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1 **Co-managers or co-residents? Indigenous peoples' participation in the**
2 **management of protected areas: a case study of the Agta in the Philippines**

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29 **Abstract**

30 Indigenous peoples’ participation in the co-management of protected areas is recognised as
31 essential for conserving both cultural and biological diversity. While this practice is increasingly
32 common, few studies have quantitatively evaluated the efficacy of these initiatives. Here we
33 examine levels of knowledge and involvement among the Agta, a hunter-gatherer population who
34 co-manage the Northern Sierra Madre Natural Park, the largest protected area in the Philippines.
35 We find that the Agta generally possess low levels of knowledge about the protected area they are
36 supposed to co-manage. Participation in park management is hampered by several factors, including
37 a lack of cultural sensitivity regarding the Agta’s foraging lifestyle among park officials and little
38 political will to realistically empower and support the Agta as co-managers. Recommendations to
39 strengthen Agta participation – and indigenous peoples’ participation in protected area
40 management more widely – are made to help protect the world’s remaining cultural and biological
41 diversity.

42

43 **Keywords:** *Indigenous peoples, co-management, protected areas, Philippines, conservation*

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54 **Introduction**

55 Protected areas are becoming increasingly important for conserving global biodiversity. Due
56 to the escalating rate of deforestation and exploitation of natural resources, protected areas provide
57 an opportunity for biodiversity to be conserved and utilised sustainably (Harmon *et al.* 2008).
58 Protected areas often overlap with areas of cultural diversity, meaning that protecting both
59 biological and cultural diversity frequently occur in tandem (Maffi 2005) as areas rich in biodiversity
60 are often inhabited by indigenous peoples (Toledo 2001). It is therefore vital to work with the
61 indigenous communities living within the protected area when developing and managing these
62 areas.

63 Protected areas have been used to guard specific areas for centuries, such as ritual land or
64 game reserves, but it is only during the past few decades that they have been used as a vital
65 conservation strategy in safeguarding biodiversity. The number of protected areas has thus
66 dramatically increased (Watson *et al.* 2014). Due to this rapid growth, they are having a larger
67 impact on the local communities living in or near the protected areas. As a consequence of this
68 overlap, and due to criticism of management practices which disregarded human rights (such as
69 displacement and ignoring local development needs), the purpose of protected areas now includes
70 supporting peoples' livelihoods (Agrawal & Redford 2009; Borrini-Feyerabend *et al.* 2004; Watson *et*
71 *al.* 2014).

72 One particular group of people affected are indigenous peoples. Despite lacking a universal
73 definition, indigenous peoples are commonly described as communities which consider themselves
74 as possessing a separate cultural heritage from neighbouring societies and having historical, often
75 pre-colonial, continuity with their land (for a more detailed discussion on the rights of indigenous
76 peoples, see the United Nations Declaration on the Rights of Indigenous Peoples (UN 2007)). As the
77 framework of protected areas has changed, so too has the role of indigenous peoples in the
78 development and management of these areas. While previously it was common practice to relocate
79 indigenous communities or to restrict their resource access (Borrini-Feyerabend *et al.* 2004), they

80 are now considered an integral element of the management of protected areas and their
81 involvement is actively sought (Colchester 2004).

82 As many state-owned top-down approaches to resource management have been
83 unsuccessful, co-management initiatives have been increasingly applied to overcome their
84 limitations (Persoon *et al.* 2003). Co-management is now a globally applied approach to protected
85 area management, and is broadly defined as the shared responsibilities and joint decision-making of
86 key stakeholders (Berkes 2009). Although co-management is being increasingly adopted, the
87 approach possesses several limitations, such as: concerns over legitimacy of the co-management
88 initiative weakening compliance (Jentoft 2000); human rights issues still existing despite local
89 community involvement (Berkes 2009), and; conflicts of interest between stakeholders inhibiting
90 successful co-management (Persoon *et al.* 2003).

