

1 **Uses, cultural significance, and management of peatlands in the Peruvian Amazon:**  
2 **implications for conservation**

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37 **Uses, cultural significance, and management of peatlands in the Peruvian Amazon:**  
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39

40 Abstract

41 Tropical peatlands play an important role in the global carbon cycle by acting as significant carbon  
42 stores. South America's largest peatland complex is located in the Loreto Region of the Peruvian  
43 Amazon. Here we present the first study of human relations with these peatlands, including their  
44 uses, cultural significance and current management, as well as implications for conservation, based  
45 on qualitative research with people living in two riverine rural communities. Our results indicate  
46 that peatlands are culturally ambiguous spaces, used mainly for hunting, palm fruit harvesting, and  
47 timber, but feared due to the dangers of getting lost, sinking into the 'sucking' ground, and being  
48 attacked by anacondas and/or mythical creatures. While the difficult terrain and remoteness of  
49 peatlands have thus far acted as natural barriers to their destruction through conversion to different  
50 land uses, overuse of natural resources is nevertheless a significant concern for people living in the  
51 peat-dominated landscape of the Peruvian Amazon, mixed with frustration about the lack of  
52 outside support to foster environmental conservation and economic opportunities. We explore  
53 how evaluations of the present situation differ across one indigenous and one *mestizo* community.  
54 We identify a range of nascent peatland conservation strategies, including seedling planting to  
55 regrow valuable (palm) trees, and the climbing of palm trees for harvesting fruit as opposed to  
56 felling them. We argue that peatland conservation could be combined with the development of  
57 sustainable management strategies, but that this would require sustained engagement by outside  
58 organisations with rapidly growing local communities in these areas.

59

60 Keywords

61 Amazon; conservation; environmental management; peatlands; Peru; Urarina

62

63 1 Introduction

64 Tropical peatlands play an important and, until recently, underappreciated role for the global  
65 climate system, due to their capacity to process and store large amounts of carbon (Rieley & Page  
66 2016). The largest known areas of peatland in the tropical latitudes are found in Amazonia,  
67 particularly in the Loreto Region of Peru (Draper et al. 2014; Lahteenoja et al. 2012), in Southeast  
68 Asia (Page et al. 2011), and the Congo Basin (Dargie et al. 2017). While Southeast Asian peatlands  
69 have been heavily affected by human uses and degradation (Dohong et al. 2017), South American  
70 and African peatlands are still comparatively intact, possibly due to the lower population density,  
71 continued availability of more suitable land for agriculture, and the comparatively higher cost of  
72 converting remote peatlands for agriculture, among others (Lilleskov et al. 2018; Roucoux et al.  
73 2017).

74 Nevertheless, very little is known about local people's relations with peatlands in the Peruvian  
75 Amazon as most research on human uses, management and conservation of tropical peatlands has  
76 focused on Southeast Asia (e.g. Medrilzam et al. 2017; Nath et al. 2017; Tachibana 2016; Thorburn  
77 & Kull 2015). Globally, people's relationships with peatlands are shaped not only by material uses  
78 of their natural resources (Page & Baird 2016), but also by their cultural status (Byg et al. 2017;  
79 Lehtinen 2000; Wilson 2018), which may have implications for their conservation and management.

80 Similarly, socio-economic factors play an important role in shaping human-peatland relationships  
81 (Dohong et al. 2017; Medrilzam et al. 2017; Tachibana 2016).

82 People living in remote and rural communities are often the principal actors shaping ecosystem  
83 management in their surroundings (Álvarez Alonso 2012; Berkes 2004; Fabricius et al. 2007;  
84 Waylen et al. 2013), yet their voices and perspectives are seldom heard in wider debates. Here we  
85 address this gap by engaging with the views of people living in peatland areas of Loreto, Peru,  
86 based on findings from semi-structured interviews and participatory mapping with local  
87 community members in two Amazonian communities, and site visits with local guides to  
88 neighbouring peatland areas. We examine the material and intangible values local people place on  
89 peatlands, the uses they make of them, the forms of management and implications for peatland  
90 conservation. In this paper, we define ‘local people’ as ‘people living in rural communities in the  
91 immediate vicinity of peatland areas’. Our findings are relevant to decision-makers from local to  
92 international scales, seeking to develop appropriate conservation and management strategies for  
93 tropical peatlands in the Peruvian Amazon and beyond.

94

## 95 2 Materials and methods

96 This is the first study to engage with local people’s views on the uses, cultural significance,  
97 management, and conservation of peatlands in Peruvian Amazonia. We thus followed an  
98 exploratory research approach, using multiple qualitative methods. Twenty semi-structured  
99 interviews with 27 inhabitants of a small indigenous community of about 150 inhabitants (near the  
100 Chambira River, Loreto Region) and 31 interviews with 35 interviewees in a *mestizo* community<sup>1</sup> of  
101 about 1,200 inhabitants (near the Tigre River, Loreto Region) were carried out by a team of four  
102 Peruvian and British researchers [anonymised for peer review] between March and April 2018 (see  
103 Figure 1 for the study location within the wider Pastaza-Marañón Basin). Given the absence of  
104 previous research on the topic, we chose to do research in two very different communities. This  
105 allowed us to explore the potential role of cultural differences, as well as variations in factors such  
106 as community size, history, integration into wider Peruvian society and economy, among others,  
107 for people’s relations with surrounding peatland areas. Both communities had been visited by  
108 members of the research team prior to our fieldwork, which we believe helped to establish the  
109 necessary trust to conduct effective research there.

110 [Insert Figure 1 around here]

111 The indigenous community is exclusively populated by members of the Urarina indigenous nation  
112 whose ancestors are likely to have lived in the area for centuries, although the exact location of the  
113 current community was only chosen about 30 years ago. Available infrastructure consists of a  
114 primary school and a church (each with their own small generator for electricity), a public speaker  
115 system, and a radio system to communicate with neighbouring communities. In contrast, the *mestizo*  
116 community was founded 85 years ago by (former) rubber tappers from a distant community  
117 elsewhere in the Peruvian Amazon, and is now inhabited by descendants of immigrants from many  
118 different parts of the Peruvian Amazon. Culturally, its inhabitants could thus also be classified as  
119 *riberaños* (Chibnik 1991), i.e. *mestizos* with cultural roots and significant environmental knowledge of  
120 the Amazon who have lived in the area for generations. Available infrastructure consists of  
121 generator-powered electricity for most of the community, a primary and secondary school, two

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<sup>1</sup> *Mestizo* - Spanish for mixed race, an ethnic category that can be traced back to the times of Spanish conquest, which nowadays has mainly cultural connotations about differences in ancestral knowledge and practices.

122 churches, a community hall, a public speaker system, mobile phone coverage, a health post, a police  
123 station, two concrete pavements, two (modest) hotels, and a number of corner shops. Neither  
124 community had running water or sanitation infrastructure.

