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1 **Payments for ecosystem services or collective** 2 **stewardship of Mother Earth? Applying deliberative** 3 **valuation in an indigenous community in Colombia**

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10 **Abstract**

11 The literature on payments for ecosystem services (PES) applied in regions where indigenous
12 peoples are key social actors has not cast much light on their preferences regarding the framing
13 and design features that such economic incentives should have to ensure their effectiveness.
14 Thus, it is key to find appropriate approaches that can be used to elicit the preferences of
15 indigenous peoples regarding PES design. Here we provide new insights regarding the use of
16 deliberative valuation to elicit of the preferences of an indigenous community from Colombia
17 towards the design of a PES program. A deliberative choice experiment is applied that sheds
18 light on why indigenous people's perspectives need to be taken into account if PES are to be
19 effective and fair. We find that participants from the indigenous community value highly equity
20 considerations that go beyond the monetary benefit that PES provide, such as being able to
21 meaningfully participate in the design of PES or deciding the fairest way to distribute payments.

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22 **Keywords**

23 PES; Indigenous peoples and local communities; equity; deliberative choice experiment;

24 valuation workshop

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25 **1. Introduction**

26 Indigenous peoples are key social actors in over a quarter of the world’s land and about
27 40% of the world’s protected areas (Garnett et al., 2018). Given that many indigenous peoples
28 are pushing to achieve increased autonomy and recognition (Laurent, 2016)—including the right
29 to manage the natural environment within their territories—effective policy-making must be
30 adapted to these particular contexts. Specifically, for global conservation efforts to succeed, it
31 is imperative that environmental policy be compatible with and relevant to the way indigenous
32 peoples choose to live and govern their territories.

33 Payments for ecosystem services (PES) are increasingly being implemented throughout
34 Latin America, often with the dual goals of increasing conservation while simultaneously having
35 positive social impacts (Adhikari and Agrawal, 2013; Börner et al., 2017; Calvet-Mir et al., 2015;
36 Wunder et al., 2018). The definition of what exactly constitutes PES has been a matter of some
37 contention (Wunder, 2015), but we use the definition provided by Engel (2016:133), which
38 defines PES as “positive economic incentives where environmental service (ES) providers can
39 voluntarily apply for a payment that is conditional either on ES provision or on an activity clearly
40 linked to ES provision.” Contrary to other types of policies, such as protected areas or fines,
41 which follow a “polluter-pays” approach, PES use a “steward-rewarded” approach (Engel et al.,
42 2008) that makes these policies well-suited to promote the conservation of land under
43 indigenous control. Consequently, many of the most emblematic PES programs are setting their
44 sights on indigenous communities in order to recognize and incentivize their roles as stewards

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45 of nature. For instance, in Ecuador the “Socio Bosque” PES program was designed to allow both
46 individual and collective contracts in order to encourage indigenous communities to participate
47 in PES schemes (Krause and Loft, 2013). In Mexico, the well-known “Pago por Servicios
48 Ambientales Hidrológicos (PSAH)” program has also targeted indigenous communities by using
49 group-level contracts, with some evidence that these policies are strengthening social capital
50 and collective action (Nieratka et al., 2015). Community-level contracts have also been allowed
51 in later phases of Costa Rica’s national PES program, after indigenous groups managed to show
52 that their original exclusion from the PES was illegal (Borge and Martínez, 2009).

53 A review of the literature examining PES in the context of indigenous communities
54 shows mixed results, however. On the positive side, there are several experiences where PES
55 have been shown to empower indigenous communities (Zander et al., 2013). There are
56 documented cases of PES programs that have been able to respect indigenous sovereignty and
57 self-determination without forgoing positive social and environmental outcomes (Denham,
58 2017). In Australia, for example, some indigenous communities have been keen to participate in
59 carbon credit schemes (Robinson et al., 2016). In Colombia, new legislation passed in 2017 states
60 that indigenous communities will be prioritized as recipients of PES funds and that these
61 programs will be implemented according to indigenous peoples’ practices and customs. Of

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62 particular note are the four references in the law with regard to using PES in a way that
63 contributes to the *buena vivir*¹ (living well) of indigenous peoples in connection with nature.

64 Nevertheless, due caution is warranted as not all experiences with PES in indigenous
65 communities have been positive. In Ecuador, where 60% of the remaining forested land is under
66 indigenous control, many communities have opposed REDD+ projects (Reed, 2011). A large
67 contributing factor to this rejection is the feeling that their voices have not been listened to
68 throughout the design process of these schemes, despite the schemes' potential to significantly
69 affect those whose livelihoods directly depend on forests. There are also documented cases of
70 PES being implemented in indigenous territories that inadvertently cause harm, with
71 detrimental impacts on local diets, food sovereignty, traditional practices and indigenous and
72 local knowledge (ILK) more broadly (Ibarra et al., 2011; Rodríguez de Francisco et al., 2013). In
73 some instances, negotiations between indigenous communities and PES managers have been
74 characterized by power asymmetries that have perpetuated and entrenched preexistent
75 inequalities, for example by reducing indigenous communities' access to water in favor of giving
76 it to wealthier downstream farmers (Rodríguez de Francisco and Boelens, 2016, 2014). The

¹ The concept of *buena vivir* is often used in indigenous circles and is closely associated with others such as *sumac kawsay*, *suma qamaña*, and *vivir bien* (Hidalgo-Capitán and Cubillo-Guevara, 2014). *Buena vivir* can be understood as an aspiration to live in harmony with nature and with each other. The concept is often called upon as an alternative to the western notion of "development," which indigenous communities often see as not only an economic goal but also a cultural one (Escobar, 2011).

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77 worst transgressions of poorly implemented PES have even led to the outright eviction of
78 indigenous groups from their homeland (Griffiths and Martone, 2009).

79 Socio-environmental conflicts between indigenous and non-indigenous groups (e.g.
80 governments) can often be attributed to stark differences in conceptions of justice (Whiteman,
81 2009) and in relational models concerning humans and nature (Muradian and Pascual, 2018).
82 This paper therefore has the twin objectives of: a) exploring under what conditions indigenous
83 communities are more likely to accept participating in PES programs in order to guarantee their
84 acceptance and success, and b) shedding light on whether deliberative valuation approaches are
85 suited to elicit the preferences of indigenous people.

86 We argue that for PES to be tailored to indigenous contexts they ought to be co-designed and
87 voluntarily accepted as legitimate by the communities themselves (Corbera et al., 2007;
88 Cranford and Mourato, 2011). Otherwise there exists a high risk of implementing maladapted
89 PES schemes that are prone to causing further harm to indigenous peoples and thus unlikely to
90 be sustainable in the long run.

91 In order to study under what conditions indigenous communities are more likely to
92 accept being actively involved in PES as service providers, we implemented a deliberative choice
93 experiment (DeCE)—a novel participatory valuation methodology that hybridizes both
94 quantitative and qualitative valuation techniques. Although there are other examples in the
95 literature of conventional choice experiments (CE) being used to elicit stakeholder preferences

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96 regarding PES design (e.g. Espinosa-Goded et al., 2010; Kaczan et al., 2013; Costedoat et al.,
97 2016; Randrianarison and Wätzold, 2016), this is the first example of a DeCE being used for this
98 purpose. Using CE to study PES design preferences is useful to shed light on questions such as if
99 PES implementers should only focus on issues like “getting the price right”, or if on the contrary,
100 PES participants also care for other design characteristics that better fit their perspectives on
101 human-nature relations to the extent that they may also be willing to receive lower payments
102 in exchange for more equitable design features. Thus, we consider that the DeCE’s mixed-
103 methods approach is particularly well suited to this task because it can shed not only on what
104 elements of PES design are most important to participants but also, crucially, to understand why
105 it is that they value those design elements (Schaafsma et al., 2018).

106 This study is of note on two counts. Firstly, this was one of the first implementations of
107 DeCE in the Global South, as there are significant technical and logistical challenges associated
108 with this methodology (Kenter et al., 2011; Christie et al., 2012). Secondly, our sample size of
109 248 participants far exceeds the usual, smaller samples of 100 people or less seen in most other
110 DeCE studies to date (Bunse et al., 2015). Despite the focus of the paper being on indigenous
111 communities, many of the findings of the paper are likely to be applicable to non-indigenous
112 local communities around the world.

