Alves, 2019; Pascual et al., 2014). We find support for this in Figure 4, where there appears to  
14 be a strong positive correlation between how PES practitioners evaluate the success of the social  
15 outcomes of their programs and how they evaluate their environmental outcomes. One respondent  
16 illustrated the link between these two types of outcomes in the following way:

17  
18 *“The idea behind the PES was that strengthening the communities both with regards to*  
19 *governance over their territory as well as in productive matters would increase the sustainability*  
20 *of the enterprise. The social objectives would ensure that the communities would not become*  
21 *dependent on the payment and would instead improve their capabilities in order to manage the*  
22 *environmental resources in a sustainable manner. Thus, the social and ecological objectives are*  
23 *interconnected. We do not believe that the ecological objectives can be fulfilled in the long term*  
24 *without also fulfilling the social ones.” (Respondent #5)*  
25

26 This is reinforced by our finding that about half of the PES practitioners reported that the  
27 environmental and social goals of their PES programs were equally important (Figure 3, Line 20), which  
28 suggests that they are aware of the difficulty of achieving positive environmental outcomes without also  
29 considering their link to social concerns. Additionally, we observe a positive association between an  
30 equitable design and implementation of PES and the likelihood that they achieve their intended social-  
31 environmental goals (Table 3). Considering all these findings in tandem, we posit that it may be time to  
32 move past the debate regarding whether addressing non-environmental concerns in PES may or may not  
33 threaten their efficiency and effectiveness, and instead start more deliberately exploring the  
34 interrelations between equity, social and environmental concerns, and how they may all need to be  
35 addressed simultaneously to maximize the potential benefits of PES programs.

36 Our contribution begins with conceptualizing equity as distinct (yet connected) to the social  
37 outcomes of PES. This is because equity permeates the entire process of PES design and implementation,  
38 rather than being reflected by a single end state. In this sense, even programs that do not have explicit  
39 social goals will inevitably have recognition, procedural and distributional equity impacts.

1           However, our finding that making PES more equitable may provide positive synergies in the  
2 achievement of the programs' desired goals should not be taken to mean that trade-offs may not exist  
3 for individual measures of equity in certain situations. For example, one of the respondents warned about  
4 a loss of environmental effectiveness in their PES brought about by an overemphasis on social selection  
5 criteria of eligible participants:

6  
7           *"Initially the selection criteria were environmental, but each year additional social criteria are*  
8 *added, which has contributed to creating a situation in which the areas of the forest that are*  
9 *being protected are not always the most ideal."* (Respondent #17)

10  
11           Nevertheless, looking at equity more holistically across 15 different indicators, we observe that  
12 PES practitioners perceive that overall it contributes positively to the likelihood of achieving their social  
13 and environmental goals. Surprisingly, we find that the most discussed indicator of equity in the  
14 literature—i.e. the change in the Gini coefficient of income attributable to PES (covered by questions 12  
15 and 13)—was the one that received the most ambivalent responses in our survey (an average score of 4  
16 on the 7-point Likert scale). This suggests that practitioners in many cases do not perceive that PES is  
17 significantly changing the relative income of participants given the modest sums that ES providers receive.  
18 We therefore echo recent calls that encourage future studies on the equity impacts of different types of  
19 environmental policy to move beyond merely looking at distributive impacts (Friedman et al., 2018).

20           It is unlikely that a single explanation can fully account for the positive relationship between  
21 equity and social-environmental outcomes that we find. There is growing evidence that perceptions of  
22 equity interact with farmers' motivations, encouraging positive behavior when they feel like they have  
23 had a say in conservation decisions (Miller et al., 2012). In part, this is due to the fact that when PES  
24 practitioners avoid a one-size-fits-all design and instead engage local actors to find home-grown solutions,  
25 they are more likely to encourage stewardship values in ecosystem service providers (Chan et al., 2017).  
26 Additionally, tapping into the local knowledge held by communities may provide a rich source of  
27 information to enhance environmental impact, particularly when practitioners are unfamiliar with the  
28 local context, as mentioned by one of the respondents:

29  
30           *"Local knowledge was fundamental for the whole process, from choosing the land, tree seed*  
31 *varieties, nursery construction, planting, caring for seedlings, transplanting, sowing, and taking*  
32 *care of the land."* (Respondent #23)

33  
34           Another benefit of encouraging participation during the design stage may be a change in farmers'  
35 perceptions of the PES program itself. In this way, rather than being perceived as something foreign or  
36 coercive that is attempting to change how they manage their land (Reed, 2011), the PES program can  
37 instead help to build relationships of trust with PES implementers (and vice versa), while helping to change  
38 norms around conservation in a positive way (Martin et al., 2014a). Additionally, encouraging stakeholder  
39 participation from the start can promote PES participants taking co-ownership of the program (Cavalcanti