125 Our sample of interviewees ranged in age from 18 to 80 years old, with 34 male and 17 female  
126 respondents who were interviewed in Spanish (with the exception of seven female interviewees in  
127 the Urarina indigenous community who were interviewed in Urarina with the help of a local  
128 translator). Most male respondents were small-scale subsistence farmers who also engaged in  
129 hunting and fishing. A majority was also active in the seasonal trade of *aguaje* palm fruit (*Mauritia*  
130 *flexuosa*), *chonta* or *huasaí* palm hearts (from *Euterpe precatoria*), and a few agricultural products such  
131 as manioc (processed as *fariña*). Many had worked for oil companies and sold timber in the past  
132 (timber harvesting was ongoing in the *mestizo* community). A minority had additional professions  
133 with an associated monetary income, e.g. as school teacher, carpenter, or small-scale retailer.  
134 Female interviewees also worked in small-scale subsistence agriculture and fishing, and were  
135 primarily in charge of childcare, cooking, collecting firewood, washing clothes, and production of  
136 textiles. In the *mestizo* community, some female interviewees also worked in the trade of *aguaje* palm  
137 fruit and in retail.

138 Semi-structured interviews covered four main themes, namely (1) natural resource use (e.g. game  
139 species, palm fruits, timber trees or fish); (2) classification of the environment surrounding the  
140 communities into different ecosystems (see Authors 2019 for an overview of Urarina indigenous  
141 ecosystems, and Halme & Bodmer 2007 for an overview of some of the ecosystems recognised by  
142 *mestizos* in the northern Peruvian Amazon); (3) cultural and mythological importance of certain  
143 ecosystems, especially those likely to have peat-rich soils; and (4) environmental governance,  
144 including past, present, and potential future strategies for the conservation and management of  
145 areas surrounding communities, again with a particular focus on peatland ecosystems. All  
146 interviews were recorded and transcribed in Spanish, and analytical categories within the interview  
147 transcripts were coded with NVivo 11 to facilitate the qualitative analysis.

148 As part of the semi-structured interviews, research participants were asked to locate resources,  
149 locally defined ecosystems, and areas that they personally travel to on A3-size maps of the areas  
150 surrounding the two communities. Additionally, one community-scale workshop was conducted  
151 per community, with about 50 attendants each, to perform a participatory mapping exercise with  
152 large A0-size maps (which showed, as a starting point, only the location of the community and the  
153 main rivers and streams). The benefits of participatory mapping for safeguarding traditional  
154 ecological knowledge, strengthening territorial rights of local communities, and supporting  
155 environmental conservation have been well documented (Gilmore & Young 2012; Ramirez-  
156 Gomez et al. 2013). Moreover, this method can serve as a vehicle to start conversations about uses  
157 and management of the environment, beyond merely locating resources and areas on a map. Not  
158 least, participatory mapping is also an enjoyable activity for research participants, which can serve  
159 as a tool for education within communities when knowledgeable community members share their  
160 experiences about the local geography (Young and Gilmore 2013). Further information on peatland  
161 uses and management was gathered during a total of six site visits to neighbouring ecosystems and  
162 areas likely to be peatlands with local community members in both locations.

163

### 164 3 Uses, cultural significance, and management of peatlands in the Peruvian Amazon

165 Given that respondents were not familiar with peat as a type of soil, we relied on various proxy  
166 indicators to identify peatland areas around communities, such as the colour of soils and their

167 porewater (i.e. dark brown to black); ‘sinkiness’ of the ground (i.e. area where one sinks in easily);  
168 amount of water in the soil (i.e. permanently waterlogged areas); and, occasionally, vegetation  
169 appeared to be an indicator (i.e. areas where trees are shorter than usual; where there are only  
170 grasses and sedges). We were also able to visit local ecosystem types whose descriptions matched  
171 those characteristic of peatlands, based on information gained from the individual semi-structured  
172 interviews and participatory mapping exercises, and presence/absence of peat was further verified  
173 by probing with a pole.

174 In the indigenous community, two local ecosystem types known as *jiiri* and *alaka* are likely to be  
175 typically associated with peat (see Authors 2019). In the *mestizo* community, the waterlogged areas  
176 likely to be peatlands were often identified as ‘ugly’ areas, classified into *aguajal chupadera* (*Mauritia*  
177 *flexuosa* palm swamp with soft and wet ground), *aguajal raiçal* or *aguajal champal* (*Mauritia flexuosa*  
178 palm swamp with comparatively firm ground where roots cover the soft and waterlogged soil),  
179 *aguajal varillal* (*Mauritia flexuosa* palm swamp with many short and thin trees; note that *varillal* by  
180 itself also exists as a vegetation category in common usage, and can be translated as ‘pole forest’  
181 *sensu* Draper et al. 2014 or Laumonier 1997), and *piripiral* (sedgeland with very soft ground and  
182 lacking trees). Use of terms varied between individual respondents, with *aguajal chupadera* (i.e.  
183 ‘sucking’ *aguajal*) being the most common term to refer to areas that we identified later as having a  
184 peat substrate. *Aguajal chupadera* and *piripiral* were regularly identified as ‘particularly ugly’ areas (i.e.  
185 “*allá es feísimo*”, in Spanish), given the great difficulty walking on the soft, waterlogged soil typical  
186 of peatlands. In contrast, some respondents described areas with firm ground as ‘beautiful areas’  
187 (i.e. “*allá es lindo*”, in Spanish). *Piripirales* (sedgelands) were also associated with ‘dead lakes’ (*cochas*  
188 *muertas*) in the *mestizo* community, with a special cultural status (see section 3.2 below). For an  
189 overview of local peatland terminology, uses, cultural significance, and current management and  
190 conservation strategies in the two studied communities, see Table 1.

191 [Insert Table 1 around here]

192

### 193 3.1 Uses of peatlands

194 People in the Peruvian Amazon do not use peat itself. Nevertheless, peatland areas provide  
195 livelihoods and economic income to local people indirectly, through the plant and animal resources  
196 that can be found there. A number of resources are collected primarily for subsistence and personal  
197 consumption, most notably meat from terrestrial mammals (e.g. tapir, peccary, agouti), monkeys  
198 (e.g. howler, squirrel monkey, monk saki), reptiles (e.g. caiman, tortoise), and birds (e.g. Spix’s guan,  
199 great tinamou). While these animals can be found in peatland areas, most can equally be found in  
200 non-peatland areas, with tapirs and caimans most commonly mentioned as typical game species of  
201 peatland areas specifically. There was some limited intra-community trade of meat in the *mestizo*  
202 community, but not in the (much smaller) indigenous community. Further non-commercial  
203 resources found in peatlands, e.g. the leaves of the *shebón* palm tree (*Attalea butyracea*) used for  
204 traditional roofs (although these are increasingly replaced by corrugated metal roofs), and the fibre  
205 of *aguaje* palm trees (*Mauritia flexuosa*) used by members of the indigenous community to produce  
206 traditional textiles, were also important. Some respondents also mentioned limited harvesting of  
207 palm fruit from several palm tree species for personal consumption, such as *ungurahui* (*Oenocarpus*  
208 *batabua*) or *aguajillo* (*Mauritiella armata*) (see also Smith 2015). As with animals, these plant resources  
209 are not exclusive to peatland areas, although relatively common there.