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113 **2. Case study background**

114 This section has two parts. First we provide a description of the case study area where
115 we implemented the DeCE. Then we discuss the relevant historical policy context in which a new
116 PES would have to be embedded. Unless otherwise cited, the information in section 2.2 was
117 obtained from discussions with locals, particularly older members of the community.

118 **2.1 The Resguardo of Muellamues**

119 We conducted our study in Muellamues, an almost 400-year-old *resguardo*² (indigenous
120 reservation) situated in the Andes Mountains in the southwestern region of Nariño in Colombia.
121 This community is of interest because it fulfills all of the prioritization criteria of the new
122 Colombian PES law: it is under indigenous control, poverty levels are high, there is presence of
123 illicit crops in the region, and it is located in a paramo. Paramos are biodiversity rich ecosystems
124 unique to northwestern South America and Central America. In Colombia, although paramos
125 only cover 1.7% of the country's land surface, they provide 70% of the country's fresh water
126 (WWF, 2018). Muellamues lies at an altitude of 3,000 to 6,000 meters above sea level. Other
127 than on the steepest slopes, few trees remain standing as most of the land has been converted
128 to pastures. Muellamues has a very small urban center since the majority of the approximately
129 6,000 residents live in small, scattered villages (Figure 1).

130

² *Resguardos* are socio-political institutions formed and led by an indigenous community according to their traditions and guidelines.

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134 **Figure 1.** The red triangle on the map indicates the location of Muellamues. The photo shows an
135 aerial view of the community. The agricultural frontier has significantly encroached into the
136 paramo, which is the source of most of the community's water (top). Imagery ©2018 CNES /
137 Airbus, Map data ©2018 Google

138 The vast majority of the inhabitants of Muellamues belong to the Pasto indigenous
139 ethnic group. Although due to outside influence they have lost some of their traditional
140 knowledge and customs (Kloosterman, 1997), many others such as the *minga* still remain

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141 relevant nowadays. *Mingas* are a traditional indigenous institution whereby the community
142 gathers to contribute their labor towards a common goal (Murillo, 2010). *Mingas* are still used
143 today in Muellamues to build houses, dig ditches or clean litter, among others. The concept of
144 the *minga* is also used when residents gather to deliberate on important matters for the
145 community; in these cases, they are referred to as *mingas de pensamiento* (*mingas* of thought).
146 The practice of *mingas de pensamiento* is very salient in Muellamues and can be seen for
147 example in the weekly meetings with indigenous authorities where community members gather
148 to take decisions that affect the entire reservation, or in the more local meetings of the *juntas*
149 *de acción comunal* (community councils) where village-related issues are managed in
150 assembly. In these meetings community members (both men and women) do not shy away from
151 voicing their (dis)agreement with the matters being discussed and will deliberate extensively
152 until a decision is reached.

153 **2.2 Historical policy context**

154 Historically, subsistence agriculture had been the main industry in Muellamues until the
155 1970s when the Colombian government implemented a series of incentives to promote the
156 production of milk as a development strategy. As part of these efforts, two milk processing
157 plants were built near Muellamues (Kloosterman, 1997). Competition between these two milk
158 plants led to an increase in the price of milk purchased from farmers, which catalyzed a regional
159 shift from traditional agricultural practices almost exclusively to milk production. Until then,
160 most of the local economy relied on bartering with neighboring regions that were located at
161 different altitudes and could therefore grow different crops.

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162 Although the shift to milk production increased the income of farmers, it unintentionally
163 gave rise to multiple ecological, social and cultural problems. First, the shift away from
164 subsistence agriculture greatly impoverished the variety of food available to locals, contributing
165 to increasing malnutrition. Second, it ended the bartering system that had traditionally been
166 practiced between the inhabitants of Muellamues and neighboring regions, eroding social ties
167 and practices such as the *minga*³ (communal work), while instead promoting a more market-
168 oriented economy. Third, the growing cattle population put pressure on locals to convert parts
169 of the paramo into pasture. As the paramo deteriorated, water scarcity became more
170 pronounced downstream. This, in conjunction with the high water consumption of the cattle
171 variety being used, led to the disappearance of many of the streams that used to pepper the
172 landscape. The local environmental agency, Corponariño, has since made some efforts to
173 remedy this environmental problem. However, the inhabitants of Muellamues are not keen to
174 have a government agency mandate what they should do with regard to their natural resources,
175 given that in the past there have been some conflicts associated with the ownership of the water
176 that originates within their territory.

177 The new development strategy also led to problems associated with land tenure which
178 reduced the authority of the *Cabildo*⁴ (council of indigenous authorities) and the territorial

³ Although no longer the case, *mingas* used to be tied with agriculture as well. For example, when farmers asked their neighbors to help with their harvest, they were expected to return the favor in the future as well as provide food and drink or part of the harvest as compensation.

⁴ *Cabildos* are elected indigenous councils that govern over the reservations in Colombia. The members are elected on a yearly basis.

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179 sovereignty of the reservation. The arrival of the milk plants encouraged farmers to obtain loans
180 to buy cattle. To do this, they approached banks that asked for collateral before granting access
181 to credit. Although by law all land within the Muellamues is technically communal—to be
182 distributed for use by the indigenous authorities using *documentos* (indigenous land titles that
183 are only valid within the reservation)—many people went behind the *Cabildo's* back to notaries
184 who drafted private titles to the land which they then offered to banks as guarantees. In the
185 case of default the bank would assume ownership of what was previously indigenous land. In
186 this way the communal ownership of the reservation became increasingly (albeit illegally)
187 privatized (Kloosterman, 1997).

188 In the mid-2000s the United Nations World Food Programme (WFP) identified Nariño as
189 an area with a high degree of malnourishment. As part of an effort to address this problem, an
190 initiative was implemented in Muellamues that rewarded workers with food in exchange for
191 labor (PMA, 2007). Just like many times in the past, residents of the reservation were summoned
192 to participate in communal work (*mingas*) to fix the roads of Muellamues. However, while the
193 WFP was executed in the region, all people who participated received bags of rice as
194 compensation for their labor. This led to a crowding out (Frey and Oberholzer-Gee, 1997) of the
195 pro-social motivations that had previously underpinned the collective action of the *mingas*.
196 Whereas residents had traditionally participated in *mingas* to fix the roads out of a sense of civic
197 duty and commitment to the community, their motivation changed in response to the
198 introduction of economic incentives that rewarded individuals for their labor (Moros et al.,

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199 2017). Consequently, when the WFP's activities in the region ended, many community members
200 ceased participating altogether in forthcoming *mingas* to fix the roads.

201 Legislation was passed in 2017 in Colombia to regulate and encourage the use of
202 payments for ecosystem services (PES). This poses both opportunities (in the form of additional
203 funds for conservation) and risks (that these programs will negatively interact with local
204 institutions and conservation norms as seen above). In this paper we therefore explore what the
205 preferences of an indigenous community are towards PES in order to ensure that these
206 programs are adapted to their particular context, and whether deliberative valuation
207 approaches are well-suited to this task.

208 **3. Methods**

209 The deliberative choice experiment (DeCE) methodology is described in detail in section
210 3.2, but in essence, our approach had small groups of participants completing two sets of choice
211 experiments (CE) with a deliberative component in between. The selection of this methodology
212 is tied to the second objective of this paper. We expected DeCE to be an apt methodology for
213 two main reasons. First, it has been found to successfully address a lot of the criticisms and
214 limitations of traditional valuation approaches such as reducing the cognitive burden on
215 participants and giving them more time to process information and form their preferences
216 (Bunse et al., 2015). This is particularly relevant when participants are asked to value unfamiliar
217 goods, which is the case with PES in Muellamues, and is compounded by the low levels of

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218 education in our study site. Second, while the CE component was useful to get the participants
219 to think about specific elements of PES implementation and provide quantitative evidence of
220 the importance of equity considerations, the focus groups between round one and two of the
221 DeCE can provide rich qualitative information regarding participants' preferences in a format
222 that is familiar and comfortable for them, as it is similar to the *mingas de pensamiento* they
223 regularly hold in their community.