1 et al., 2013), which in turn can translate into lower costs of implementation (Cranford and Mourato, 2011),  
2 and may even help to crowd-in intrinsic positive environmental motivations (Ezzine-de-Blas et al., 2019).  
3 Through this psychological process, even PES participants who incur a financial loss because of the  
4 program may continue to participate as they obtain a ‘warm glow’ (Arriagada et al., 2015) by behaving  
5 consistently with their values and identities as stewards of nature (Chan et al., 2017). Furthermore,  
6 participants may be more likely to comply with the rules of a program that they consider to be fair (Alpizar  
7 et al., 2017; Jindal et al., 2013; Pascual et al., 2014, 2010).

8 In line with these ideas, a two-stage implementation of PES may be warranted (Cranford and  
9 Mourato 2011), including a pre-deployment stage in which practitioners ensure that prospective  
10 ecosystem service providers are socially and culturally aligned with the program, fostering a bottom-up,  
11 cooperative and reciprocal arrangement that moves beyond tapping solely into participants’ pecuniary  
12 motivations. We posit that successfully building up and harnessing this trust and social capital (Bond and  
13 Mayers, 2010; Van Noordwijk et al., 2007) are crucial steps towards ensuring the long-term success and  
14 sustainability of PES, in particular when these programs have only modest or intermittent funding (as is  
15 often the case in many developing countries). In this way, it is possible that a lot of what are currently  
16 considered to be transaction costs, such as holding meetings with stakeholders to inform them and elicit  
17 participation every step of the way, may need to be reconsidered as key factors that contribute to  
18 enhancing the effectiveness of PES.

19 A robust social-ecological perspective based on methodological pluralism is required to better  
20 understand the complex roles and impacts of equity in PES programs. Our approach taps into the as-of-  
21 yet rarely used experiences of PES practitioners to draw new insights. However, as with all methods, this  
22 approach carries certain limitations. While PES practitioners have a privileged bird’s-eye view of their PES  
23 program and therefore hold invaluable knowledge that would be otherwise hard to obtain, ES providers  
24 may have their own, subjective, perceptions regarding the equity effects of these programs. This is  
25 important to keep in mind, particularly given that PES practitioners are in a relatively more powerful  
26 position, which may inhibit their perception of certain equity impacts on participants.

27 Our methodological approach, which looks across more than 60 PES programs also required  
28 making certain assumptions, such as being unable to provide program-specific weights to different equity  
29 indicators, or portraying the relationship between equity and outcomes as rather linear. These  
30 assumptions may have flattened some context-dependent (historical, cultural, political or economic)  
31 nuances pertaining to each of the PES programs included in our analysis (Pascual et al. 2014), that may  
32 have been picked up by deeper (yet narrower) approaches that focus on a single (or a few) PES programs.  
33 It therefore follows that the findings presented here should be interpreted as complementary to, rather  
34 than a substitute for, more in-depth case studies based on qualitative approaches, as these can provide a  
35 higher resolution by looking at PES programs individually, and are thus better suited to analyze context-  
36 specific concerns (e.g. Corbera et al., 2007b; Büscher, 2012; Gross-Camp et al., 2012; Martin et al., 2014b;  
37 Porrás and Blackmore, 2014; Rodríguez de Francisco and Budds, 2015; Bétrisey et al., 2018).

38

## 1    **6. Conclusions**

2    The goal of this paper is to explore the relationship between an equitable design and implementation of  
3    more than 60 Latin American PES programs and their social-environmental outcomes, from the  
4    perspective of PES practitioners. The study was motivated by the conflicting evidence in the PES literature  
5    of both potential tradeoffs (e.g., Halpern et al., 2013) and synergies (e.g. Miller et al., 2012) between social  
6    equity and conservation outcomes. A likely reason contributing to the lack of consensus in the literature  
7    and the predominance of conceptual and theoretical (rather than empirical) approaches is the dearth of  
8    scientific evidence on PES impacts. Evaluators rarely have access to baseline data, control areas or  
9    randomized designs (Salzman et al., 2018), rendering it quite difficult to robustly assess PES empirically.  
10    This spottiness of available quantitative information and the growing need to systematically collect  
11    environmental and socio-economic data has recurrently been noted by recent PES reviews (Wunder et  
12    al., 2008; Pattanayak et al., 2010; Martin-Ortega et al., 2013; Hejnowicz et al., 2014; Naeem et al., 2015;  
13    Börner et al., 2017).