210 Economically important products include fruit from the *aguaje* palm tree (Horn et al. 2018), and  
211 palm hearts from the *huasá* or *chonta* palm tree (*Enterpe precatória*) (Paniagua-Zambrana et al. 2017),

212 which members of both communities regularly harvested to sell to travelling traders. In the *mestizo*  
213 community, there was a simple commercial value chain whereby a network of intermediaries would  
214 buy these products from other community members and sell them in bulk to traders from Nauta  
215 and Iquitos (the two closest towns in the northern Peruvian Amazon). Due to the strong economic  
216 importance of this trade, one community member called their community by the nickname “*The*  
217 *capital of aguaje*”, although *aguaje* trade occurs on similar scales elsewhere in the region (Horn et al.  
218 2018). Both *aguaje* fruit and *chonta* palm hearts are typically harvested by felling palm trees during  
219 the harvesting season, which lasts several months of the year. While *aguaje* palm trees do not need  
220 peat to grow, they are extremely common in areas with a persistently high water table and frequently  
221 form monodominant stands (locally known as *aguajales*, see Endress et al. 2013), which often overlie  
222 peat in this area (Freitas Alvarado et al. 2006).

223 Finally, wood and timber products were also harvested from peatland areas, mostly for personal  
224 use, and in the *mestizo* community, for trade and monetary income as well (in the indigenous  
225 community, timber harvest and trade ceased about five years previously). The most frequently  
226 mentioned species was *cumala* (*Virola* sp.); further timber species mentioned were e.g. *moena* (which  
227 may refer to several species of the *Lauraceae* or laurel family), *shiringa* (*Hevea brasiliensis*; rubber tree),  
228 *lagarto caspi* (*Calophyllum brasiliense*), although several interviewees commented that trees from  
229 peatland areas might have less durable wood of lower quality than from non-peatland areas. Beyond  
230 these timber tree species, stems of smaller trees typical of peatland palm swamps and pole forests  
231 were occasionally used as poles for construction (especially in the indigenous community), e.g.  
232 *punga* (*Pachira brevipes*). *Remo caspi* (*Aspidosperma rigidum*) was mentioned as a source of firewood in  
233 the *mestizo* community, despite traditionally being favoured for making oars (*remo* = oar). It should  
234 be noted, however, that *remo caspi* was more strongly associated with low-lying areas in general  
235 (*bajiales*), which may not necessarily be peatlands.

236

### 237 3.2 Cultural significance of peatlands

238 While peatlands themselves are not recognised as such by members of the two communities, the  
239 ecosystems typically associated with peat had a special cultural status among indigenous and *mestizo*  
240 respondents alike. In the Urarina indigenous community, the *jiiri* and *alaka* [peatland] ecosystems  
241 were considered to be the home of a mythical creature, the guardian spirit *Baainu*, who may trick  
242 people into losing their way (see Authors 2019 for a detailed discussion), with some similarities to  
243 forest guardian spirits elsewhere in the Amazon more broadly (see e.g. Smith 2015). They were also  
244 of special cultural importance as the source of *aguaje* fibre for textile production. *Aguaje* textiles play  
245 a central role in Urarina cosmology and their creation myth, which includes an element in which  
246 a ‘wise’ woman is identified by her ability to weave *aguaje* palm-fibre cloth (Dean 1994). In the  
247 *mestizo* community, many guardian spirits were known, too, most commonly under the name  
248 *Yashingo* (other names used were *Chullachaqui*, *Sacharuna*, *Shapshico*, *Yacumama*, or simply *madre*  
249 [mother] or *dueño* [owner]), but most of these were not specific to peatlands as a broader ecosystem  
250 category. Instead, some *madres* or *dueños* inhabit specific individual lakes and their surroundings,  
251 which is a common pattern in Amazonia more broadly (see e.g. Mezzenzana 2018; Ricopa Yaicate  
252 2009).

253 Some of these lakes belonged to a category locally known in the *mestizo* community as *cocha muerta*  
254 (dead lake). Based on respondents’ descriptions, it appears that the areas around ‘dead lakes’ could  
255 have peat substrates. These were described as sedgelands (*piripirales*) or grasslands (*hierbales*) with  
256 “very ugly” soil, where one can sink in to an extent that it poses a risk of drowning. Trees were  
257 either absent or much shorter than usual, with the most common tree species being *renaco* (*Ficus* sp.

258 or *Coussapoa* sp.). In the wider surroundings, *aguaje* might be found as well. All respondents familiar  
259 with dead lakes also noted an abundance of aquatic plants such as *rayabalsa* (*Montrichardia arborescens*)  
260 and *huama* (*Pistia stratiotes*), i.e. their surface is usually covered by vegetation. The water of dead  
261 lakes was described as follows: “The water is brown [...], like [Coca Cola], extremely ugly, like  
262 when you mix a soft drink with milk, [...] a very thick water” (male respondent, *mestizo* community,  
263 27 years). Contrary to their name, dead lakes are actually full of fish, and game species such as river  
264 turtles, tapirs, and monkeys can comparatively easily be found nearby, which is why a minority of  
265 settlers still visit them, despite being fearful.

266 Theories about the origin of the name ‘dead lake’ varied, with some attributing it to the lack of  
267 trees, and others citing their calmness which resembled a genuinely dead lake. It seems possible  
268 that the name for these comparatively remote lakes and ponds is as much related to their cultural  
269 status as taboo areas inhabited by particularly powerful and irritable ‘mothers’ and ‘owners’, as to  
270 the actual risk of death by attacking anacondas or caimans, or sinking into the soft ground. The  
271 ‘mothers’ of dead lakes can be angered easily by any sort of noise, such as from rifles used for  
272 hunting or boat engines, and will retaliate with instant thunderstorms. Such ‘mothers’ often take  
273 the shape of anacondas, and respondents noted being particularly fearful of anaconda attacks in  
274 dead lakes. Reportedly, these are also the home of giant black caimans with lengths of up to 12  
275 metres. Also, the *renaco* trees growing near dead lakes possessed a special mythological role. Several  
276 respondents reported that felling a *renaco* would lead to the death of the person in question and  
277 their entire family, which effectively protected *renacos* from the timber trade. The degree to which  
278 community members believed in supernatural phenomena differed widely, and descriptions of dead  
279 lakes were not uniform either. Interestingly, such beliefs were sometimes held in parallel to  
280 Christian beliefs, introduced through missionary activities and maintained by two evangelical  
281 churches in the *mestizo* community.