224 **3.1. Sample and workshop design**

225 The CE attributes were chosen after an initial exploratory field visit to the community in
226 September 2017. Two pretest valuation workshops were conducted in January 2018, after which
227 small changes were made to the choice cards and presentation to make them easier to
228 understand. Data collection took place over the course of 4 weeks in February 2018. Given on-
229 the-ground logistical challenges, it was not possible to randomly sample participants for the
230 implementation of the DeCE. Instead we asked individuals from the different villages of
231 Muellamues to assemble groups of about 10 people to participate in the workshops. The
232 workshops were conducted either in the organizers' homes, in the village communal houses
233 where public assemblies are generally held, or in local schools. In total, 248 people (Table 1)
234 participated in 24 workshops. We did not find any evidence of cross-contamination between
235 groups, which is unsurprising as villages in Muellamues are spread far apart.

236 Workshops lasted approximately two hours and were all moderated by the same two
237 people: one of the authors (male) who had previous experience with focus groups and a local

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238 helper (female) with no prior experience that was trained for this purpose. Both moderators
 239 were in their late twenties. There were no language barriers as the community and both
 240 moderators were native Spanish speakers. Power issues between participants were not very
 241 salient as evidenced by the fact that participants were overwhelmingly respectful of each other’s
 242 turn to speak. When some participants were particularly shy, the moderators would ask them
 243 direct questions to encourage their participation. During the focus groups there were no cases
 244 of disagreements leading to any significant conflicts.

245 **Table 1.** Descriptive statistics of the sample

Number of participants	248	Schooling:	
Number of groups	24	<i>None</i>	7%
Minimum number of participants per group	6	<i>Some primary</i>	26%
Maximum number of participants per group	14	<i>Primary</i>	30%
Average number of participants per group	10	<i>Secondary</i>	25%
Median number of participants per group	10	<i>Technical school</i>	9%
		<i>University</i>	4%
Percentage of women/men	53%/47%	Average age	43
Average household size	4.1	Median age	42
Percentage that had previously heard of PES	14%	Age structure:	
Monthly family income:		<i><20</i>	5%
<i><300.000 COL\$</i>	49%	<i>20-29</i>	14%
<i>300.001-400.000 COL\$</i>	20%	<i>30-39</i>	24%
<i>400.001-500.000 COL\$</i>	11%	<i>40-49</i>	26%
<i>500.001-600.000 COL\$</i>	6%	<i>50-59</i>	15%
<i>600.001-800.000 COL\$</i>	6%	<i>60-69</i>	12%
<i>800.001-1.000.000 COL\$</i>	4%	<i>>69</i>	5%
<i>>1.000.000 COL\$</i>	3%		

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247 Although there is no publicly available census to check the representativeness of the
248 sample, efforts were made to include people from all the different villages of Muellamues.
249 Muellamues has a population of around 6,000 people, so our sample included a little more than
250 4% of the residents. The sample has an almost equal representation of men and women, and
251 people of all ages participated. The only restriction for participants was that they be at least 16
252 years old.

253 The DeCE approach we followed was partly based on the valuation workshop
254 methodology proposed by Kenter et al. (2011) and Völker and Lienhoop (2016). The workshops
255 had four parts: the introduction, the DeCE, the survey, and the conclusion. For the introduction,
256 participants were welcomed and the objective of the workshop was explained; then,
257 participants signed an informed consent form that stated among other things that they were
258 free to leave at any point. This was followed by a poster presentation in which the general idea
259 of PES was explained and examples of working PES were given to illustrate different possible
260 modalities. Finally, the different attributes that would be included in the CE as well as the
261 instructions of how to complete the exercise were explained and any questions were answered.
262 This was followed by the DeCE, which consisted of three parts: the first round in which
263 participants individually answered eight choice cards, followed by a moderated focus group
264 discussion in which all participants took part, and which concluded with a second round of CE in
265 which participants once again individually answered the eight choice cards. Once the DeCE was
266 concluded, participants were asked to answer a survey that included questions to gather basic

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267 socio-demographic information. At the end of the workshop, participants were given 10
268 seedlings each along with a certificate that acknowledged and thanked them for their
269 attendance to the workshop.

270 During the introduction, participants were told that the objective of the workshops was
271 to capture the preferences of the community with regard to a potential PES for Muellamues. It
272 was made clear that although the PES in question was hypothetical, legislation had recently been
273 passed in the country in which areas like Muellamues would be prioritized and that the
274 information obtained could be used to inform policy makers. Examples of other Latin American
275 PES with very different characteristics (e.g. land-use change [e.g. reforestation, building live
276 hedges, silvopasture]; origin of funds; cash vs. in-kind payments) were described to give an
277 overview of how different PES programs can be. Many of the specific characteristics of the
278 hypothetical PES being valued during the DeCE were left purposefully vague, as one of the
279 attributes that was valued in the CE was the degree to which community participation would be
280 capable of shaping the final program. The tradeoff of this decision was that the hypothetical PES
281 program may have been less concrete than if we had described it in further detail, but in
282 exchange it made the possibility of community participation having a meaningful impact more
283 credible, as there would be no point in participating in the design of a PES that already had its
284 final form. Participants were allowed to ask questions to either of the two moderators at any
285 point in the workshop. Those who had trouble completing the choice cards and the survey
286 (particularly older and illiterate participants) received help from the moderators. Typically, this

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287 was the case with two to four participants per workshop. In order to facilitate the understanding
288 of the different alternatives on the choice cards, pictures were used and carefully explained to
289 make it easier for participants who had difficulty reading.

290 **3.2. Deliberative choice experiment design**

291 The attributes that respondents were asked to consider in the CE (table 2) included the
292 payment amount and three dimensions of social equity: recognition, procedure and distribution
293 (Pascual et al., 2014). The motivation to tackle equity concerns in PES is related to the first
294 objective of the study, and stems from the fact that in the past, when western and indigenous
295 conceptions of justice have conflicted, they rarely met as “equal and opposing paradigms”
296 (Whiteman, 2009). Instead, the western paradigm has routinely dominated the indigenous one
297 and has led to the rejection of PES by many indigenous communities. There is increasing
298 recognition that environmental decision-making is inevitably value-laden (Schneider et al., 2019)
299 and will have justice implications by creating winners and losers (Sikor, 2013). As such, in order
300 to avoid perpetuating this historical inequality, bringing justice concerns (Agyeman et al., 2016)
301 to the forefront of a discussion around PES is a logical first step before their implementation.

302 To cover the recognition dimension of equity (Martin et al., 2016), two options were
303 included: a PES that was implemented by the indigenous leadership of the *Cabildo* of
304 Muellamues, therefore recognizing the right of indigenous people to control the natural
305 resources within their territories vis-à-vis one implemented by the environmental agency of the
306 regional government (Corponariño). The importance of this attribute was identified during the

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307 first field visit to the community, as discussions with community members about local
308 environmental degradation and possible solutions highlighted tensions over territorial
309 sovereignty between the indigenous authorities and Corponariño. This is because according to
310 Colombian law, many of the natural resources in indigenous lands fall under the jurisdiction of
311 the state. This has led to past conflicts in Muellamues between the community and the regional
312 environmental agency, Corponariño.

313 For procedural equity, three options were included reflecting increasing degrees of
314 community participation in the design of a PES scheme (Arnstein, 1969; Richards et al., 2004)
315 (table 2). This attribute was selected after the initial field visit made obvious that community
316 decision-making (tied to the practice of *mingas de pensamiento*) was common in Muellamues,
317 and that therefore a PES that was perceived to be designed and implemented without
318 community input risked being perceived as illegitimate.

319 For distributional equity, three different ways of distributing the payment among
320 community members were included (table 2). We selected three common distributional rules
321 that are used in PES around the world, but which are based on different fairness criteria (Pascual
322 et al., 2010). This attribute was chosen as allowing communities to decide how to distribute
323 benefits has been found to be important in determining the equity outcomes of PES (Gebara,
324 2013). Payment amounts were formulated in terms of how much the participant's monthly
325 earnings would increase if they participated in the PES schemes; six options were included
326 ranging from 0 COP (the PES would only cover opportunity costs) to 50,000 COP (approximately

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327 17 USD, about 10% of the average monthly income per family). This attribute represents the
328 payment net of opportunity costs rather than the PES payment itself, and is a more appropriate
329 measure of the financial benefit from participating in PES (Pagiola et al., 2005). Given the
330 importance of this attribute a specific portion of the introductory presentation was dedicated
331 to carefully explaining that the monetary amount on the choice cards did not represent the final
332 payment but rather the difference between the costs of implementation and the PES payment.
333 Including a monetary attribute allows us to test whether participants' choices are driven first
334 and foremost by the expected income gains of participating in PES or if the levels of the other
335 attributes also play a role in driving their choices.