91 Despite these problems, co-management gives indigenous peoples the opportunity to
92 participate in park management. Often referred to as 'rightsholders' in many countries ("actors
93 socially endowed with legal or customary rights with respect to land, water and natural resources"
94 (Borrini-Feyerabend *et al.* 2013, 15)), indigenous peoples' participation in co-management respects
95 their rights to ancestral land and protects their livelihoods, and in theory also benefits the protected
96 area. Such benefits include increased knowledge of local flora and fauna among all parties involved
97 through information-sharing (Berkes 2009) and increased protection of biodiversity through
98 indigenous stewardship (Larsen and Oviedo 2006).

99 Co-management can be difficult to implement successfully. Indigenous communities are not
100 always given sufficient training on co-management or information about the protected area (Young
101 and Horwich 2004), and therefore do not have the power or resources to co-manage effectively.
102 This reduces their participation and weakens their influence on park decisions. Involvement can also
103 be undermined by other co-managers, such as government officials and Non-Government
104 Organisations (NGOs), who may speak on their behalf (Kothari 2008), or only partly acknowledge
105 their input (Cundill *et al.* 2013). Furthermore, differences in cultural practices between indigenous

106 peoples and other stakeholders can be problematic during decision-making processes (Premauer
107 and Berkes 2015), reducing the impact of their involvement.

108 One indigenous group who face these challenges are the Agta, co-managers of the Northern
109 Sierra Madre Natural Park (NSMNP) in the Philippines. Theoretically, the Agta are well-represented
110 as co-managers of the park (see ‘Philippine Legislation Surrounding Indigenous Peoples’ section) and
111 have been labelled as “guards of the mountain ranges...protectors of the forest” by government
112 officials (Minter 2010, 257). However, previous research suggests that they have limited
113 understanding of the protected area and little decision-making influence (Minter 2010; Minter *et al.*
114 2014). Here we explore these issues in greater detail and examine the Agta’s participation as co-
115 managers; specifically their knowledge on park rules, their rights as indigenous peoples and their
116 involvement in park management. We employ a combination of qualitative semi-structured
117 interviews and quantitative statistics to explore patterns of knowledge and participation. This study
118 also explores the individual and social factors which influence knowledge and involvement, including
119 sex differences, age, geography, social structure and involvement with external agencies. These
120 results will provide a solid empirical foundation from which initiatives to increase Agta participation
121 – and indigenous peoples’ participation in protected area management more widely – can be built,
122 with the overall aim of protecting the world’s remaining cultural and biological diversity.

123 **Population, Legislative and Geographic Background**

124 **Ethnography**

125 The Agta are an indigenous Filipino population from northeast Luzon, believed to have
126 descended from the original colonisers of the Philippines ~35,000 years ago (Bellwood 1999). The
127 Agta’s appearance is distinct from non-Agta Filipinos due to their dark skin, curly hair and small body
128 size. They predominantly practice a predominantly hunter-gatherer lifestyle, and as with many other
129 hunter-gatherers (Boehm 2001), they are egalitarian and lack positions of authority (some camps
130 have ‘chiefs’, but these are appointed by external organisations). This study focuses on the Agta
131 residing in the municipalities of Palanan (~1,000 individuals) and Maconacon (~250 individuals).

132 Camp sizes range from single dwellings to larger camps of up to 26 houses, with an average of seven
133 houses. The Agta are semi-nomadic and move frequently between camps, and as such have little
134 material wealth.

135 Although the Agta live in close proximity and frequently interact with non-Agta, conflicts are
136 not uncommon. Throughout history the Agta have been a minority group and often discriminated
137 against (Headland and Headland 1997). The principle reason for this is the difference in the Agta's
138 lifestyle and culture, which is perceived as unusual among many non-Agta (a more-recently
139 colonised agricultural population), resulting in feelings of hostility (Minter 2010). Interventions
140 aimed to help the Agta have occurred, although these efforts are often misguided and fail to
141 consider the Agta's distinct way of life (Minter 2010). There is also conflict over resource use, with
142 the Agta feeling that the non-Agta are impacting their livelihoods by over-exploiting resources.
143 Despite these conflicts, many interactions between the Agta and non-Agta are mutually beneficial,
144 such as trading foraged goods for agricultural products (Peterson 1978).