282 In the *mestizo* community, other types of ecosystems likely to be peatlands (i.e. the various types of  
283 *aguajal* mentioned above) did not appear to have a similar cultural significance for local mythology  
284 as dead lakes. Nevertheless, through their strong *socio-economic* importance as the source of *aguaje*  
285 fruit, they still had a great influence on everyday life in the community, and in this way, on local  
286 culture. Indeed, the *aguaje* palm tree could be understood as a cultural keystone species in the sense  
287 proposed by Garibaldi and Turner (2004), with great importance for ecology and local culture alike.  
288 For example, the *aguaje* harvest is a very important element of the community’s seasonal calendar  
289 and, at harvesting times, would dominate community life. Nevertheless, most respondents also  
290 emphasised (and maybe lamented) the physically difficult environment in which *aguaje* grows. This  
291 difficult environment tends to shape peatlands’ perceptions as culturally ambivalent spaces in Peru  
292 (Authors 2019) as elsewhere around the globe (Boaden 1981; Byg et al. 2017; Lehtinen 2000;  
293 Wilson 2018).

294

### 295 3.3 Current management and conservation of peatlands and potential threats

296 Neither of the two communities studied had specific management practices in place for peatlands.  
297 If anything, the cultural taboos surrounding dead lakes in the *mestizo* community, and fear of the  
298 *Baainu* in the Urarina community, may act as (weak) indirect incentives for environmental  
299 conservation of some peatland areas specifically. Nevertheless, both communities had local  
300 agreements in place with a view to conserving their natural resources, including those in peatlands,  
301 which were complied with to varying degrees.

302 The most effectively implemented strategy to conserve natural resources concerned their  
303 protection against outsiders. Any non-members of the community caught fishing, hunting, or  
304 harvesting timber inside the community territory would be sanctioned, either with verbal warnings,  
305 fines, temporary detention, or confiscation of their equipment and boat engines. In the larger  
306 *mestizo* community, a police post was in place to take care of any potentially illegal activities by  
307 outsiders, mostly by monitoring river traffic day and night. The indigenous community also had  
308 agreed on a ban on using poison for fishing, which is a very effective, but unsustainable traditional  
309 fishing method. While this is illegal according to Peruvian law, people in both communities were  
310 generally only aware of the regulations agreed within their own local governance systems.

311 These community agreements were framed by respondents as the result of community deliberation  
312 and self-governance, but also appeared to be strongly related to the initiative of incumbent local  
313 leaders, who in turn may have been influenced by interacting with state authorities, NGOs, and  
314 other institutions (see e.g. Cossío et al. 2014). Both communities used a dual governance system  
315 typical for indigenous communities, in which indigenous leaders (officially known as *apu* and *vice-*  
316 *apu*) and state-recognised leaders (known as *teniente gobernador* and *agente municipal*) would be elected  
317 by community members and govern collaboratively. In the indigenous community, there was also  
318 a *madre indígena* ('indigenous mother') who represented women's concerns specifically. This position  
319 has been developed relatively recently as a result of state and other outside demands for better  
320 representation of women's interests and needs in indigenous communities. These demands were  
321 passed to communities via indigenous federations, which in turn unite representatives of several  
322 communities within a certain geographical area. However, most major decisions would be taken by  
323 the community as a whole, and both communities had a formal register of decisions taken, signed  
324 by all attending community members. The local police post of the *mestizo* community was  
325 established due to lobbying of the state authorities by local leaders, following an incident in which  
326 a group of criminals murdered a member of the community and injured two others (the reason for  
327 the incident remained obscure, but might have been related to drug trafficking; see Perú21 2012).

328 Both communities had also formally agreed to limit their use of natural resources through the local  
329 governance system, including fish, meat, and timber, but compliance was mixed at best. In the  
330 *mestizo* community, a monthly limit on selling fish had been agreed, but different respondents cited  
331 different figures (between 20 kg and 50 kg/month/family), and many openly admitted that non-  
332 compliance with this rule is the norm. This was mostly attributed to the lack of alternative sources  
333 of livelihoods, the need to provide for one's family, and, when referring to other people's behaviour,  
334 their indifference to environmental conservation (in the sense of a symptom of the broader  
335 undesirable character trait of carelessness). In the indigenous community, a former local authority  
336 had brokered a temporary agreement among community members during his tenure, to stop all  
337 commercial timber harvesting activities to let trees regrow (possibly related to the presence of an  
338 environmental NGO in the community at the time, see Cossío et al. 2014), which seemed to be  
339 complied with. However, some respondents suggested that this was entirely due to the recent  
340 appearance of alternative economic opportunities, in the form of employment in the maintenance  
341 of a local oil pipeline corridor (conversely, the former local authority cited the agreement as a local  
342 environmental management success). Thus, experiences in both communities highlight the need  
343 for diversifying conservation strategies beyond simple resource use bans, which may also  
344 disproportionately affect the most marginalised community members, given that these typically  
345 lack alternative livelihood strategies.

346 Despite the problems with community-level environmental management strategies, almost all  
347 respondents noted the need to protect natural resources to ensure the sustainability of local  
348 livelihoods. Concerns about resource depletion and ecological change, including in areas which we



349 identify as likely to be peatland areas, were common in both communities but much more  
350 pronounced in the *mestizo* community. While in the indigenous community some respondents  
351 commented on the disappearance of commercially valuable timber species such as mahogany  
352 (*Swietenia macrophylla*, known as *caoba* in local Spanish) or *cedro* (*Cedrela odorata*) in the past few decades,  
353 there was no sense that survival of the community and traditional livelihood strategies (hunting,  
354 fishing, small-scale farming) were at stake. In the *mestizo* community, however, there was a sense of  
355 doom about disappearing natural resources, i.e. fish, game species, and *aguaje*, which was often  
356 related with the (possibly idealised) abundance of the past:

357 “Here we used to have a lot of fish... if you pointed a torch at the river at low water  
358 levels, the eyes of the caimans were shining like electric light [...] just here at the mouth  
359 of the Tigrillo River, you could see the *fasacos* [*Hoplias malabaricus*, a local fish species]  
360 on the river margins, we did not care, they appeared to be [as abundant as] wooden  
361 sticks. [...] Same thing with the *aguaje*, you used to find it right here, but nowadays  
362 people have to walk the whole day to harvest two, three, four bags... they started  
363 destroying right here [...] and they continue destroying until today.” – male respondent,  
364 *mestizo* community, 72 years

365 Overall, overuse of natural resources, caused by the lack of alternative livelihood strategies and  
366 population growth, was the most common threat identified by members of the *mestizo* community.