336

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337 **Table 2.** DeCE attributes and levels

Attribute	Description	Attribute levels
PES implementer	Agency responsible for implementing and coordinating the PES	<ul style="list-style-type: none"> • <i>Cabildo</i>: council of indigenous authorities • Corponariño: environmental agency of the regional government (<i>base level for dummy coding</i>)
Participation in PES design ⁵	Degree of community participation and input in the design of the PES	<ul style="list-style-type: none"> • Low: only informative meetings with no active participation from the community • Medium: meetings where participants would be consulted about their preferences, but in which the PES implementer decided on the final design • High: joint decision making in which participants and the PES implementer had to agree on the final design of the PES
Payment distribution rule	How PES compensation would be distributed among participants	<ul style="list-style-type: none"> • Per capita • According to conservation effort • Per land unit enrolled in the PES (<i>base level for dummy coding</i>)
Increase in monthly earnings	Change in income per month from participating in the PES	<ul style="list-style-type: none"> • 0 COP • 10,000 COP • 20,000 COP • 30,000 COP • 40,000 COP • 50,000 COP

338

339 A D-optimal fractional factorial design for a Random Parameter Model (RPL) was
 340 generated using the NGENE software (ChoiceMetrics, 2012) with 24 rows which we distributed
 341 across three blocks.

⁵ Because using categorical variables requires larger samples we used level coding for this attribute. If we could have obtained a larger sample this attribute would ideally be dummy coded.

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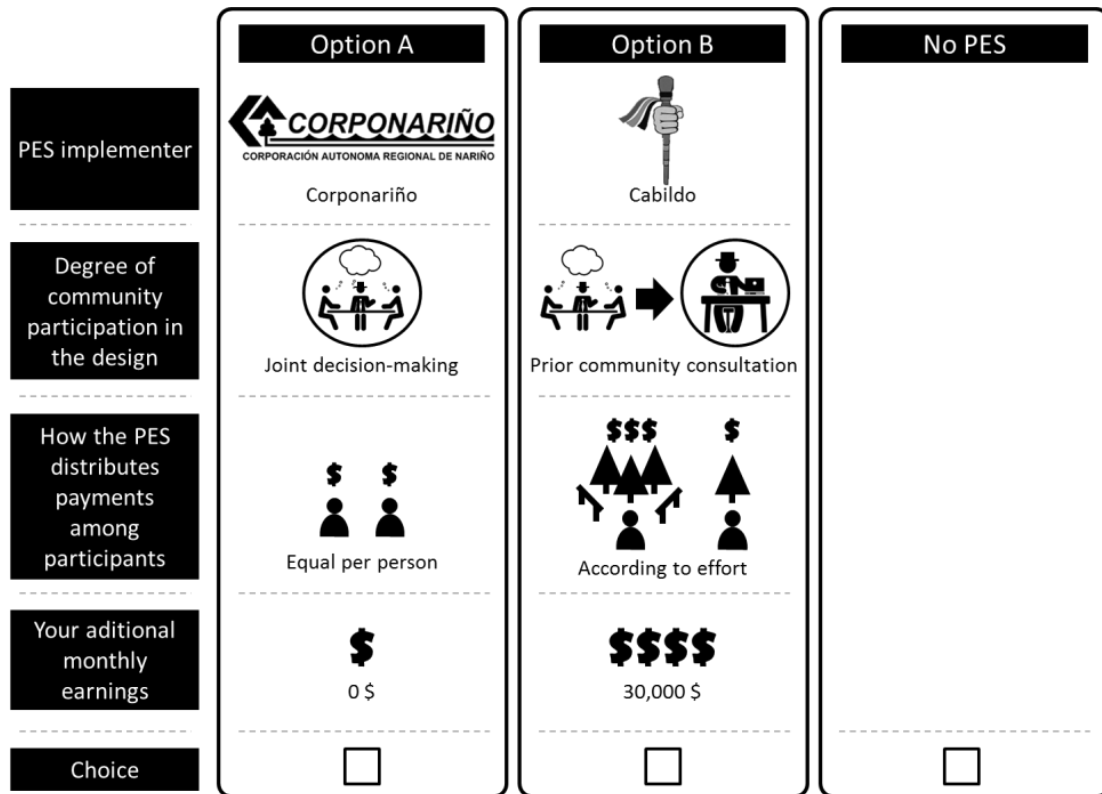
342 Across all workshops three different sets of eight choice cards were used (totaling 24
343 different choice cards). In any given workshop all participants answered the same choice cards
344 but each of them in a randomized order. Each participant individually answered eight choice
345 cards (see figure 2 for an example) in round one, participated in a 40-minute focus group
346 moderated by one of the authors and assistant local helper, and then repeated the CE
347 individually in round two by answering the same choice cards again in a different order than in
348 the previous round (once again randomized). DeCE can be designed so that participants make
349 individual decisions, as in our case, or a single group decision. We opted for individual decision-
350 making as there are some risks associated with group decisions which we wanted to avoid such
351 as issues of power asymmetries and coercion (Dryzek, 2002), as well as the possibility of false
352 consensus whereby some participants agree with the group decision out of conformity rather
353 than rational conviction (Bartkowski and Lienhoop, 2018).

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354

355 **Figure 2.** Example choice card. Each choice card had three alternatives (A, B, Opt out⁶).

356 The focus group format followed a guide with questions covering each of the attributes
 357 (Appendix A). Before the discussion started, participants were informed that the audio would
 358 be recorded for note-taking purposes. The focus group began by asking participants what they
 359 thought of the workshop thus far (this was included as a warm-up question for participants to
 360 get more comfortable). Then they were asked how they felt towards PES as an environmental

⁶ In the Random Utility Model we estimate, the representative utility for the opt-out alternative is set to zero (Appendix B)

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361 policy and if they thought it could work in their community to help address environmental
362 degradation. Following this, each of the attributes was discussed one by one in the order that
363 they appeared in the choice cards. When the conversation did not flow naturally, the moderator
364 asked questions about the attributes to engage participants and encourage them to discuss
365 further. The conversation was generally allowed to continue at each point until participants had
366 nothing more to say. Finally, participants were asked if they had any final thoughts or
367 recommendations on how to best adapt the PES scheme to their community.

368 In the following section we present the results of the CE for both rounds. We use RPL
369 models to analyze our results. We include the model specification in Appendix B. We also follow
370 Kenter et al. (2011) by presenting a summary of the major themes that surfaced during the focus
371 groups and the debates that took place. The qualitative information obtained from the focus
372 groups is used to complement the quantitative information obtained from the RPL models and
373 provides useful insights into the types of considerations that would increase the likelihood of
374 success of PES in indigenous contexts.

375 **4. Results**

376 Table 3 shows the results of the RPL models for round one (pre-deliberation) and round
377 two (post-deliberation) respectively. The size of the mean coefficients can be interpreted as the
378 change in the representative utility for individuals from a one-unit increase in the attribute.
379 Given that RPL models do not assume that all individuals have homogeneous preferences, the

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380 standard deviation coefficients reflect how broad the distribution of measured preferences is
381 (Hensher et al., 2015). The significance and positive sign of the alternative specific constants
382 (ASC) indicates that respondents' utility is higher for the first two alternatives than from the opt-
383 out alternative.