145 **Philippine Legislation Surrounding Indigenous Peoples**

146 The inclusion of indigenous peoples in the co-management of protected areas in the
147 Philippines was established in 1992 with the National Integrated Protected Areas System (NIPAS) Act
148 (La Viña *et al.* 2010). This act is the overarching framework for managing the Philippines' protected
149 areas and acknowledges the rights that indigenous communities have to continue living on their
150 ancestral land. To ensure that indigenous peoples are included as co-managers, NIPAS imposed the
151 creation of a Protected Area Management Board (PAMB) for each park. PAMB comprises of
152 representatives from indigenous communities, as well as government officials and NGO
153 representatives, and is responsible for making decisions which benefit both the park and its
154 residents (DENR 1992).

155 The rights of Filipino indigenous peoples are further recognised through the Indigenous
156 Peoples' Rights Act (IPRA) 1997, which created and gave responsibility to the National Commission
157 on Indigenous Peoples (NCIP) to represent and protect the country's indigenous peoples. A

158 prominent feature of IPRA 1997 was that indigenous communities could claim a Certificate of
159 Ancestral Domain Title (CADT) which legally recognises the indigenous peoples' ownership of
160 ancestral land. An issue preventing successful CADT claims is that ancestral lands often overlap with
161 protected areas, meaning that many CADT claims are unsuccessful as this would conflict with the
162 protected area objectives outlined in the NIPAS Act (La Viña *et al.* 2010; for a background on the
163 Agta's CADT claims see Minter, 2010, 261-263). At the time of fieldwork the Agta residing in the
164 NSMNP had not yet formally received a CADT.

165 **Northern Sierra Madre Natural Park**

166 Previously designated as a Wilderness Area in 1979, the NSMNP was officially established in
167 1997 (Presidential Proclamation 978). Located in Isabela province, northeast Luzon, the NSMNP is
168 the largest protected area in the Philippines (359,496 hectares; La Viña *et al.* 2009), and
169 approximately 23,000 people (including Agta) reside in the park (Minter 2010). It is home to
170 numerous endangered and endemic species: 48% of mammals, 29% of birds, 72% of amphibians and
171 56% of butterflies recorded in the park are endemic to the Philippines (DENR 2001). Therefore, the
172 park is considered one of the most important protected areas in the Philippines (DENR 2006).

173 The park contains valuable resources which are often unsustainably extracted by both local
174 and non-local Filipinos, threatening the park's biodiversity. These include numerous wildlife species,
175 rattan and swiftlet nests (Minter *et al.* 2014), and it is common for residents to use chainsaws, guns
176 and electric- or poison-fishing methods. Another major issue is logging; 20,000-35,000 cubic metres
177 of timber is illegally extracted each year which the DENR do little to combat (van der Ploeg *et al.*
178 2011). To control resource use a zoning system was implemented. A 'strict protection zone' covers
179 the majority of the park which permits only the Agta to obtain resources through "traditional
180 resource use" (DENR 2001, 73). Other zones include: a 'sustainable use zone' permitting sustainable
181 resource extraction by all; a 'multiple use zone' allowing rural development; and a 'buffer zone'
182 surrounding the park to prevent encroachment (DENR 2001; Minter 2010). Despite this system, the

183 park receives poor governance and the rate of unsustainable resource use is not adequately
184 addressed.

185 As mentioned previously, the park is managed by PAMB which is governed by the
186 Department of Environment and Natural Resources (DENR). PAMB is responsible for developing and
187 implementing policies which meet the parks overall goals, including habitat and biodiversity
188 protection and facilitating community-based resource management. Examples of specific topics
189 discussed at PAMB include: CADT, resource extraction, park projects and logging (Minter *et al.*
190 2014). PAMB contains 36 members representing various sectors, including local governments, NGOs
191 and indigenous communities. Twelve PAMB members are Agta representatives, all of whom are
192 considered chiefs (and also all male). Four meetings occur each year; all members attend two of
193 these, while the executive committee (comprised of nine seats, one of which is an Agta
194 representative) meet a further two times annually. In theory any park related decisions need the
195 Agta's consent before implementation. However, Agta attendance is low. On average only four of 12
196 Agta attend these meetings, and when they do attend they rarely contribute to discussions.
197 Participation in PAMB is limited by numerous factors, including their illiteracy and low
198 socioeconomic status (Minter *et al.* 2014).