14            In order to remedy this lack of data, our analysis taps into the on-the-ground experience of PES  
15    practitioners, whose perspectives have not been sufficiently taken into account in the literature. By  
16    looking across 15 different indicators for social equity, we find that the PES programs that explicitly  
17    recognize marginalized actors, ensure fair procedures in decision-making, and guarantee an equitable  
18    distribution of benefits are more likely to fulfill their social-environmental goals. Although our results  
19    point to the fact that achieving environmental goals is more closely tied with distributive equity  
20    considerations (i.e. satisfaction with payments, impact on income distribution, and the ability to decide  
21    the type of compensation and how to distribute them), we find that achieving social goals is mostly tied  
22    to all three dimensions of social equity (recognition, procedure, and distribution). With close to half of the  
23    PES practitioners stating that environmental and social goals were equally important for their PES  
24    programs, we put forward that all dimensions of equity should be carefully considered when designing  
25    and implementing PES. We hope that further examination of this debate leads to an increasingly rich and  
26    nuanced understanding of these interactions and tests the findings of this study: that PES programs should  
27    not just strive to be equitable because it is the right thing to do, but also because they may perform better  
28    for it.

29

## 7. References

- Adhikari, B., Agrawal, A., 2013. Understanding the social and ecological outcomes of PES projects: A review and an analysis. *Conservation and Society* 11, 359. <https://doi.org/10.4103/0972-4923.125748>
- Aldeia, J., Alves, F., 2019. Against the Environment. *Problems in Society/Nature Relations*. *Front. Sociol.* 4, 29. <https://doi.org/10.3389/fsoc.2019.00029>
- Alix-Garcia, J.M., Shapiro, E.N., Sims, K.R., 2012. Forest conservation and slippage: Evidence from Mexico's national payments for ecosystem services program. *Land Economics* 88, 613–638.
- Alix-Garcia, J.M., Sims, K.R.E., Yañez-Pagans, P., 2015. Only One Tree from Each Seed? Environmental Effectiveness and Poverty Alleviation in Mexico's Payments for Ecosystem Services Program. *American Economic Journal: Economic Policy* 7, 1–40. <https://doi.org/10.1257/pol.20130139>
- Alpizar, F., Nordén, A., Pfaff, A., Robalino, J., 2017. Unintended Effects of Targeting an Environmental Rebate. *Environmental and Resource Economics* 67, 181–202. <https://doi.org/10.1007/s10640-015-9981-2>
- Andeltová, L., Catacutan, D.C., Wünscher, T., Holm-Müller, K., 2019. Gender aspects in action- and outcome-based payments for ecosystem services—A tree planting field trial in Kenya. *Ecosystem Services* 35, 13–22. <https://doi.org/10.1016/j.ecoser.2018.10.004>
- Arriagada, R.A., Ferraro, P.J., Sills, E.O., Pattanayak, S.K., Cordero-Sancho, S., 2012. Do payments for environmental services affect forest cover? A farm-level evaluation from Costa Rica. *Land Economics* 88, 382–399.
- Arriagada, R.A., Sills, E.O., Ferraro, P.J., Pattanayak, S.K., 2015. Do Payments Pay Off? Evidence from Participation in Costa Rica's PES Program. *PLOS ONE* 10, e0131544. <https://doi.org/10.1371/journal.pone.0131544>
- Barnaud, C., Antona, M., 2014. Deconstructing ecosystem services: Uncertainties and controversies around a socially constructed concept. *Geoforum* 56, 113–123. <https://doi.org/10.1016/j.geoforum.2014.07.003>