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384 **Table 3.** Random Parameter Logit (RPL) Models for round one (pre-deliberation) and round two
385 (post-deliberation)

RPL (Round One)				RPL (Round Two)			
<i>Alternative specific constants</i>	Coef.	Std. Error		<i>Alternative specific constants</i>	Coef.	Std. Error	
ASC 1	3.257	0.301	***	ASC 1	3.630	0.273	***
ASC 2	3.032	0.296	***	ASC 2	3.295	0.276	***
<i>Attributes (means)</i>				<i>Attributes (means)</i>			
PES implemented by Cabildo	0.139	0.121		PES implemented by Cabildo	0.094	0.110	
Degree of participation	0.219	0.066	***	Degree of participation	0.085	0.051	*
Distribution rule: per capita	-0.019	0.097		Distribution rule: per capita	0.153	0.087	*
Distribution rule: per effort	-0.008	0.097		Distribution rule: per effort	0.141	0.088	*
Increase in monthly earnings	0.038	0.021	*	Increase in monthly earnings	0.046	0.020	**
<i>Attributes (sd. deviations)</i>				<i>Attributes (sd. deviations)</i>			
PES implemented by Cabildo	0.997	0.437	**	PES implemented by Cabildo	0.433	0.165	***
Degree of participation	0.524	0.254	**	Degree of participation	0.095	0.184	
Distribution rule: per capita	0.028	0.458		Distribution rule: per capita	0.102	0.518	
Distribution rule: per effort	0.031	0.708		Distribution rule: per effort	0.000	0.212	
Increase in monthly earnings	0.004	0.130		Increase in monthly earnings	0.084	0.045	*
Log-likelihood	-1382.5			Log-likelihood	-1339.9		
Number of parameters	12			Number of parameters	12		
Observations	1819			Observations	1840		
Akaike Info. Criterion	2789.0			Akaike Info. Criterion	2703.8		
Bayesian Info. Criterion	2855.1			Bayesian Info. Criterion	2770.0		

***, **, *: significant at the 1%, 5% and 10% level

Normally distributed coefficients: 'PES implemented by Cabildo', 'Degree of participation' and 'Distribution rule'

Log normally distributed coefficients: 'Increase in monthly earnings'

The number of observations is lower in round one due to some participants leaving cards blank in this round.

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387 Focusing on the means of the estimated distributions, in round one the only significant
388 non-monetary coefficient was the degree of participation by the community in designing the
389 PES scheme. As expected, the change in monthly income also had a significant and positive
390 impact. Preferences regarding the PES implementer show non-significant mean coefficients, but
391 their standard deviations show significant high unobserved preference heterogeneity. Given
392 their zero mean coefficients, this attribute seems to be controversial in the sense that its impact
393 for approximately half of the respondents is positive and for the other half is negative.

394 Results change significantly between rounds. One difference when comparing the
395 models for Round 1 and 2 is the decrease in the preference heterogeneity among the
396 respondents regarding the degree of participation and an increase in preference heterogeneity
397 regarding the payment attribute. This is reflected in the fact that the standard deviation of the
398 participation attribute loses its statistical significance in Round 2, while the opposite is true of
399 the payment attribute.

400 Another difference between the rounds is the fact that the distribution rules used by
401 the PES, which do not appear to have a significant effect on participants' preferences in the first
402 round become significant in the second. Specifically, given the positive and significant mean
403 coefficients of both "equal per capita" and "according to effort" distribution rules, we can infer
404 that a distribution rule "according to the area included" is highly disfavored, as it is the baseline
405 against which the other two coefficients are measured. Finally, the number of participants that

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406 chose the opt-out alternative at least once decreases by two thirds between rounds, from 9.7%
407 in the first round to 3.5% in the second.

408 Table 4 summarizes the main themes and debates that surfaced in the focus groups.
409 These are used to interpret the results from the CE in the next section. A more detailed version
410 of this table with a selection of illustrative quotes can be found in Appendix C.

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411 **Table 4.** Recurring themes and debates across the 24 focus groups. The third column indicates
412 the number of groups where the theme was relevant for the discussion.

Theme	Description	#
In favor of the Cabildo	They are the legitimate authority that represents the community's sovereignty and thus have more sway with locals. They are the holders of indigenous and local ecological knowledge. They are a "father" to the community. They are respected both inside and outside the community.	17
Against the Cabildo	They only look out for themselves and are involved in politicking. There have been instances of elite capture in the past. They have failed to protect the environment so far. They buy back plots of land under the pretext of conservation and then sell it to their supporters. A new Cabildo is elected yearly making it very hard for project continuity.	15
In favor of Corponariño	Much more interested in the environment than the Cabildo. Better track record as they have carried out environmental projects in the past. More technical expertise and resources. More capable of offering PES continuity.	12
Against Corponariño	Lack of trust in them. They are only interested in taking control over the water of Muellamues and charging residents for it. Letting them run the PES would be selling off the territory. They don't possess local ecological knowledge and would thus be incapable of offering appropriate environmental solutions.	12
Collaboration	The Cabildo and Corponariño should collaborate to implement the PES together.	5
Importance of community participation in PES design	Important because: It is not legitimate when the few decide for the many. The more people participate the more knowledge is shared and the better the outcome. Important to listen to all views and arrive at a consensus. Everyone relies on nature so everyone should be part of the solution. Participation reduces corruption and politicking. Participatory decision-making is the indigenous way.	16
Distribution rules	In favor of per effort: Fairest rule. Hard work should be recognized. Would prevent free-riding.	22
	In favor of equal per capita: So there is no inequality. To reduce envy. To make everyone aware of the benefits of conservation. Because it reflects how traditional 'mingas' work.	10
	Against per unit of land: Not fair to offer more payments to the biggest land owners. Could cause problems (e.g. limits between neighbors are not always clear).	9
In favor of paying to conserve nature	People are poor and live from the land, so payment is necessary so they can keep making a living. Conservation is hard work that should be recognized. Payment will motivate many more people to conserve. Money is a necessary evil.	17
Against paying to conserve nature	Caring for the environment is a moral duty. Environmental benefits from conservation should be reason enough. Taking care of the environment should not be seen as a cost but rather as an investment. Money has made people lose their moral compass. Paying risks eroding traditional practices like the 'minga'. Paying for	18

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	conservation will mean people do it for the wrong reason. Conservation should not become a business.	
Linking PES with indigenous terminology and concepts	Participants would often use indigenous terminology and concepts to discuss PES, such as: 'territory', 'mingas', 'mother earth', 'mother nature', 'indigenous authority', 'indigenous identity', 'chagras' (indigenous medicinal gardens), 'duty', favoring terms like 'help' or 'support' rather than 'payments'.	19
Bequest value of nature	The environment must be protected for the children and for future generations to come.	11

413 5. Discussion

414 We begin by exploring under what conditions participants would be most likely to accept
415 participating in a future PES. The fact that the degree of community participation was deemed
416 important from the start was unsurprising given that community members are quite used to
417 collective decision-making in Muellamues. Additionally, given historical conflict and struggles for
418 their land (Kloosterman, 1997), there is a sense that active community participation is important
419 when making decisions concerning land use (cf. Table 4). Others have noted the importance of
420 communal decision-making in indigenous contexts (e.g. Kenter et al. 2011), highlighting the
421 centrality of this attribute for effective PES design and implementation. However, involving the
422 community in the design of PES should only be done if their participation is meaningful as there
423 are numerous examples of tokenistic gestures in this regard that have ultimately led to
424 frustration among the communities in question (Whiteman, 2009).

425 Table 3 shows how distributive concerns become significant in round two. This change
426 is likely a result of the deliberative process, as during the focus group participants were asked
427 to carefully consider and discuss the impact of each attribute one at a time, and supports that

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428 DeCE may be capable of capturing more considered preferences than conventional CE, which
429 would only provide the results for the first round. There were differing opinions on whether
430 people most preferred an effort-based payment or an equal-per-capita payment (cf. Table 4).
431 Interestingly, the equal-per-land-unit payment was often rejected despite it being the most
432 commonly used approach in PES programs (Wunder et al., 2018, 2008). The focus group
433 discussions shed some light on why this may be. Land ownership is a sensitive subject in
434 Muellamues for multiple reasons. As described in Section 2.2, some of the land has unclear
435 tenure due to illegal privatization. Additionally, the fact that the redistribution of land that the
436 reservation recovered in the past has been subject to some favoritism by previous *Cabildos*
437 means that many people are not keen on a PES that draws attention to how much land they
438 own.

439 This highlights how local context may interact in unexpected ways with specific PES
440 characteristics that may easily go unnoticed by PES implementers who are not intimately
441 familiar with participating communities, and supports the use of participatory and deliberative
442 approaches to design PES that reflect the preferences of indigenous communities. This stands
443 in contrast to the fact that only a minority of PES allow participants to decide how they prefer
444 to share the benefits obtained. However, there are some notable exceptions where indigenous
445 populations have been allowed to allocate payments according to complex community-decided
446 distribution rules (Nieratka et al., 2015). Engaging communities in this process in future PES

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447 could help increase the legitimacy and uptake of PES, in addition to making PES more
448 transparent and reducing the potential for elite capture.