199 Since the park's formation, various NGOs have worked with the DENR, helping shape its
200 management plan and delivering projects promoting sustainable resource use. Previous agencies
201 included PLAN International (PLAN) and World Wide Fund for Nature (WWF), although their
202 involvement was only short-term. PLAN in particular worked closely with the Agta, helping maintain
203 the park's natural resources while ostensibly enhancing their quality of life via community-based
204 projects (Araño and Persoon 1998). More recently, Agta participation in park projects has decreased,
205 and agencies active in the area, such as Conservation International and Mabuwaya Foundation,
206 focus mainly on biological conservation issues. Nonetheless, the NCIP still work with the Agta,
207 particularly regarding land rights, and collaborate with the DENR to provide opportunities for the
208 Agta to participate in park projects.

209 **Methods**

210 **Data Collection**

211 Two forms of data collection – surveys and semi-structured interviews – were employed to
212 assess the Agta’s knowledge of, and involvement in, NSMNP co-management (see SI for survey and
213 topic guide). Surveys were conducted on all adults in camps visited ($n=308$, average age=36.6,
214 males=151) and assessed the Agta’s knowledge and perceptions of the NSMNP through a series of
215 short closed-ended questions. These questions focused on awareness of living in a protected area,
216 park zoning system, IPRA 1997, CADT and agencies who previously or currently work in the park.
217 Survey data were collected in 20 camps, 13 in the Palanan municipality ($n=240$) and seven in
218 Maconacon ($n=68$). Camp sizes ranged from four to 49 adults, with an average of 15.4.

219 Semi-structured interviews explored these issues in greater detail. Four individuals from
220 each camp were interviewed (except in one large camp where eight individuals were interviewed,
221 one small camp with only three interviewees, plus another small camp where interviews were not
222 conducted). Preference was given to chiefs and individuals who were willing and available to
223 participate. Equal numbers of males and females were interviewed in each camp. Interview
224 questions were based on six themes: overall understanding of the NSMNP and its rules, park zoning
225 system, CADT, PAMB, agencies working in the park and Agta involvement in park projects. Although
226 a topic guide was used, additional questions were asked depending on individual responses,
227 resulting in some questions differing between participants (hence slight variations in sample sizes
228 reported below). Interview data were collected from 19 camps, 12 of which were in Palanan ($n=52$)
229 and seven in Maconacon ($n=27$).

230 Surveys and interviews were conducted in private to prevent responses being influenced by
231 others. Data were collected with the help of a translator who spoke the local dialect. Questions were
232 asked in English by the researcher and then translated into the local dialect (Paranan, Tagalog or
233 Ilocano). Prior to data collection, translators were trained on the context of the questions to ensure
234 that they understood why these questions were asked and to check that the meaning remained the

235 same after translation. Data collection occurred between February and October 2014. Ethical
236 approval was granted by University College London Ethics Committee (UCL ethics code 3086/003).
237 Informed consent was obtained from individuals and fieldwork permission granted by the DENR.

238 **Statistical Analysis**

239 To assess knowledge, participants were assigned a score out of 11, calculated by summing
240 their survey responses, with a point given for each agency or other park-related subject known. Zero
241 points were given if the participant had not heard, or were unsure if they had heard, of a topic. To
242 analyse involvement, independent analyses were conducted for each of the three questions.
243 Answers were converted to a binary variable for each question and all 'don't know' responses coded
244 as missing. This was employed for the involvement analyses but not the knowledge analyses due to
245 greater ambiguity over a 'don't know' response regarding involvement (i.e., a 'don't know' response
246 to recognising an agency was interpreted as not knowing it, while a 'don't know' response to feeling
247 involved in park decisions is different from unequivocally stating no involvement).