- Benra, F., Nahuelhual, L., 2019. A trilogy of inequalities: Land ownership, forest cover and ecosystem services distribution. *Land Use Policy* 82, 247–257. <https://doi.org/10.1016/j.landusepol.2018.12.020>
- Bétrisey, F., Bastiaensen, J., Mager, C., 2018. Payments for ecosystem services and social justice: Using recognition theories to assess the Bolivian Acuerdos Recíprocos por el Agua. *Geoforum* 92, 134–143. <https://doi.org/10.1016/j.geoforum.2018.04.001>
- Blundo-Canto, G., Bax, V., Quintero, M., Cruz-García, G.S., Groeneveld, R.A., Perez-Marulanda, L., 2018. The Different Dimensions of Livelihood Impacts of Payments for Environmental Services (PES) Schemes: A Systematic Review. *Ecological Economics* 149, 160–183. <https://doi.org/10.1016/j.ecolecon.2018.03.011>
- Bond, I., Mayers, J., 2010. Fair deals for watershed services: lessons from a multi-country action-learning project. International Institute for Environment and Development, London.
- Börner, J., Baylis, K., Corbera, E., Ezzine-de-Blas, D., Honey-Rosés, J., Persson, U.M., Wunder, S., 2017. The Effectiveness of Payments for Environmental Services. *World Development*. <https://doi.org/10.1016/j.worlddev.2017.03.020>
- Bremer, L.L., Farley, K.A., Lopez-Carr, D., 2014. What factors influence participation in payment for ecosystem services programs? An evaluation of Ecuador's SocioPáramo program. *Land Use Policy* 36, 122–133. <https://doi.org/10.1016/j.landusepol.2013.08.002>
- Brouwer, R., Tesfaye, A., Pauw, P., 2011. Meta-analysis of institutional-economic factors explaining the environmental performance of payments for watershed services. *Environmental Conservation* 38, 380–392. <https://doi.org/10.1017/S0376892911000543>
- Büscher, B., 2012. Payments for ecosystem services as neoliberal conservation: (Re)interpreting evidence from the Maloti-Drakensberg, South Africa. *Conservation and Society* 10, 29. <https://doi.org/10.4103/0972-4923.92190>
- Calvet-Mir, L., Corbera, E., Martin, A., Fisher, J., Gross-Camp, N., 2015. Payments for ecosystem services in the tropics: a closer look at effectiveness and equity. *Current Opinion in Environmental Sustainability* 14, 150–162. <https://doi.org/10.1016/j.cosust.2015.06.001>
- Carifio, J., Perla, R., 2008. Resolving the 50-year debate around using and misusing Likert scales. *Medical Education* 42, 1150–1152. <https://doi.org/10.1111/j.1365-2923.2008.03172.x>
- Carifio, J., Perla, R.J., 2007. Ten Common Misunderstandings, Misconceptions, Persistent Myths and Urban Legends about Likert Scales and Likert Response Formats and their Antidotes. *Journal of Social Sciences* 3, 106–116. <https://doi.org/10.3844/jssp.2007.106.116>
- Cavalcanti, C., Engel, S., Leibbrandt, A., 2013. Social integration, participation, and community resource management. *Journal of Environmental Economics and Management* 65, 262–276. <https://doi.org/10.1016/j.jeem.2012.09.004>
- Chan, K.M.A., Anderson, E., Chapman, M., Jespersen, K., Olmsted, P., 2017. Payments for Ecosystem Services: Rife With Problems and Potential—For Transformation Towards Sustainability. *Ecological Economics* 140, 110–122. <https://doi.org/10.1016/j.ecolecon.2017.04.029>
- Cleaver, F., 2012. *Development through bricolage: rethinking institutions for natural resource management*. Routledge, London.
- Cleaver, F., Whaley, L., 2018. Understanding process, power, and meaning in adaptive governance: a critical institutional reading. *E&S* 23, art49. <https://doi.org/10.5751/ES-10212-230249>
- Corbera, E., Brown, K., Adger, W.N., 2007a. The equity and legitimacy of markets for ecosystem services. *Development and Change* 38, 587–613.