367 While community-level conservation strategies appeared to be difficult to enforce, individual  
368 members of the *mestizo* community had developed their own environmental management strategies  
369 to address unsustainable *aguaje* harvesting practices (this also echoes comments e.g. by Waylen et  
370 al. 2013 about the importance of recognising intra-community differences in conservation). This  
371 has important implications for peatland conservation, given that *aguaje* mostly grows in peatlands  
372 in the Pastaza-Marañón Basin, and degradation of *aguaje* stocks may reduce the carbon storage  
373 function of *aguaje*-dominated peat swamp forests (Bhomia et al. 2018). These can be roughly  
374 grouped into three broad themes: (1) climbing, rather than felling, *aguaje* palm trees for harvesting  
375 the fruit; (2) planting of *aguaje* seedlings to restore depleted areas; (3) identification of alternative  
376 monetary income strategies. The first two strategies are closely related given that at present,  
377 climbing palm trees is only possible indirectly, where other trees are planted next to *aguaje* palm  
378 trees to act as a ladder. Other trees have branches that can be used for climbing, unlike the single-  
379 stem *aguaje* palm trees, which also grow very tall when mature, making them impossible to climb  
380 without suitable specialist equipment (not known in the community prior to our fieldwork).  
381 Considering time spans of between seven to nine years for *aguaje* to bear fruit for the first time  
382 (González Coral & Torres Reyna 2010), planting seedlings requires a relatively long-term vision,  
383 but was portrayed as worth the effort by the small minority of community members who engaged  
384 in it:

385 “I have planted [*aguaje* palm trees] right here [in my orchard]. Now this takes away my  
386 stress when sometimes I don’t have money, I sell some [*aguaje* fruit] and I get money.  
387 I tell people from here, if you don’t have [money], it’s because you don’t plant [*aguaje*],  
388 it’s really because you don’t want to.” – female respondent, *mestizo* community, 69 years

389 Similarly, felling of *aguaje* palm trees was occasionally described as an income strategy of last resort:

390 “I feel sad felling *aguajes* [...], because sometimes when you fell an *aguaje* [...],  
391 sometimes it is full of fruit, and the next year it’s not going to be there. [...] That’s why  
392 I hardly go... only when I don’t have work here I might sometimes go there [to harvest  
393 *aguaje*].” – male respondent, *mestizo* community, 33 years

394 The same respondent also noted having trained as a carpenter to avoid relying on harvesting natural  
395 resources for his monetary income, and had planted several *aguaje* palm trees in his orchard so that  
396 his children would have a sustainable supply of *aguaje* in the future. Other parents were hoping for  
397 their children to study and train as teachers, nurses, and other professions so that they would not  
398 have to rely on the dwindling natural resources of their community.

399 In the indigenous community, there had been some planting of seedlings of timber species by an  
400 environmental NGO in the past (see Cossío et al. 2014: 11-12), which was generally welcomed by  
401 community members at the time. They had also received some training in environmental  
402 management. Yet, not long after the NGO left, replanting activities were discontinued, indicating  
403 a need for sustained support if communities are to obtain a benefit from external involvement in  
404 resource management (Davies & White 2012).

405 Despite the numerous obvious benefits of planting (*aguaje*) seedlings, this strategy also comes with  
406 a number of challenges. Planted seedlings would be considered as economically valuable  
407 investments by those planting them, potentially requiring the allocation of more formal land use  
408 rights if this was taken up on a larger scale. At present, community members are typically free to  
409 cultivate any unoccupied land they find available, subject to approval by the community. Large-  
410 scale monoculture plantations of *aguaje* would likely not be viable due to the species' susceptibility  
411 to numerous pests and diseases (Smith 2015). And not least, it is a dioecious palm species, i.e. it  
412 takes years to find out whether seedlings are male or female, a problem reported by several  
413 interviewees. Expert guidance suggests that the best way to deal with this uncertainty is to adopt a  
414 long-term perspective, which involves gradually replacing male trees with new seedlings, which will  
415 then increase the share of female trees over time (González Coral & Torres Reyna 2010). Further  
416 recommendations for *aguaje* management include felling older trees, which may not be as  
417 productive, to accelerate the growth of younger, fruit-carrying trees; as well as letting some fruit-  
418 bearing branches fall to the ground, to allow natural dispersal of seeds via *aguaje*-consuming animals  
419 (Aquino 2005).

420

#### 421 4 Implications for conservation

##### 422 4.1 Cultural and ecological degradation as a related process

423 As noted e.g. by Pröpper and Haupts (2014), culture and ecology are often closely linked among  
424 people living in remote rural settings, to an extent that culture does not exist separately of the  
425 natural landscapes that people rely on for their (subsistence) livelihoods. It follows that ecological  
426 degradation may go along with cultural degradation and vice versa. In the two studied communities  
427 (i.e. both indigenous and *mestizo*), such processes seem evident as well. Several respondents  
428 commented that formerly resource-rich areas used to be populated by numerous 'mothers' and  
429 spirits, which might attack humans; see for example, the following vivid description of the turbulent  
430 past of a major lake near the *mestizo* community (which here emphasises spiritual and mythological  
431 aspects of culture):

432 "You could not go to that lake. You arrived there and would hear a loud noise, thunder,  
433 rain, you could not enter, its water boiled. That is what my grandfather told me [...].  
434 'Son, when I arrived there, immediately lightning would strike, it was a very rough lake.'  
435 The Supay [River] as well, because of the anacondas. That's what my grandfather told  
436 me when I used to walk around with him. The entire area was very rough." – male  
437 respondent, *mestizo* community, 36 years

438 However, such fighting back by ‘mothers’ and spirits via (super-)natural phenomena (sudden  
439 thunderstorms; anaconda attacks) was said to disappear as more and more humans visited an area  
440 to hunt and fish. While the noise of boat engines would initially anger the ‘mothers’, persistent  
441 disturbance would eventually make them flee, just like game species and fish. A fully degraded area  
442 would be empty of spiritual beings as well, suggesting a particularly close link between ecology and  
443 culture.

444 In the indigenous community, there was evidence for such linkages as well. For example, some  
445 younger people would consider traditional ecological knowledge, as well as knowledge of cultural  
446 traditions and customs, as being beyond their expertise, and would try to redirect our queries to  
447 the two oldest male community members. Other cultural-ecological traditions were still maintained  
448 to some degree, for example the practice of using *agnaje* fibre for textile production. This is of  
449 strong cultural importance to the Urarina, given e.g. the central role that *agnaje* textiles occupy in  
450 everyday culture and their creation myth (Dean 1994), as mentioned in section 3.2.

451 Nevertheless, while under threat, cultural and ecological knowledge was still better conserved in  
452 the indigenous community than in the *mestizo* community, as evidenced by the continued practice  
453 of producing *agnaje* textiles among the Urarina, for example (see further examples below). This is  
454 maybe not surprising, as their ancestors had lived in the area for centuries and most community  
455 members would not usually leave the area, except for community leaders and their families. Family  
456 links were exclusively with other Urarina communities in the region. In contrast, the *mestizos* had  
457 been present for 85 years at most and their ancestors originated from many different areas (as far  
458 away as Portugal) and had family all over Peru (and beyond, with one respondent mentioning her  
459 cousin visiting from the US). In the 31 interviews conducted there, 53 different towns and  
460 settlements were mentioned where people had travelled or knew someone (without this being an  
461 explicit focus of our research).