248 Analyses employed multi-level models to control for the non-independence of data points
249 (individuals clustered within camps; Kreft and de Leeuw 1998). For each analysis, model fit was
250 compared (using AIC values) to determine whether the data possessed a multi-level structure. Linear
251 regressions were employed for knowledge, while logistic regressions were used for involvement
252 analyses. Independent variables included age, sex, distance from main town, chief presence,
253 whether the camp had an evangelical church and municipality (Palanan or Maconacon). Analyses
254 were conducted in R (R Core Team 2015) using the package *lme4*.

255 Data from semi-structured interviews were coded according to participant's park
256 knowledge, involvement and their role as co-managers. Percentages are used to show trends and
257 quotations utilised to add context.

258

259

260 **Results**

261 **Agta's Knowledge of the Northern Sierra Madre Natural Park**

262 Knowledge of park rules and associated legislation was generally low among the Agta (table
263 1), with an average knowledge score of 4.2 out of 11. The percentage of individuals who knew each
264 survey knowledge question is displayed in figure 1.

265 Only 44% of individuals surveyed were aware they were living in a protected area. Similarly,
266 only 21 of 69 (30.4%) individuals interviewed felt they understood what a protected area was, while
267 only nine of these 21 (42.9%) who attempted to define it were broadly correct. Two activities were
268 identified by the majority of individuals interviewed as being illegal in the park:

269 electric/poison/dynamite fishing (84.1%) and logging (77.2%; $n=79$).

270 35.4% of individuals surveyed recognised PAMB, while only five of 26 (19.2%) interviewees
271 who had heard of PAMB felt they understood its purpose. Of the three individuals who tried to
272 define it, only one possessed an adequate understanding. Despite this, four individuals interviewed
273 claimed to have previously attended a PAMB meeting. Although their experiences were generally
274 positive, one individual said “they are supportive in what I say, but they do not act upon this”. After
275 PAMB was explained to interviewees, 85.7% of 77 individuals said that they would like to attend a
276 PAMB meeting if given the opportunity.

277 Most individuals surveyed were aware of one or more government agency or NGO who had
278 worked in the park (87.7%). The best-known agencies were the DENR, PLAN and NCIP, while the
279 least-known were Conservation International, WWF and Mabuwaya Foundation (figure 1). Most
280 individuals expressed that the DENR (28 out of 34) and the NCIP (10 out of 11) were effective,
281 although a few mixed responses were given. Comments included “there are some DENR employees
282 who keep the forest and ocean good, but there are some employees who are doing the illegal
283 activities. It makes me feel sad as they are only pretending to help protect the forest and ocean”,
284 and “[the NCIP] are always promising but nothing happens”.

285 The majority of surveyed individuals did not know which zone they were residing in (98%),
286 and had not heard of a CADT (64.6%) or IPRA 1997 (76.3%). 11 of 76 (14.5%) interviewees believed
287 they knew what a CADT was, although only eight individuals correctly described one.

288 Next, the factors influencing knowledge were explored. As the null multi-level model was a
289 better fit (null AIC=1449.1; null multi-level AIC=1401.4) multi-level models were used. In a
290 multivariate model including all independent variables (see table 1 for descriptive statistics), both
291 individual- and camp-level factors predicted knowledge (table 2). Older participants were more
292 knowledgeable, with approximately a 20-year increase in age associated with a one unit increase in
293 knowledge. Participants residing in camps with a chief were also associated with increased
294 knowledge, with a score 1.23 higher relative to camps without a chief. On average, males possessed
295 an additional 0.83 knowledge points. Furthermore, camp location was associated with knowledge,
296 with an additional 10 kilometre increase from the town predicting a decrease in knowledge by
297 approximately one unit (figure 2).

298 **Agta Perceptions of Involvement**

299 Of the 308 individuals surveyed, 271 individuals responded that there was an individual or
300 agency they could report illegal activities to (chiefly electric/poisoning fishing and illegal logging).
301 After removing nine 'don't know' responses, 90.6% of individuals had someone to report illegal
302 activities to, while 9.4% had no-one. The most common person or agency identified were *barangay*
303 (district) officials (58.5%) and Agta chiefs (18.7%).