449 Participant preferences with regard to who should implement the PES program (the
450 *Cabildo* or Corponariño) requires careful interpretation. Like Costedoat et al. (2016), who used
451 a conventional CE to ask farmers about their preferences regarding PES, we find that involving
452 a government agency appears to have little effect on participants preferences from a statistical
453 point of view. However, at least in our case, the fact that the mean for the estimated distribution
454 of this coefficient was not significant in either of the two rounds should not be understood as a
455 lack of importance, as this attribute was often the most heatedly debated topic during the focus
456 groups (cf. Table 4). The issue elicited a broad range of opinions from participants which they
457 generally felt very strongly about. This lack of consensus is reflected in the RPL models as a lack
458 of significance for the attribute means, but a highly significant attribute standard deviation. This
459 implies that for about half of respondents this attribute was positive and for the other half it
460 was negative; that is, half preferred a PES program lead by the indigenous authorities while the
461 other half preferred the regional environmental agency.

462 The focus group discussions revealed that the majority of the people hold a deep respect
463 for the *Cabildo* as an indigenous institution, even if some do not like the political or personal
464 inclinations of a specific *Cabildo* in a given year (a new *Cabildo* is elected on a yearly basis). In
465 this regard the *Cabildo* is seen as a legitimate authority over indigenous matters by the
466 overwhelming majority of respondents. This is paired with the fact that there exists a

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467 widespread feeling of wariness towards Corponariño which stems from past efforts of the
468 government to gain greater control over the water sources in the paramo within the reservation.
469 Nevertheless, there is a prevailing sense that previous *Cabildos* have not done enough to protect
470 the environment (cf. Table 4). This is why a significant percentage of participants shied away
471 from selecting PES alternatives led by the *Cabildo* and felt that, as an external environmental
472 institution, Corponariño could be better suited to manage the PES. There was also a feeling that
473 project continuity would be hard to achieve with the yearly changes of the *Cabildo*, while
474 Corponariño's involvement would likely grant the program more permanence. However, in five
475 separate focus groups respondents suggested that ideally the PES should not be implemented
476 by a single entity but rather by a collaboration between the *Cabildo* and Corponariño. In this
477 way the PES could benefit from the *Cabildo's* local knowledge and legitimacy as well as
478 Corponariño's technical expertise. Similar community preferences for co-management systems
479 have also been noted in other contexts of the Global South (Hind et al., 2010). The suggestion
480 of a co-management system demonstrates how involving communities in PES design may not
481 only help to choose between alternative design options, but may also surface options not
482 previously considered, and supports the use of deliberative approaches for policy design.

483 It is worth noting that, in the second round RPL, the monthly earnings attribute also had
484 a significant standard deviation. We attribute this heterogeneity in preferences to the fact that
485 part of the focus group discussion covered whether people should be paid for protecting the
486 environment or whether it should be done for free. The majority of participants expressed that

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487 PES was a good idea as receiving compensation would allow them, as poor farmers, to invest in
488 conservation efforts. However, in most groups (c.f. Table 4) at least one or two people would
489 often argue that protecting nature was the “duty” of all people and expressed reservations as
490 to whether bringing money into the equation would be productive in the long term or whether
491 conserving nature would simply “become a business.” Therefore, it is possible that while the
492 payment attribute was important for the majority, some may have balked at choosing choice
493 card alternatives with high payments for moral or ethical reasons. Another possible explanation
494 that cannot be discarded is social desirability bias, where some respondents may not have
495 wanted to appear to be choosing PES alternatives based primarily on financial gain, despite the
496 exercise being individual and anonymous.

497 Despite the fact that the levels of significance of the non-monetary attributes in the
498 second round are relatively low, an interesting implication of their statistical significance is that
499 respondents would be willing to receive lower PES payments in exchange for more equitable
500 PES. If this were not the case, we would expect to find that only the monthly earnings attribute
501 was significant. We ascribe the low levels of significance to the fact that our sample was
502 relatively low (n=248) for this type of methodology and that the CE approach was quite
503 cognitively challenging for many participants. We cannot however rule out that despite our
504 efforts to select attributes that adequately reflected equity concerns in PES design, alternative
505 ones may have been even more relevant to participants and thus been more significant.
506 However, the focus group discussions assuage this concern somewhat as many participants

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507 expressed strong opinions regarding the attributes we included. In either case, the fact that both
508 the choice experiment results and the focus groups reflect that participants' equity concerns go
509 well beyond the monetary benefit that PES may bring, would suggest that policy makers would
510 do well to carefully consider the equity implications of PES designs if these are to be well
511 received by local communities.

512 In the literature, PES is often framed using economic terminology (e.g. increasing the
513 provision of ecosystem services, internalizing externalities, aligning incentives, compensating
514 opportunity costs). While this jargon is useful to dissect and analyze PES in certain academic and
515 policy making contexts, in an indigenous context such framing could well be counterproductive.
516 This is because in Muellamues, like in many other indigenous communities, there is an active
517 resistance to the encroachment via ideological imposition of what are perceived to be "western"
518 ideas. Therefore, it was interesting to observe how, as participants became more familiar with
519 the concept of PES, they often began using their own framing and semantics to talk about the
520 use of these programs and their surrounding environment during the focus groups (cf. table 4).
521 When this took place, the change in language often appeared to be accompanied by a change
522 in their human-nature relational model (Muradian and Pascual, 2018). Specifically, these
523 discussions began with nature being talked about as the backdrop over which community
524 members made their living, where the value of nature was discussed primarily in instrumental
525 terms. However, as conversations about PES and environmental degradation progressed,
526 participants often began to draw on indigenous expressions and concepts. They talked about

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527 using “*mingas*” to “care” for their “territory”; they referred to their “duty” to guard “Mother
528 Earth”; and they underscored the necessity to preserve nature for their descendants.
529 Interestingly, they also favored using terms such as receiving “help” or “support” from the
530 government rather than “payments.” All this highlights the importance of considering relational
531 values when looking at indigenous peoples’ relationship with nature (Chan et al., 2018, 2016;
532 Pascual et al., 2017). This shift in framing around PES could be understood as a change in the
533 human-nature relational model being used to talk about PES from “utilization” to one of
534 “wardship” or “devotion” (Muradian and Pascual, 2018), with nature seen as something worth
535 being protected for its own sake and for future generations, and not just as means to an end.
536 This visible contrast between the often monistic, western representation of nature and
537 ecosystem services and that of indigenous peoples’ is increasingly receiving attention in the
538 scientific literature. Notably, the Intergovernmental Platform on Biodiversity and Ecosystem
539 Services (IPBES) recently included in its framework the concept of “nature’s contributions to
540 people” (NCP) (Pascual et al., 2017; Diaz et al., 2018), a reframing of ES that attempts to be more
541 inclusive of the diverse set of world views and values associated with the benefits (and
542 detriments) that nature provides to humankind.

543 Adapting the PES framing to a more indigenous worldview and aligning it more closely
544 with their intrinsic motivations (Midler et al., 2015) and traditional knowledge, including their
545 cosmology, culture, identity and values (Houde, 2007), seems like a promising way to help PES
546 succeed in these communities. Using their own terminology and conceptualization of nature

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547 could potentially help to rally indigenous communities around conservation in a similar way to
548 how indigenous politicians in Colombia have begun to dress in traditional garments to
549 externalize their “indigenoussness” in an attempt to signal to their supporters and bring
550 indigenous identity to the forefront (Laurent, 2016). In this regard there is already some
551 evidence that community identity and pride can be tapped into to motivate participation in PES
552 (Bremer et al., 2014).