462 Such different levels of cultural and ecological knowledge have significant environmental  
463 management implications, including for peatland areas, as also noted by Paniagua Zambrana et al.  
464 (2007). Where cultural traditions erode, for example through integration into mainstream Peruvian  
465 society, this may create challenges for environmental conservation, whereas the conservation of  
466 traditional practices can be beneficial to prevent ecological degradation. For example, it appears  
467 that the Urarina tradition of moving community locations from time to time (described also by  
468 Kramer 1979) is a suitable strategy to cope with resource ‘depletion’ in a certain area, which is still  
469 being practiced today. As mentioned above, the indigenous community we visited had only been  
470 in their current location for about 30 years. And earlier in 2018, a neighbouring community had  
471 also changed their location, in this case from a smaller tributary to the shores of the much larger  
472 Chambira River. In fact, Urarina hunters or fishermen do not appear to be particularly selective  
473 when choosing which animal or fish to catch. Thus, one could imagine a similar dynamic of gradual  
474 disappearance of natural resources to occur over the longer term, as described in the *mestizo*  
475 community, which would then be mitigated by moving location.

476 While from an ecological point of view, moving an entire community may be beneficial, it can  
477 create legal problems. The Peruvian state is slow to recognise such moves and land titles are usually  
478 fixed to a certain territory – indeed the Urarina community we visited was still lobbying to have  
479 their new location officially recognised through an enlargement of their territory, which still only  
480 covers the area around their previous location. The state may also be reluctant to concede  
481 comparatively valuable non-wetland territory to communities, given that the Urarina usually settle  
482 in small dry patches surrounded by wetlands, including peatlands. Many other Urarina communities

483 in the region do not have any legal recognition at all and are thus simply ignored by the state  
484 (Walker 2013).

485 Strong solidarity between community members, expressed for example by sharing meat and fish  
486 (Álvarez Alonso 2012) is another important traditional Amazonian strategy to cope with food  
487 insecurity, which is inherent to a subsistence lifestyle that is based on hunting and fishing. These  
488 practices were present in the indigenous community where no shops existed and monetary  
489 exchange was only practiced with non-community members, if at all. In the *mestizo* community,  
490 sharing of food and natural resources also existed to help those less well off, but a clear tendency  
491 towards market transactions was evident from the existence of several shops, as well as from  
492 comments about trade between community members:

493 “Here we have a tariff for selling meat to each other, it is very well established. We  
494 have our norms well thought out. For example for the meat, we charge each other 4  
495 soles when it is fresh, and 4.5 soles when it is dried.” – male respondent, *mestizo*  
496 community, 57 years

497 Similarly, if the inhabitants of the *mestizo* community were to disperse and move to different  
498 currently uninhabited areas, it is possible that they could start subsistence hunting, farming, *aguaje*  
499 harvesting, and fishing afresh, in order to let populations recover at their current location. Yet, we  
500 would argue this is unlikely to happen as they do not share the same traditions as their indigenous  
501 counterparts. Going forward most inhabitants of the *mestizo* community seem to favour integration  
502 into the wider Peruvian economy over continuing with subsistence livelihoods. The practical  
503 challenges of achieving this type of economic development in the *mestizo* community could  
504 potentially generate and exacerbate intra-community conflict, as well as an increasing sense of  
505 desperation among local people and strong expectations of support from visiting outsiders, state  
506 institutions, NGOs, business, and research (see following section).

507

#### 508 4.2 Peatland science and implications for conservation

509 As might have been expected, our research has shown that peatlands as a particular landscape  
510 category are not of concern to local people in the Peruvian Amazon. Even among university-  
511 educated Peruvians elsewhere in the country, only some specialists would be familiar with the  
512 Spanish term for peatlands (*turberas*), because peat has had no historic uses in Peru, unlike in many  
513 other countries (Braadbaart et al. 2012; Cruickshank et al. 1995; Gapsalamov 2015). Nevertheless,  
514 our research has also shown that peatlands are sufficiently distinct and recognisable to potentially  
515 allow local or collaborative management of these areas, and that there are local terms for  
516 ecosystems that are typically or frequently associated with peat.

517 Respondents in both communities suggested that these areas could be protected by temporary bans  
518 on the use of certain natural resources, the planting of seedlings of commercially valuable (palm)  
519 trees, including *aguaje* and *cumala*, and the creation of alternative economic opportunities. While the  
520 origin of the ideas for these conservation strategies is unclear, they may have been informed to  
521 varying degrees by previous interactions with environmental NGOs, state development institutions,  
522 commercial actors, and academic researchers, who have been active in the region for decades  
523 (Schleicher et al. 2017; Zinngrebe 2016), not least in the very large and relatively near Pacaya-  
524 Samiria National Reserve (see Figure 1; Kilbane Gockel & Gray 2009). In the *mestizo* community,  
525 several respondents also suggested that commercial agriculture could replace subsistence farming,  
526 fishing, and hunting in the future once local fish and game species were depleted. Given the poor

527 soils and seasonal flooding regime, this may not prove to be practical, however, and experience  
528 elsewhere in the Amazon also shows that such shifts from subsistence to commercial agriculture  
529 often lead to displacement and marginalisation of the original small-scale farmers (Ioris 2017).

530 The desire for alternative monetary income sources was especially pronounced in the *mestizo*  
531 community where, overall, there was clearly a joined-up understanding that environmental  
532 conservation was inseparable from the underlying issue of insufficient economic opportunities for  
533 community members (even if levels of concern for environmental conservation differed  
534 considerably between respondents). This was to be achieved through combining conventional  
535 economic development with better assistance from state authorities, NGOs, and international  
536 donors. The most frequently mentioned option to create jobs was to build a processing factory for  
537 *aguaje* fruit in the community, an idea which had reportedly been mooted by Korean investors in  
538 the past, and remained popular even after the investors disappeared. It would be essential, however,  
539 to combine this with verified sustainable harvesting practices to avoid increasing pressure on  
540 already degraded *aguajales*. Nevertheless, processing of sustainably sourced *aguaje* fruit would relate  
541 well with the idea of peatland conservation, given that *aguaje* is common in peatland areas in the  
542 Peruvian Amazon (Freitas Alvarado et al. 2006).

543 Conservation of peatlands is a science-driven endeavour, in the sense that without the recent efforts  
544 to quantify carbon storage capacities of Peruvian tropical peatlands (Draper et al. 2014; Lähteenoja  
545 et al. 2012), peatland conservation would not be on any environmental management agenda in Peru.  
546 This makes peatland scientists, voluntarily or not, one of the key actors in any debates on peatland  
547 conservation, both with local, national, and international stakeholders, as well as with local people  
548 in peatland areas. The need for peatland scientists to reflect on peatland conservation has also  
549 motivated the present study. Having identified the magnitude of carbon storage in Peruvian  
550 peatlands (Draper et al. 2014; Lähteenoja et al. 2012), lobbying for their conservation to avoid  
551 negative implications for the global climate seems to be a logical next step, even if it is often difficult  
552 to be heard by relevant decision-makers.