304 A small proportion of interviewees had previously reported an illegal activity (23.4%; 11 out
305 of 47), although the outcome of this reporting varied. One individual discussed how they reported a
306 *barangay* official electric fishing to the *barangay* captain but no action was taken, saying "I feel
307 angry that nothing happened and that there's no-one else to report illegal activities to". Other
308 individuals discussed how their *barangay* captain attempts to stop illegal activities but has little
309 impact, with one Agta saying "the people don't listen". Although the majority of individuals surveyed
310 were able to identify who they could report illegal activities to, 85.7% of 28 interviewees would not

311 actually make a report. The most common reason for this was fear of retaliation from the person
312 performing the activity, with some individuals commenting “I am worried that the person doing the
313 illegal activity will kill me”, “the non-Agta would get angry with me”, and “we don’t want quarrelling
314 or misunderstanding, so if we see cutting of trees we just ignore it”.

315 The factors influencing whether the Agta identified an individual or agency to report illegal
316 activities to were explored. The null multi-level model possessed greater model fit (null AIC=187.9;
317 null multi-level AIC=179.4) so was employed. No variables were significantly associated with
318 identifying someone to report to (table 3; although females and individuals from camps with a chief
319 were slightly more likely to name someone).

320 Of the individuals surveyed, 101 individuals felt they had enough information on the NSMNP
321 and its rules, while 101 did not (50% each; after removing 106 ‘don’t know’ responses). In contrast,
322 after removing 59 ‘don’t know’ responses, 203 (81.5%) individuals surveyed responded that the Agta
323 had enough influence on park management, while 46 (18.5%) felt they did not. Thus, perceptions of
324 Agta influence over park decisions were ~30% points higher than perceptions of whether individuals
325 had enough information.

326 Factors influencing perceptions of having enough information were explored. Multi-level
327 models were used as the null multi-level model was a better fit (null AIC=282; null multi-level AIC
328 =271.5). Individuals from camps with a chief were approximately 2.5 times more likely to state they
329 had enough information than those without a chief (table 3). No other effects were significant.
330 When exploring perceptions of Agta influence regarding park decision-making, the two null models
331 were equivalent (null AIC=240.3; null multi-level AIC=241.1), so non-hierarchical models were used.
332 No variables in this analysis were associated with whether the Agta felt they had enough influence
333 over park decisions (table 3). To explore if there was an association between knowledge and
334 perceptions of involvement three additional logistic regressions were conducted; in each model
335 greater knowledge was associated with greater perceived involvement (table 4).

336

337 **Discussion**

338 According to the NIPAS Act and the NSMNP Management Plan the Agta are co-managers of
339 the NSMNP and should be actively involved in park management, yet the present research suggests
340 that this is not the case. These findings highlight that the Agta lack basic knowledge of the protected
341 area they live in, suggesting that they are unable to co-manage effectively. Indeed, fewer than half
342 of all individuals were even aware they were living in a protected area. These results have significant
343 implications for co-management plans and highlight the importance of quantifying participation in
344 these co-management schemes (Minter *et al.* 2014), as well as identifying recommendations for
345 future practice.

346 Given that the Agta are theoretically responsible for co-managing the NSMNP, the average
347 knowledge score was low (4.2 out of 11). Although many individuals were aware of at least one
348 agency working in the park, the majority of individuals had not heard of many aspects central to
349 successful participation in protected area management, such as IPRA 1997, PAMB, CADT or the
350 zoning system. These findings demonstrate that overall the Agta have a poor understanding of the
351 park and their rights as indigenous peoples. Both age and sex influenced knowledge, with males and
352 older individuals more knowledgeable than females or younger Agta. One explanation for these
353 differences could be that older males are invited to park-related meetings more frequently than
354 females and younger males. This gender bias was noted in previous research (Minter 2010) and
355 indicates little improvement of female participation over the past decade. Despite this, a large
356 percentage of females stated they would like to be included in PAMB meetings (~70%; although, as
357 noted by some women, child-rearing responsibilities can make attendance at distant meetings
358 difficult). Age may also influence knowledge as the older generation may have participated in early
359 park projects managed by PLAN, which were still remembered by older individuals despite their
360 project ending in 2002. Additional exploration of the association between age and knowledge
361 suggests that this may be the case, as the knowledge of individuals younger than ~30 years (and
362 therefore children during PLAN's presence) was lower than older individuals, after which knowledge

363 appears to plateau (figure S1). This suggests that earlier interventions which were inclusive of the
364 Agta may have been more effective in engaging them with park issues. Indeed, interviews
365 highlighted that the Agta were not updated on changes in park management, with one individual
366 commenting “I don’t know why they [PLAN] don’t come here anymore”.