553 The importance of encouraging community participation in the design of PES to tailor
554 these programs to their specific contexts should also not be underestimated if we consider the
555 potential PES has to create, interact with, and change existing social norms (Kerr et al., 2017), in
556 turn crowding in or out participants’ motivations (Chan et al., 2017; Rode et al., 2015). For
557 example, the debate that arose in several focus groups during the DeCE about whether people
558 should be paid to do their “duty” highlights an important conundrum. Depending on how
559 participants perceive PES, the act of paying to protect nature can contribute to the creation of
560 one of two opposing social norms. It is possible that an implementation of PES that is
561 accompanied by an effort to engage the community, may be able to tap into pre-existing pro-
562 social motivations to conserve and transmitting the value of protecting the environment. This in
563 turn could send the message that people are receiving help to protect nature because its
564 stewardship is a vital exercise that the government is willing to support. In this case even if
565 payments were to stop at some point, the social norm that conservation is important may have
566 been reinforced and people may be more willing to continue expending effort in the pursuit of

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567 the endeavor. On the contrary, if PES is seen as foreign—as a way for the government to
568 manipulate individuals into doing something that is not worth doing for its own sake—the social
569 norm that is created is that conserving nature is not a worthwhile effort unless you get paid to
570 do it. Something similar happened with the experience of the UN World Food Program in
571 Muellamues described in Section 2.2; although in that case the program crowded out the
572 motivations of participants to work as a community to collectively maintain their roads, a poorly
573 designed PES could risk reducing any non-pecuniary motivations that the inhabitants of
574 Muellamues could have to conserve local ecosystems. Avoiding this is certainly no easy task
575 given that pecuniary and social motivations often interact in unexpected ways (Rode et al.,
576 2015). Ultimately, the effect that a cash payment would have on the motivations to care for the
577 environment remains an open question. However, at least in this case we find that the use of a
578 deliberative monetary valuation method was a good way to identify this potential, as it forced
579 participants to think about the effect that payments would have on their behavior, and provided
580 a forum in which to discuss this. Although no consensus was reached on whether people should
581 be paid to conserve, the fact that this debate took place (cf. Table 4) may serve as a warning to
582 policy-makers to consider alternative designs that may decrease the risk of motivational
583 crowding out such as using in-kind payments (Engel, 2016).

584 Our results highlight the importance and value of co-designing PES programs with
585 indigenous communities themselves. PES designs should recognize and respect indigenous
586 peoples' perspectives, preferences and worldviews underpinning their preferred relational

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587 models with regard to nature (Muradian and Pascual, 2018). Reducing the emphasis on
588 pecuniary motivations to participate in PES and instead focusing on peoples' relational values
589 towards nature may be a way to reduce the risk of crowding out (Bremer et al., 2018). Despite
590 recurring criticisms in the past that have accused PES as relying on the "asocial logic of
591 neoclassical economics" (McAfee, 2012:105), the reality is that PES are flexible tools that rarely
592 follow a strict market rationale (Muradian and Gómez-Baggethun, 2013). In Bolivia, for example,
593 PES have been successfully reframed as "reciprocal agreements for water" (Bétrisey and Mager,
594 2014), thereby avoiding the market transaction framing and instead tapping into preexistent
595 social norms of reciprocity. In Mexico, the idea of PES as "payments" has been rejected by
596 farmers in favor of conceptualizing them as a "support" or "recognition" instead (Denham,
597 2017). In Australia, PES have also been reinterpreted and translated to fit more closely with
598 indigenous narratives (Robinson et al., 2016), moving away from the framing of nature as a
599 service provider and instead towards the circular relationship between humans and nature.
600 Other proposals include articulating PES as "co-investment in environmental stewardship" (CIS)
601 (Chan et al., 2017; van Noordwijk and Leimona, 2010), with an emphasis on social exchange
602 rather than financial transactions. The discussions that took place during the focus groups
603 support that these types of alternative approaches to traditional PES framings are more likely to
604 be aligned with indigenous peoples' worldviews and thus more likely to guarantee their success
605 in these contexts.

606

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607 **6. Conclusions**

608 With PES increasingly becoming part of the strategy to protect the environment not only
609 in Colombia but also the rest of the world, it is crucial to find ways to adapt these policy
610 instruments to the diversity of contexts and peoples that exist. Although many of our findings
611 may be relevant beyond indigenous communities, it is particularly important that in these
612 contexts PES implementers find a way to tailor these programs so that they accommodate the
613 full range of worldviews and ways of living of these groups. If not, two main risks exist: either
614 that PES face widespread opposition by these communities for being incompatible with their
615 culture and understanding of the natural world, or that PES is implemented but leads to
616 unintended consequences that could, for example, erode the communities' customs and
617 cultural heritage (as happened in the two cases illustrated in Section 2.2).

618 We find that the deliberative valuation approach is a useful way to elicit preferences in
619 an indigenous context. One of the advantages of adding a deliberative component to the CE
620 methodology is that it allowed us to extract information not only about what participants value,
621 but also about why they value it (Lienhoop et al., 2015). The deliberation process helped
622 individuals to carefully consider the importance of each of the attributes in question, not just
623 for themselves but also with regard to how the implementation of a PES scheme would interact
624 with their community more broadly (Kenter et al., 2016).

625 Finally, and particular to the context of Andean indigenous groups in Colombia, the focus
626 group discussion was based on a familiar format for participants (i.e. deliberative meetings)

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627 where individuals could voice and discuss their opinions freely in front of the group. While this
628 approach worked well in the specific context of Muellamues, where deliberating openly is
629 common when making decisions, care should be taken in contexts where local elites (or other
630 individuals who are empowered by their class, social position, gender or education) are more
631 apt to dominate meetings and therefore silence other individuals (Orchard-Webb et al., 2016).

632 Our study in the reservation of Muellamues in Colombia attests to the importance of
633 carefully considering equity in PES design and allowing community members to meaningfully
634 take part in the decision-making process. We also found evidence that adapting the language
635 and framing of PES to fit with the jargon and concepts used by indigenous peoples can be useful
636 to engage participants and help them find a place in their community for these types of
637 conservation approaches. These could be important first steps to avoid PES being perceived as
638 a neoliberal tool used to commodify nature in a way that often clashes with the values of these
639 communities (Kosoy and Corbera, 2010). We have seen in the past how failure to do so has
640 caused widespread rejection of programs such as REDD+ by indigenous peoples in Latin America
641 (e.g. Reed, 2011), due in large part to a lack of prior involvement of the communities and scarce
642 efforts to adapt PES to different relational models (Muradian and Pascual, 2018). With more
643 than a quarter of the world's land surface under indigenous control (Garnett et al., 2018), the
644 importance of not only tailoring PES to fit with indigenous' worldviews, but also reimagining
645 them in a way that allows indigenous groups to take ownership of them can hardly be
646 overstated.

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656

657 **8. References**

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882

883 **Appendix A: Focus group guide**

884

- 885 1. What did you think of the exercise? Easy? Hard? Was there anything you did not
886 understand?
- 887 2. General PES questions
- 888 a. Who had heard about PES before today?
- 889 b. What is your opinion about PES?
- 890 i. General thoughts about PES
- 891 ii. What are some actions that could be done to improve the local
892 environment?
- 893 c. Did someone pick the “No PES” option on any of the cards? Why?
- 894 d. Which of the four characteristics on the cards were the most important to
895 you? Why?
- 896 3. PES IMPLEMENTER
- 897 a. What impact would this have on the PES?
- 898 b. What do you think about the Cabildo and Corponariño?
- 899 4. DEGREE OF PARTICIPATION IN PES DESIGN
- 900 a. What impact would this have?
- 901 b. Who has taken part of a participative process in the past?
- 902 c. Was it useful?
- 903 d. How would you like for the processes to be?
- 904 e. What would you hope they would accomplish with regards to a PES?
- 905 5. DISTRIBUTIVE RULE.

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- 906 a. Which is the most/least fair? Why?
907 b. Which rule would cause the least problems?
908 c. Is there a better way to distribute the compensation?
909 6. MONTHLY PROFIT
910 a. Should people receive something in exchange for taking care of nature?
911 b. Were the amounts offered on the cards fair?
912 c. Where should the money come from / who should finance the PES?
913 d. Would you participate in a PES that only covered opportunity costs and
914 nothing else (\$0)?
915 e. If you lost some money by participating, would it still be worth it if it improved
916 the environment?
917 f. What if after some time a PES runs out of money? Would you stop the
918 sustainable practices?
919 7. What would be the most important thing to include/ensure in a PES (even if we
920 haven't mentioned it yet)?
921 8. What was the most important thing that was said today?
922 9. Ask the other moderator to summarize the focus group and ask any questions they
923 may have to the group
924

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925 **Appendix B: Model specification**

926 The choice experiment framework is based on McFadden's (1974) Random Utility
927 Theory. This assumes that the utility U for individual n from choosing alternative j in choice
928 situation t is:

$$U_{njt} = V_{njt} + \varepsilon_{njt} = \beta'x_{njt} + \varepsilon_{njt}, \quad (1)$$

929 where V is the observable utility (also called representative utility), ε is the unobserved error
930 term, β is a vector of unknown parameters, and x is a vector of K attribute levels. The
931 multinomial logit model (MNL)—the most restrictive discrete choice model—describes the
932 probability that the individual n chooses alternative i in choice card t as:

$$P_{nit} = \frac{\exp(x'_{nit} \beta)}{\sum_{j=1}^J \exp(x'_{njt} \beta)}. \quad (2)$$