- 1 Corbera, E., Kosoy, N., Martínez Tuna, M., 2007b. Equity implications of marketing ecosystem services in protected  
2 areas and rural communities: Case studies from Meso-America. *Global Environmental Change* 17, 365–  
3 380. <https://doi.org/10.1016/j.gloenvcha.2006.12.005>
- 4 Corbera, E., Pascual, U., 2012. Ecosystem services: heed social goals. *Science* 335, 655–656.
- 5 Cranford, M., Mourato, S., 2011. Community conservation and a two-stage approach to payments for ecosystem  
6 services. *Ecological Economics* 71, 89–98. <https://doi.org/10.1016/j.ecolecon.2011.08.007>
- 7 Denham, D., 2017. Community Forest Owners Evaluate a Decade of Payments for Ecosystem Services in the  
8 Mexican Cloud Forest: The Importance of Attention to Indigenous Sovereignty in Conservation. *Society &*  
9 *Natural Resources* 30, 1064–1079. <https://doi.org/10.1080/08941920.2017.1295495>
- 10 Engel, S., 2016. The Devil in the Detail: A Practical Guide on Designing Payments for Environmental Services.  
11 *International Review of Environmental and Resource Economics* /9, 131–177.  
12 <https://doi.org/10.1561/101.00000076>
- 13 Engel, S., Ibañez, A.M., 2007. Displacement Due to Violence in Colombia: A Household-Level Analysis. *Economic*  
14 *Development and Cultural Change* 55, 335–365. <https://doi.org/10.1086/508712>
- 15 Engel, S., Pagiola, S., Wunder, S., 2008. Designing payments for environmental services in theory and practice: An  
16 overview of the issues. *Ecological Economics* 65, 663–674.  
17 <https://doi.org/10.1016/j.ecolecon.2008.03.011>
- 18 Ezzine-de-Blas, D., Corbera, E., Lapeyre, R., 2019. Payments for Environmental Services and Motivation Crowding:  
19 Towards a Conceptual Framework. *Ecological Economics* 156, 434–443.  
20 <https://doi.org/10.1016/j.ecolecon.2018.07.026>
- 21 Friedman, R.S., Law, E.A., Bennett, N.J., Ives, C.D., Thorn, J.P.R., Wilson, K.A., 2018. How just and just how? A  
22 systematic review of social equity in conservation research. *Environmental Research Letters* 13, 053001.  
23 <https://doi.org/10.1088/1748-9326/aabcde>
- 24 Grieg-Gran, M., Porras, I., Wunder, S., 2005. How can market mechanisms for forest environmental services help  
25 the poor? Preliminary lessons from Latin America. *World Development* 33, 1511–1527.  
26 <https://doi.org/10.1016/j.worlddev.2005.05.002>
- 27 Grima, N., Singh, S.J., Smetschka, B., Ringhofer, L., 2016. Payment for Ecosystem Services (PES) in Latin America:  
28 Analysing the performance of 40 case studies. *Ecosystem Services* 17, 24–32.  
29 <https://doi.org/10.1016/j.ecoser.2015.11.010>
- 30 Gross-Camp, N.D., Martin, A., McGuire, S., Kebede, B., Munyarukaza, J., 2012. Payments for ecosystem services in  
31 an African protected area: exploring issues of legitimacy, fairness, equity and effectiveness. *Oryx* 46, 24–  
32 33. <https://doi.org/10.1017/S0030605311001372>
- 33 Halpern, B.S., Klein, C.J., Brown, C.J., Beger, M., Grantham, H.S., Mangubhai, S., Ruckelshaus, M., Tulloch, V.J.,  
34 Watts, M., White, C., Possingham, H.P., 2013. Achieving the triple bottom line in the face of inherent  
35 trade-offs among social equity, economic return, and conservation. *Proceedings of the National Academy*  
36 *of Sciences* 110, 6229–6234. <https://doi.org/10.1073/pnas.1217689110>
- 37 Hausknot, D., Grima, N., Singh, S.J., 2017. The political dimensions of Payments for Ecosystem Services (PES):  
38 Cascade or stairway? *Ecological Economics* 131, 109–118. <https://doi.org/10.1016/j.ecolecon.2016.08.024>
- 39 Hejnovic, A.P., Raffaelli, D.G., Rudd, M.A., White, P.C.L., 2014. Evaluating the outcomes of payments for ecosystem  
40 services programmes using a capital asset framework. *Ecosystem Services* 9, 83–97.  
41 <https://doi.org/10.1016/j.ecoser.2014.05.001>
- 42 Ishihara, H., Pascual, U., Hodge, I., 2017. Dancing With Storks: The Role of Power Relations in Payments for  
43 Ecosystem Services. *Ecological Economics* 139, 45–54. <https://doi.org/10.1016/j.ecolecon.2017.04.007>
- 44 Jayachandran, S., de Laat, J., Lambin, E.F., Stanton, C.Y., Audy, R., Thomas, N.E., 2017. Cash for carbon: A  
45 randomized trial of payments for ecosystem services to reduce deforestation. *Science* 357, 267–273.  
46 <https://doi.org/10.1126/science.aan0568>
- 47 Jindal, R., Kerr, J.M., Ferraro, P.J., Swallow, B.M., 2013. Social dimensions of procurement auctions for  
48 environmental service contracts: Evaluating tradeoffs between cost-effectiveness and participation by the  
49 poor in rural Tanzania. *Land Use Policy* 31, 71–80. <https://doi.org/10.1016/j.landusepol.2011.11.008>
- 50 Kinzig, A.P., Perrings, C., Chapin, F.S., Polasky, S., Smith, V.K., Tilman, D., Turner, B.L., others, 2011. Paying for  
51 ecosystem services—promise and peril. *Science* 334, 603–604.
- 52 Kolinjivadi, V., 2019. Avoiding dualisms in ecological economics: Towards a dialectically-informed understanding of  
53 co-produced socio-natures. *Ecological Economics* 163, 32–41.  
54 <https://doi.org/10.1016/j.ecolecon.2019.05.004>
- 55 Kosoy, N., Martínez-Tuna, M., Muradian, R., Martínez-Alier, J., 2007. Payments for environmental services in  
56 watersheds: Insights from a comparative study of three cases in Central America. *Ecological Economics* 61,  
57 446–455. <https://doi.org/10.1016/j.ecolecon.2006.03.016>
- 58 Leimona, B., van Noordwijk, M., de Groot, R., Leemans, R., 2015. Fairly efficient, efficiently fair: Lessons from  
59 designing and testing payment schemes for ecosystem services in Asia. *Ecosystem Services* 12, 16–28.  
60 <https://doi.org/10.1016/j.ecoser.2014.12.012>
- 61 Liu, Z., Kontoleon, A., 2018. Meta-Analysis of Livelihood Impacts of Payments for Environmental Services  
62 Programmes in Developing Countries. *Ecological Economics* 149, 48–61.  
63 <https://doi.org/10.1016/j.ecolecon.2018.02.008>