367 The presence of a camp chief was also associated with increased knowledge. At face value
368 this could be interpreted as chiefs disseminating information to camp-mates, therefore increasing
369 overall camp knowledge. Descriptive statistics suggest that chiefs were more knowledgeable than
370 non-chiefs (mean chief knowledge score=7 ($n=7$); mean non-chief knowledge score=4.1 ($n=301$)).
371 However, this information may not be transmitted to camp-mates. When asked who informed them
372 about illegal activities, only two individuals (of 48; 4.2%) identified a chief, whereas the most
373 common responses were the DENR (39.6 %) and *barangay* captain (25%). Although further research
374 is needed to fully determine how the Agta are informed on park issues, this suggests that chiefs do
375 not often inform camp-mates. As is common among other egalitarian hunter-gatherers, individual
376 Agta (including chiefs) have little authority to tell camp-mates how to behave as this would violate
377 the egalitarian ethic of autonomy (Gardner 1991). Rather, Agta chiefs tend to act as mediators in
378 disputes or as spokesmen to outsiders. Therefore, other factors associated with having a chief may
379 enhance knowledge. For example, camps are encouraged to appoint chiefs by park agencies and
380 church groups, and it is possible that these camps are informed by these external agencies more
381 than camps without a chief.

382 Furthermore, only chiefs are selected as PAMB members (Minter 2010). These individuals
383 are responsible for participating in park decision-making and are crucial for the Agta’s involvement
384 in park management. However, this system does not consider the Agta’s egalitarian social system, in
385 which group decisions are generally reached by consensus rather than by the opinions of a select
386 few. This role of chief as primarily mediator rather than decision-maker was exemplified by one chief
387 who, when asked about the decision-making process in camp, replied that “everyone has a voice,
388 and whoever is the best they [will] follow, because even though I am the chief, it’s not good if my

389 decision is the only one to be followed as I may not be right". Therefore, the current PAMB
390 organisation may not be the optimal system to empower the Agta as co-managers, potentially
391 limiting participation (in addition to other PAMB barriers; Minter *et al.* 2014).

392 The final factor associated with knowledge was distance, with individuals in camps located
393 closest to main towns possessing greater knowledge than more distant individuals. As park-related
394 meetings are mainly held in municipal towns, they are therefore more accessible to those living
395 nearer. Furthermore, distant camps have less contact with park officials due to the time and effort it
396 takes to reach them. Although the DENR and NCIP do occasionally visit distant camps, comments
397 made by the Agta suggest that they only visit if attending a meeting, engaging with *barangay*
398 captains or visiting plantations. One individual commented "they [DENR] have come to the camp
399 before but didn't talk to me. I don't know what they wanted". Although agencies may occasionally
400 visit areas near Agta camps, they rarely inform the Agta of park updates.

401 In contrast to knowledge, few variables affected the Agta's perception of their involvement
402 in park management. The main factor was that the presence of a chief was associated with an
403 increased probability of an individual stating that they had enough park information. As discussed
404 above, this chief effect is plausibly linked to the wider implications of having a chief (e.g., greater
405 external agency involvement). However, only 50% of Agta felt they had enough information on the
406 NSMNP. This highlights the need for information-sharing among all Agta, not just a select few. As
407 knowledge predicted involvement in all three domains, an essential first step towards greater Agta
408 participation would be to increase their knowledge and awareness of these issues.