933

934 However, random parameter logit (RPL) models are increasingly being used due to their
935 flexibility. Mariel and Meyerhoff (2018) describe how, although being more computationally
936 demanding, RPL models lead to better model fit and show higher precision of coefficients for
937 dummy-coded attributes. The defining characteristic of RPL models is that the parameters β are
938 assumed to be randomly distributed, thus accounting for preference heterogeneity among
939 individuals. For an RPL model the utility U for individual n from choosing alternative j in choice
940 situation t is:

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$$U_{njt} = x'_{njt}\beta_n + \varepsilon_{njt}, \quad (3)$$

941

942 where ε_{njt} is independent and identically distributed (IID) over individuals, alternatives and
943 choices. Coefficients β_n are distributed with density $f(\beta|\Omega)$ and can be rewritten as:

$$\beta_n = \beta + \Delta z_n + \Gamma v_n, \quad (4)$$

944

945 where β represents the fixed means of the random parameter distribution, z_n is the vector of
946 observed respondent-specific characteristics that affect the mean of the random parameter
947 distribution and Δ is the associated parameter matrix. The last term Γv_i is the unobserved
948 heterogeneity, with an unknown lower triangular matrix of parameters Γ that must be estimated
949 and random unobserved taste variation v_i . As is common in case studies with a limited number
950 of observations, we assume uncorrelated random parameters such that:

$$\Gamma = \text{diag}(\gamma_{11}, \gamma_{22}, \dots, \gamma_{KK}). \quad (5)$$

951

952 The expected probabilities for RPL models are:

$$P_{ijt} = \int L_{ijt}(\beta) f(\beta|\Omega) d\beta, \quad (6)$$

953

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954 where $f(\beta|\Omega)$ is the multivariate probability density function and $L_{ijt}(\beta)$ is the standard logit
955 probability evaluated at β . According to formula (2), conditional on β_n , the probability that the
956 individual n makes a sequence of choices $\{i_{n1}, i_{n2}, \dots, i_{nT}\}$ is:

957

$$L_{ni}(\beta) = \prod_{t=1}^T \left(\frac{\exp(x'_{ni_{nt}} \beta_n)}{\sum_{j=1}^J \exp(x'_{njt} \beta_n)} \right), \quad (7)$$

958

959 assuming that ε_{njt} are independent over time. The unconditional probability of the sequence of
960 choices $\{i_{n1}, i_{n2}, \dots, i_{nT}\}$ is the mixed logit probability formula:

$$P_{ni} = \int L_{ni}(\beta) f(\beta) d\beta. \quad (8)$$

961

962 The log-likelihood function of the RPL is defined as:

$$LL(\Omega) = \sum_{n=1}^N \ln \left(\int \left(\prod_{t=1}^T \left(\frac{\exp(x'_{ni_{nt}} \beta_n)}{\sum_{j=1}^J \exp(x'_{njt} \beta_n)} \right) \right) f(\beta|\Omega) d\beta \right). \quad (9)$$

963

964 The maximum simulated likelihood estimator (MSLE) is the value of Ω that maximizes $SLL(\Omega)$.

965

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967 Appendix C: Themes and debates surfacing during the focus groups with illustrative quotes

Theme	Description	#	Illustrative quotes from focus groups
In favor of the Cabildo	They are the legitimate authority that represents the community's sovereignty and thus have more sway with locals. They are the holders of indigenous and local ecological knowledge. They are a "father" to the community. They are respected both inside and outside the community.	17	"Since we are in an indigenous community the implementer should be the Cabildo. We've always worked with the Cabildo here. [...] Corponariño doesn't have a lot of knowledge about the local environment. That's why we need the Cabildo. They have more knowledge. For example, if we brought a technician from Corponariño he wouldn't know about our trees. He wouldn't know them."
Against the Cabildo	They only look out for themselves and are involved in politicking. There have been instances of elite capture in the past. They have failed to protect the environment so far. They buy back plots of land under the pretext of conservation and then sell it to their supporters. A new Cabildo is elected yearly making it very hard for project continuity.	15	"With the Cabildo it can't be done. For example, in this village there used to be some plots of land that were a protected natural reserve because they contained a spring. But then a new Cabildo was elected and they parceled it out. The Cabildo doesn't pay the least attention to environmental management."
In favor of Corponariño	Much more interested in the environment than the Cabildo. Better track record as they have carried out environmental projects in the past. More technical expertise and resources. More capable of offering PES continuity.	12	"I would prefer with Corponariño, because they are an entity that was created exactly for this purpose: for the country side, for the environment. They are the ones that protect it. That care for it. They implement the laws about water and natural resources. So they are the most knowledgeable."
Against Corponariño	Lack of trust in them. They are only interested in taking control over the water of Muellamues and charging residents for it. Letting them run the PES would be selling off the territory. They don't possess local ecological knowledge and would thus be incapable of offering appropriate environmental solutions.	12	"Corponariño is only interested in charging water fees. That's what they're interested in. Not in caring for the sources of water. On the other hand the Cabildo is interested our community because they see our needs up close."
Collaboration	The Cabildo and Corponariño should collaborate to implement the PES together.	5	"The Cabildo and Corponariño should knock on doors together. 'Come on let's go do this!' We shouldn't exclude anyone. The more entities are involved the better."
Importance of community participation in PES design	Important because: It is not legitimate when the few decide for the many. The more people participate the more knowledge is shared and the better the outcome. Important to listen to all views and arrive at a consensus. Everyone relies on nature so everyone should be part of the solution. Participation reduces corruption and politicking. Participatory decision-making is the indigenous way.	16	"Of course it's important when the community participates. That's how you convince people to make decisions and reach agreements. To take care of the needs of each of the villages. Even if there is a lot of work to do, the important thing is the people, which are the holders of knowledge."
Distribution rules	In favor of per effort: Fairest rule. Hard work should be recognized. Would prevent free-riding. In favor of equal per capita: So there is no inequality. To reduce envy. To make everyone aware of the benefits of conservation. Because it reflects how traditional 'mingas' work. Against per unit of land: Not fair to offer more payments to the biggest land owners. Could cause problems (e.g. limits between neighbors are not always clear).	22 10 9	"I prefer to distribute per effort. Because otherwise we get spoiled, like children. We get used to receiving and receiving. But there comes a moment where we must also give back. We receive something but must give something in exchange. [...] Because sometimes the ones who work are not the ones that receive."
In favor of paying to conserve nature	People are poor and live from the land, so payment is necessary so they can keep making a living. Conservation is hard work that should be recognized. Payment will motivate many more people to conserve. Money is a necessary evil.	17	"It would be like telling people 'you are going to care for the environment and we're going to pay you.' Even though we all know that this is the responsibility of all the beings that inhabit the environment. And people think, 'from now on I'm going to make a business of this.' And I'm not okay with that. [...]"

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Against paying to conserve nature	Caring for the environment is a moral duty. Environmental benefits from conservation should be reason enough. Taking care of the environment should not be seen as a cost but rather as an investment. Money has made people lose their moral compass. Paying risks eroding traditional practices like the 'minga'. Paying for conservation will mean people do it for the wrong reason. Conservation should not become a business.	18	<i>The future of our environment should not depend on money. We used to go out and plant trees in 'minga' and nobody would pay us. Because it was our duty. But with PES people will now think, 'wonderful, I'm going to get paid!' [...] In reality it should be the opposite. It should be obligatory. The environment is life."</i>
Linking PES with indigenous terminology and concepts	Participants would often use indigenous terminology and concepts to discuss PES, such as: 'territory', 'mingas', 'mother earth', 'mother nature', 'indigenous authority', 'indigenous identity', 'chagras' (indigenous medicinal gardens), 'duty', talking about 'help' or 'support' rather than 'payments'.	19	<i>"I think the community itself should be in charge of it. Here we shouldn't be talking about forest rangers, who get paid to care for the forest. We are talking about communities, about organizations responsible for caring. Maybe we could talk about 'incentives', but not about 'payments'. As indigenous people this is our duty. We must take care, protect and watch over our resources without needing payment."</i>
Bequest value of nature	The environment must be protected for the children and for future generations to come.	11	<i>"If we receive some help all the better. Because it would only be an additional incentive. It would be recognition for the years that we've been protecting nature, for what we will leave to our children. Because we are only passengers on this planet."</i>