- 1 Lliso, B., Pascual, U., Engel, S., Mariel, P., 2020. Payments for ecosystem services or collective stewardship of  
2 Mother Earth? Applying deliberative valuation in an indigenous community in Colombia. *Ecological*  
3 *Economics*. <https://doi.org/10.1016/j.ecolecon.2019.106499>
- 4 Locatelli, B., Vignola, R., 2009. Managing watershed services of tropical forests and plantations: Can meta-analyses  
5 help? *Forest Ecology and Management* 258, 1864–1870. <https://doi.org/10.1016/j.foreco.2009.01.015>
- 6 Martin, A., Coolsaet, B., Corbera, E., Dawson, N.M., Fraser, J.A., Lehmann, I., Rodriguez, I., 2016. Justice and  
7 conservation: The need to incorporate recognition. *Biological Conservation* 197, 254–261.  
8 <https://doi.org/10.1016/j.biocon.2016.03.021>
- 9 Martin, A., Gross-Camp, N., Kebede, B., McGuire, S., 2014a. Measuring effectiveness, efficiency and equity in an  
10 experimental Payments for Ecosystem Services trial. *Global Environmental Change* 28, 216–226.  
11 <https://doi.org/10.1016/j.gloenvcha.2014.07.003>
- 12 Martin, A., Gross-Camp, N., Kebede, B., McGuire, S., Munyarukaza, J., 2014b. Whose environmental justice?  
13 Exploring local and global perspectives in a payments for ecosystem services scheme in Rwanda.  
14 *Geoforum* 54, 167–177. <https://doi.org/10.1016/j.geoforum.2013.02.006>
- 15 Martin-Ortega, J., Ojea, E., Roux, C., 2013. Payments for Water Ecosystem Services in Latin America: A literature  
16 review and conceptual model. *Ecosystem Services* 6, 122–132.  
17 <https://doi.org/10.1016/j.ecoser.2013.09.008>
- 18 Martin-Ortega, J., Ojea, E., Roux, C., 2012. Payments for Water Ecosystem Services in Latin America: Evidence from  
19 Reported Experience.
- 20 McDermott, M., Mahanty, S., Schreckenber, K., 2013. Examining equity: A multidimensional framework for  
21 assessing equity in payments for ecosystem services. *Environmental Science & Policy* 33, 416–427.  
22 <https://doi.org/10.1016/j.envsci.2012.10.006>
- 23 Miller, B.W., Caplow, S.C., Leslie, P.W., 2012. Feedbacks between Conservation and Social-Ecological Systems:  
24 Conservation and Social-Ecological Systems. *Conservation Biology* 26, 218–227.  
25 <https://doi.org/10.1111/j.1523-1739.2012.01823.x>
- 26 Muradian, R., Arsel, M., Pellegrini, L., Adaman, F., Aguilar, B., Agarwal, B., Corbera, E., Ezzine de Blas, D., Farley, J.,  
27 Froger, G., others, 2013. Payments for ecosystem services and the fatal attraction of win-win solutions.  
28 *Conservation letters* 6, 274–279.
- 29 Muradian, R., Corbera, E., Pascual, U., Kosoy, N., May, P.H., 2010. Reconciling theory and practice: An alternative  
30 conceptual framework for understanding payments for environmental services. *Ecological Economics* 69,  
31 1202–1208. <https://doi.org/10.1016/j.ecolecon.2009.11.006>
- 32 Mustalahti, I., Rakotonarivo, O.S., 2014. REDD+ and Empowered Deliberative Democracy: Learning from Tanzania.  