553 Among local community members, Peruvian and especially international scientists are often  
554 perceived as potential development workers, a role that they are then forced to engage with, if only  
555 to explicitly reject it. For example, one respondent (a former community leader) suggested the  
556 introduction of what, for scientists, would be termed as a type of Payments for Ecosystem Services  
557 (PES) scheme (which already exist elsewhere in the Pastaza-Marañón Basin, see e.g. Roucoux et al.  
558 2017 for a summary of a carbon-based conservation initiative of the Green Climate Fund<sup>2</sup>). In a  
559 long narrative indicating his experience with the wider framing of development and conservation  
560 initiatives in the region, he explained the need for developed countries such as Scotland to pay  
561 community members for conserving peatlands and palm swamps:

562 “Previously, there was a project here in Peru, [...]. We heard that foreign countries  
563 were sending money to every family of a village, and they all had a limited area, of  
564 about ten or twenty hectares to look after, let’s say, where they had to plant trees. But  
565 there were conditions for having this salary, planting and conserving trees, [...], and in  
566 return, they went to the bank to get their payment [...]. We heard about this [project]  
567 in Nauta, and we asked ourselves, why did they not come to Nueva York [i.e. the  
568 *mestizo* community]? [...] It is always like that, you go there [to the regional authorities  
569 in Nauta] and they say a project is coming, but they cheat you and it actually doesn’t  
570 come. [...] And then [when you return to Nauta] the project is completed already. [...]

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<sup>2</sup> More information is available here: <https://www.greenclimate.fund/projects/fp001>

571 Then they say, we are going to extend the project, but *pucha*, we don't know what's  
572 happening, we haven't seen anybody. [...] Several communities were going to be part  
573 of this, but nothing happened.

574 [...]

575 Scotland is a developed country, right? [...] I would like to suggest, [...] this idea that  
576 I have, maybe you could take it to your country: a project [like the above], [...] about  
577 reforestation, [...] that way we would have had a way to sustain ourselves, we wouldn't  
578 be cutting neither the *aguaje* palm trees nor the *chonta* palm trees, nor the timber trees,  
579 all that. It might already not be for our own benefit, but for the future generations that  
580 are coming.” – male respondent, *mestizo* community, 53 years

581 Such (perhaps overly ambitious) demands for foreign intervention are not uncommon when  
582 foreign researchers visit remote rural communities (see e.g. Staddon 2014; Townsend 1995).  
583 Nevertheless, these are often difficult to navigate on the ground even when prior consultation and  
584 the parameters for engagements and desired outcomes for communities have been agreed between  
585 all parties. An example of this occurred in a previous scoping visit for this project when the  
586 researchers suggested that the project could facilitate a palm tree climbing workshop with  
587 community members, in which they would learn how to climb *aguaje* palm trees, rather than cutting  
588 them, for harvesting fruit. (This approach has numerous ecological and economic benefits, and  
589 strongly enhances sustainability of *aguaje* fruit trade [Smith 2015]). At the time of prior consultation,  
590 in a meeting attended by 50 adults (21 women/29 men), the community had seemed strongly  
591 supportive of this idea. When it came to implementing the workshop, however, attendance was  
592 very low (it proved popular mostly with children and adolescents). Of course, low turn-out in such  
593 contexts usually has a range of explanations (Cheng & Mattor 2006; Davies & White 2012;  
594 Messerschmidt 2007). In this particular case, timing may well have been an issue as people were  
595 rushing to save their manioc harvests from being flooded by unexpected rises in the river at that  
596 time.

597 Yet, it is also important to recognise the legacies of the experience of past projects on undermining  
598 trust. Local people reported their negative memories of NGOs, government entities, businesses,  
599 and others disappearing without a trace after announcing grand development plans (e.g. building  
600 an *aguaje* processing factory). They mentioned their time being wasted by ineffective programmes  
601 like teaching vegetable production and then handing out low quality seeds unsuitable for local soils.  
602 Others cited how their money had been stolen in different ways – for example a monetary  
603 investment was required to participate in an initiative but the programmes were never completed  
604 or their payments disappeared via corrupt channels including, in some cases, within the community.

605 Thus, more sustained engagement with local communities is needed to regain local people's trust,  
606 particularly following this series of disappointments (see also Davies & White 2012). It is clear that  
607 past outside interventions, which were inadequately planned and did not fulfil their promises,  
608 served as a reference point for community members. The long shadow cast by such breaks in trust  
609 needs to be taken seriously if sustainable development partnerships are to be built. A scientific  
610 agenda alone is thus insufficient for effective conservation. Research in other contexts following  
611 sustained experiences of community organising around indigenous planning initiatives, for example  
612 by Laurie et al. (2002), indicates that such disappointments influence negotiations over funding,  
613 collaboration and investment from outside actors at a community level in unpredictable ways no  
614 matter how well-grounded in local needs they are.

615

616 5 Conclusions

617 Until now, no empirical research has investigated human relations with peatlands in the Peruvian  
618 Amazon. Using an exploratory approach with qualitative empirical research methods (semi-  
619 structured interviews; participatory mapping; guided site visits) in two different local communities  
620 (one small indigenous community and one comparatively large *mestizo* community), we found that  
621 peatlands are valuable to local people because of their natural resources (palm fruit; wood and  
622 timber; game species) and their cultural importance (as important areas for the local mythology),  
623 even if ‘peatlands’ per se are not a category of concern to them. Peatlands also occupy a culturally  
624 ambiguous position due to the dangers associated with them, such as sinking into the waterlogged  
625 ground or being attacked by anacondas and evil spirits. Nevertheless, we also found that the  
626 biophysical characteristics of tropical peatlands make them sufficiently distinct to potentially allow  
627 peatland-targeted environmental management and conservation activities in collaboration with  
628 local communities, who may refer to peatland areas with specific local terms (such as *aguajal*  
629 *chupadera*, or ‘sucking’ palm swamp; see also Authors 2019).

630 At present, management of these areas is extremely limited as it mostly consists of keeping out  
631 non-community members, while the mounting degradation of peatlands was recognised especially  
632 by members of the *mestizo* community who participated in our research. They ascribed degradation  
633 to overuse, overpopulation, carelessness, as well as lack of outside support and alternative  
634 economic opportunities.

635 It also appeared that ecological degradation is strongly linked with a loss of cultural heritage, with  
636 potential implications for peatland conservation. The Urarina still practice the cultural tradition of  
637 moving the location of their community every few decades, which allows palm trees, as well as  
638 animal populations to recover, but then struggle to have these moves legally recognised by the  
639 Peruvian state. *Mestizos* are instead hoping to modernise their community and switch to a fully  
640 monetary and capitalist economy, which seems comparatively less compatible with peatland  
641 conservation (even if carbon conservation projects may have potential elsewhere in the Peruvian  
642 Amazon, see Roucoux et al. 2017).