33 *World Development* 59, 199–211. <https://doi.org/10.1016/j.worlddev.2014.01.022>
- 34 Naeem, S., Ingram, J.C., Varga, A., Agardy, T., Barten, P., Bennett, G., Bloomgarden, E., Bremer, L.L., Burkill, P.,  
35 Cattau, M., Ching, C., Colby, M., Cook, D.C., Costanza, R., DeClerck, F., Freund, C., Gartner, T., Goldman-  
36 Benner, R., Gunderson, J., Jarrett, D., Kinzig, A.P., Kiss, A., Koontz, A., Kumar, P., Lasky, J.R., Masozera, M.,  
37 Meyers, D., Milano, F., Naughton-Treves, L., Nichols, E., Olander, L., Olmsted, P., Perge, E., Perrings, C.,  
38 Polasky, S., Potent, J., Prager, C., Quétier, F., Redford, K., Saterson, K., Thoumi, G., Vargas, M.T.,  
39 Vickerman, S., Weisser, W., Wilkie, D., Wunder, S., 2015. Get the science right when paying for nature's  
40 services. *Science* 347, 1206–1207. <https://doi.org/10.1126/science.aaa1403>
- 41 Namirembe, S., Leimona, B., van Noordwijk, M., Minang, P., 2017. Co-investment in ecosystem services: global  
42 lessons from payment and incentive schemes. Co-Investment in Ecosystem Services: Global Lessons from  
43 Payment and Incentive Schemes. World Agroforestry Centre, Nairobi. [https://www.worldagroforestry.org/sites/default/files/u884/Ch1\\_IntroCoinvest\\_ebook.pdf](https://www.worldagroforestry.org/sites/default/files/u884/Ch1_IntroCoinvest_ebook.pdf).
- 44 Nieratka, L., Bray, D., Mozumder, P., 2015. Can Payments for Environmental Services Strengthen Social Capital,  
45 Encourage Distributional Equity, and Reduce Poverty? *Conservation and Society* 13, 345.  
46 <https://doi.org/10.4103/0972-4923.179880>
- 47 Pagiola, S., Arcenas, A., Platais, G., 2005. Can Payments for Environmental Services Help Reduce Poverty? An  
48 Exploration of the Issues and the Evidence to Date from Latin America. *World Development* 33, 237–253.  
49 <https://doi.org/10.1016/j.worlddev.2004.07.011>
- 50 Pascual, U., Muradian, R., Rodríguez, L.C., Duraiappah, A., 2010. Exploring the links between equity and efficiency in  
51 payments for environmental services: A conceptual approach. *Ecological Economics* 69, 1237–1244.  
52 <https://doi.org/10.1016/j.ecolecon.2009.11.004>
- 53 Pascual, U., Phelps, J., Garmendia, E., Brown, K., Corbera, E., Martin, A., Gomez-Baggethun, E., Muradian, R., 2014.  
54 Social Equity Matters in Payments for Ecosystem Services. *BioScience* 64, 1027–1036.  
55 <https://doi.org/10.1093/biosci/biu146>
- 56 Pattanayak, S.K., Wunder, S., Ferraro, P.J., 2010. Show Me the Money: Do Payments Supply Environmental Services  
57 in Developing Countries? *Review of Environmental Economics and Policy* 4, 254–274.  
58 <https://doi.org/10.1093/reqp/req006>
- 59 Persson, M., Alpizar, F., 2013. Conditional Cash Transfers and Payments for Environmental Services—A Conceptual  
60 Framework for Explaining and Judging Differences in Outcomes. *World Development* 43, 124–137.  
61 <https://doi.org/10.1016/j.worlddev.2012.10.006>
- 62

- 1 Porras, I., Blackmore, E., 2014. Innovations for equity and inclusion in smallholder payments for ecosystem services  
2 - IIED Publications Database [WWW Document]. URL <http://pubs.iied.org/16579IIED.html> (accessed  
3 5.18.16).
- 4 Reed, P., 2011. REDD+ and the Indigenous Question: A Case Study from Ecuador. *Forests* 2, 525–549.  
5 <https://doi.org/10.3390/f2020525>
- 6 Ren, L., Li, J., Li, C., Li, S., Daily, G., 2018. Does Poverty Matter in Payment for Ecosystem Services Program?  
7 Participation in the New Stage Sloping Land Conversion Program. *Sustainability* 10, 1888.  
8 <https://doi.org/10.3390/su10061888>
- 9 Robalino, J., Pfaff, A., 2013. Ecopayments and Deforestation in Costa Rica: A Nationwide Analysis of PSA's Initial  
10 Years. *Land Economics* 89, 432–448. <https://doi.org/10.3368/le.89.3.432>
- 11 Rodríguez de Francisco, J.C., Budds, J., 2015. Payments for environmental services and control over conservation of  
12 natural resources: The role of public and private sectors in the conservation of the Nima watershed,  
13 Colombia. *Ecological Economics* 117, 295–302. <https://doi.org/10.1016/j.ecolecon.2014.05.003>
- 14 Rodríguez, I., Inturias, M., Frank, V., Robledo, J., Sarti, C., Borel, R., 2019. Conflictividad socioambiental en  
15 Latinoamérica: Aportes de la transformación de conflictos socioambientales a la transformación ecológica.  
16 (No. 3). Ciudad de México : Friedrich-Ebert-Stiftung.
- 17 Ryff, C.D., Keyes, C.L.M., 1995. The Structure of Psychological Well-Being Revisited 9.
- 18 Salzman, J., Bennett, G., Carroll, N., Goldstein, A., Jenkins, M., 2018. The global status and trends of Payments for  
19 Ecosystem Services. *Nature Sustainability* 1, 136–144. <https://doi.org/10.1038/s41893-018-0033-0>
- 20 Santos de Lima, L., Ramos Barón, P.A., Villamayor-Tomas, S., Krueger, T., 2019. Will PES Schemes Survive in the  
21 Long-term Without Evidence of Their Effectiveness? Exploring Four Water-related Cases in Colombia.  
22 *Ecological Economics* 156, 211–223. <https://doi.org/10.1016/j.ecolecon.2018.09.005>
- 23 Schomers, S., Matzdorf, B., 2013. Payments for ecosystem services: A review and comparison of developing and  
24 industrialized countries. *Ecosystem Services* 6, 16–30. <https://doi.org/10.1016/j.ecoser.2013.01.002>
- 25 Spangenberg, J.H., von Haaren, C., Settele, J., 2014. The ecosystem service cascade: Further developing the  
26 metaphor. Integrating societal processes to accommodate social processes and planning, and the case of  
27 bioenergy. *Ecological Economics* 104, 22–32. <https://doi.org/10.1016/j.ecolecon.2014.04.025>
- 28 Sullivan, G.M., Artino, A.R., 2013. Analyzing and Interpreting Data From Likert-Type Scales. *Journal of Graduate  
29 Medical Education* 5, 541–542. <https://doi.org/10.4300/JGME-5-4-18>
- 30 Tadaki, M., Allen, W., Sinner, J., 2015. Revealing ecological processes or imposing social rationalities? The politics of  
31 bounding and measuring ecosystem services. *Ecological Economics* 118, 168–176.  
32 <https://doi.org/10.1016/j.ecolecon.2015.07.015>
- 33 Van Hecken, G., Bastiaensen, J., Windey, C., 2015. Towards a power-sensitive and socially-informed analysis of  
34 payments for ecosystem services (PES): Addressing the gaps in the current debate. *Ecological Economics*  
35 120, 117–125. <https://doi.org/10.1016/j.ecolecon.2015.10.012>
- 36 Van Hecken, G., Merlet, P., Lindtner, M., Bastiaensen, J., 2017. Can Financial Incentives Change Farmers'  
37 Motivations? An Agrarian System Approach to Development Pathways at the Nicaraguan Agricultural  
38 Frontier. *Ecological Economics*. <https://doi.org/10.1016/j.ecolecon.2016.12.030>
- 39 Van Noordwijk, M., Leimona, B., Emerton, L., Tomich, T.P., Velarde, S., Kallesoe, M., Sekher, M., Swallow, B., 2007.  
40 Criteria and indicators for environmental service compensation and reward mechanisms: realistic,  
41 voluntary, conditional and pro-poor CES Scoping Study Issue Paper no. 2. ICRAF Working Paper no. 37.  
42 Nairobi, Kenya: World Agroforestry Centre.
- 43 Wegner, G.I., 2016. Payments for ecosystem services (PES): a flexible, participatory, and integrated approach for  
44 improved conservation and equity outcomes. *Environment, Development and Sustainability* 18, 617–644.  
45 <https://doi.org/10.1007/s10668-015-9673-7>
- 46 Wunder, S., 2005. Payments for environmental services: some nuts and bolts. Center for International Forestry  
47 Research (CIFOR).
- 48 Wunder, S., Brouwer, R., Engel, S., Ezzine-de-Blas, D., Muradian, R., Pascual, U., Pinto, R., 2018. From principles to  
49 practice in paying for nature's services. *Nature Sustainability* 1, 145–150. <https://doi.org/10.1038/s41893-018-0036-x>
- 50
- 51 Wunder, S., Engel, S., Pagiola, S., 2008. Taking stock: A comparative analysis of payments for environmental services  
52 programs in developed and developing countries. *Ecological Economics, Payments for Environmental  
53 Services in Developing and Developed Countries* 65, 834–852.  
54 <https://doi.org/10.1016/j.ecolecon.2008.03.010>
- 55 Zabala, A., Pascual, U., García-Barríos, L., 2017. Payments for pioneers? Revisiting the role of external rewards for  
56 sustainable innovation under heterogeneous motivations. *Ecological Economics* 135, 234–245.
- 57 Zafra-Calvo, N., Garmendia, E., Pascual, U., Palomo, I., Gross-Camp, N., Brockington, D., Cortes-Vazquez, J.-A.,  
58 Coolsaet, B., Burgess, N.D., 2019. Progress toward Equitably Managed Protected Areas in Aichi Target 11:  
59 A Global Survey. *BioScience* 69, 191–197. <https://doi.org/10.1093/biosci/biy143>
- 60 Zbinden, S., Lee, D.R., 2005. Paying for Environmental Services: An Analysis of Participation in Costa Rica's PSA  
61 Program. *World Development* 33, 255–272. <https://doi.org/10.1016/j.worlddev.2004.07.012>  
62