643 The main conservation strategies advocated by locals in both communities were limiting access and  
644 resource use, sowing new (palm) trees, and above all, creating alternative economic opportunities.  
645 These might either be related to peatland use, such as the construction of *aguaje* fruit processing  
646 plants, or unrelated, such as working for oil companies, and in this way, mirror classic debates  
647 about the need to combine environmental conservation and economic development.

648 Nominally, most community members approached potential conservation and development  
649 strategies with pragmatism. For example, *mestizo* community members were supportive of the idea  
650 of developing markets for sustainable peatland products (see also Roucoux et al. 2017), especially  
651 *aguaje* palm fruit, which could be harvested by climbing palm trees. At present, they are already  
652 heavily involved in the unsustainable palm fruit market. Nevertheless, it is also likely that such ideas  
653 would face implementation challenges, notably gaining local people’s trust for using novel  
654 harvesting techniques after a history of failed development interventions in the area.

655

656 Declaration of interests

657 The authors declare no conflict of interests.

658

659 References

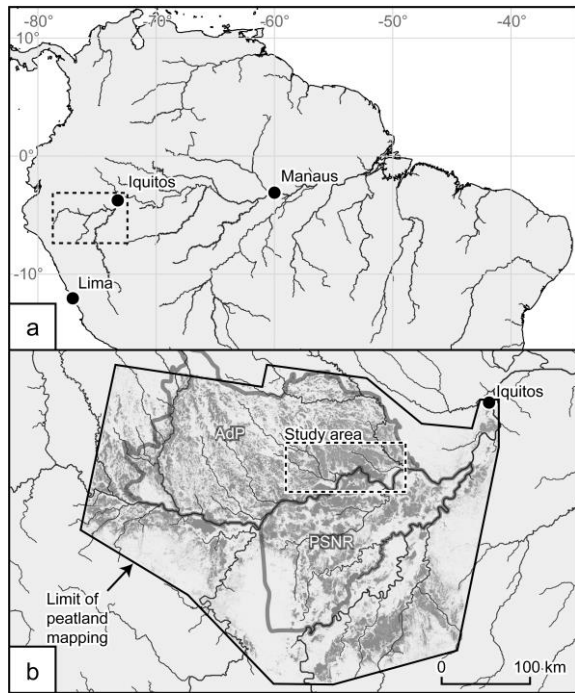
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815 Figure 1: (a) Location of the Pastaza-Marañón Basin in western Amazonia (dashed box); (b) inset showing the Pastaza-  
 816 Marañón Basin, with the modelled distribution of peatlands following Draper et al. (2014) in grey. The study area, around  
 817 the Chambira and Tigre River Basins of Peru's Loreto Region, is indicated. AdP stands for 'Abanico del Pastaza', a Ramsar  
 818 wetland site; PSNR stands for Pacaya-Samiria National Reserve, a protected area.

819 Table 1: Summary of uses, cultural significance, and current management of peatlands in two communities of the Peruvian  
 820 Amazon (explained in depth in sections 3.1-3.3)

	<b>Mestizo community</b>	<b>Indigenous community (Urarina)</b>
Local terms likely associated with peatland areas	<p><i>Agnajal chupadera</i> ('sucking' palm swamp dominated by <i>Mauritia flexuosa</i>)</p> <p><i>Agnajal raiçal/champal</i> (palm swamp with comparatively firm ground dominated by <i>Mauritia flexuosa</i>)</p> <p><i>Agnajal varillal</i> (<i>Mauritia flexuosa</i> palm swamp with short and thin trees like pole forest)</p> <p><i>Piripiral</i> (sedgeland)</p> <p>"<i>Allá es feísimo.</i>" ("very ugly" areas)</p>	<p><i>Alaka</i> (palm swamp forest; permanently to seasonally wet ecosystem)</p> <p><i>Jiiri</i> ('open space'; permanently wet ecosystem including open peatland areas and pole forest)</p>
Uses (section 3.1)	<p>Palm fruit for own consumption (<i>Mauritia flexuosa</i>; <i>Oenocarpus batahua</i>; <i>Mauritiella armata</i>)</p> <p>Palm fruit for trade (<i>Mauritia flexuosa</i>), including intra-community intermediaries and travelling traders</p>	<p>Palm fruit for own consumption (<i>Mauritia flexuosa</i>; <i>Oenocarpus batahua</i>; <i>Mauritiella armata</i>)</p> <p>Palm fruit for small-scale trade (<i>Mauritia flexuosa</i>) with travelling traders</p>

	Palm leaves ( <i>Attalea butyracea</i> ) for roofing	Palm leaves ( <i>Attalea butyracea</i> ) for roofing
	Palm hearts for trade ( <i>Enterpe precatorea</i> ), including intra-community intermediaries and travelling traders	Palm hearts for small-scale trade ( <i>Enterpe precatorea</i> ) with travelling traders
		Palm fibre for textile production ( <i>Mauritia flexuosa</i> )
	Wood and timber for personal use and trade (e.g. <i>Virola sp.</i> ; <i>Lauraceae</i> ; <i>Hevea brasiliensis</i> , <i>Calophyllum brasiliense</i> )	Wood and timber for personal use (mostly <i>Virola sp.</i> )
Cultural significance (section 3.2)	Hunting (e.g. tapirs, caimans, peccaries, agoutis, various monkey species, Spix's guan, great tinamou)	Hunting (e.g. tapirs, caimans, peccaries, agoutis, various monkey species, Spix's guan, great tinamou)
	Home of various locally confined guardian spirits (but not exclusive to peatlands)	<i>Jiiri</i> and <i>alaka</i> as home of the <i>Baainu</i> , a dangerous guardian spirit
	Area where 'dead lakes' can be found (cultural taboo areas where natural resource use carries risks for one's life)	Area where <i>Mauritia flexuosa</i> grows, with importance for Urarina creation myth (Dean 1994)
Current management and conservation (section 3.3)	Local community self-governance with dual system of indigenous and state-recognised authorities, and community assemblies	Local community self-governance with dual system of indigenous and state-recognised authorities, and community assemblies
	Safeguarding from resource use by non-community members	Safeguarding from resource use by non-community members
	Trade limits for fish; fixed prices for intra-community trade of fish and meat; very limited compliance	Ban on timber harvesting and use of fish poison, mostly complied with
	Strong sense of resource depletion, including game species, palm trees, timber	Limited sense of resource depletion, including game species, palm trees, timber
	Individual adoption of sustainable practices, such as climbing <i>Mauritia flexuosa</i> palm trees, planting <i>Mauritia flexuosa</i> seedlings, alternative monetary income strategies	Limited adoption of sustainable practices, such as planting of tree seedlings (with NGO support)
	Community has been in the same place since foundation in 1933, area of depleted resources is gradually expanding outwards	Community has been in the same place since the 1980s, change of community location every few decades to allow resource regeneration