409 Additionally, it is important to note that although most Agta identified someone to report
410 illegal activities to, very few individuals stated that they would actually make a report. This was
411 largely due to fear of retaliation from non-Agta, highlighting the underlying conflict and power
412 asymmetry existing between Agta and non-Agta. While some Agta do attempt to stop illegal
413 activities, this also demonstrates that the Agta are largely powerless to prevent these activities,
414 despite their role as co-managers.

415 **Recommendations**

416 It is evident from these findings that the Agta are not equipped or empowered as co-
417 managers of the NSMNP, and that the current structure of PAMB is not an effective system to
418 facilitate Agta participation. Therefore, it is suggested that an important first step in enhancing the
419 Agta's role as co-managers would be to extend and restructure PAMB. Not only does previous
420 research show that attendance and participation issues exist for Agta representatives at PAMB
421 meetings (Minter *et al.* 2014), the present study demonstrates that appointing Agta representatives
422 may be an ineffective method for information-sharing among the Agta. While chiefs may attend
423 these (and other) meetings, their highly-autonomous egalitarian social system means that this
424 knowledge is rarely transmitted to camp-mates. Implementing regular meetings regarding current
425 park issues for all Agta in each municipality (alongside the existing PAMB meetings) may be a more
426 successful strategy. The meeting should be attended by non-Agta PAMB members, and would give
427 the Agta the opportunity to make joint decisions. Meetings on this scale would require great
428 organisation, but attendance at similar meetings has previously been high (Minter *et al.* 2005). This
429 style of meeting would permit a decision-making process analogous to everyday group decisions
430 which may increase participation and empower the Agta as co-managers. Furthermore, unlike the
431 current PAMB meetings (Minter *et al.* 2014) it is important that expenses incurred by the Agta
432 attending these meetings are reimbursed to ensure that participation is not limited by the Agta's
433 socioeconomic situation.

434 Secondly, the present study demonstrates the importance of knowledge in increasing the
435 Agta's perceptions of involvement in park management, highlighting the need for all Agta to be
436 regularly updated on park issues. The DENR should be responsible for this, and here we suggest that
437 they update the Agta by regularly visiting Agta camps. Due to the distant location of camps and the
438 large number of individuals (~2,000 Agta live in the NSMNP; Minter 2010), this may be logistically
439 difficult, although it is advised to build upon existing structures. One option would be to implement
440 a similar format to the current *barangay* meetings, which are meetings for residents to discuss local

441 issues and occur close to Agta camps. Additional data collected on the *barangay* meetings show that
442 they are frequently attended by Agta (72.4% of 76 Agta had attended one or more meetings).
443 Participation in these *barangay* meetings is also less sex-biased, with approximately equal
444 proportion of males and females attending. Although contributions are not exceptionally high (~40%
445 of individuals claimed to have actively contributed to discussions), the majority of Agta across all
446 *barangays* felt that their *barangay* captain would listen and take action if they raised an issue (95%
447 of 40), with one individual commenting that they were “proud to raise issues” at these gatherings.
448 This could be due to the familiarity and trust that the Agta have with the *barangay* captain who
449 attends all meetings. Therefore, it is essential that the same DENR representative chairs these
450 meetings to help facilitate trust between the Agta and the DENR, which is critical for effective co-
451 management (Berkes 2009).

452 Thirdly, it is important that women are equally informed and involved in park decisions as
453 men. Recent evidence has highlighted that conservation outcomes are improved if women are
454 involved in co-management of natural resources (Leisher *et al.* 2016). Additionally, as outlined by
455 the United Nations Sustainable Development Goals, gender equality is essential for long-term
456 sustainable development (United Nations, 2015). Therefore, women should be invited to park-
457 related meetings and female PAMB membership encouraged. Not only will increasing women’s
458 participation reduce the divide in knowledge between the sexes, it is also more compatible with the
459 Agta’s social system of sex equality (Dyble *et al.* 2015). In this system, many Agta women are
460 extremely active in the social and political lives of their communities and are often highly influential
461 decision-makers (see also Endicott and Endicott 2008).

462 Although these recommendations are needed to strengthen the Agta’s role as co-managers
463 (see also Minter *et al.* 2014), it would be difficult to fully achieve an effective co-management
464 scheme without examining the wider social context. The Agta’s lifestyle is still prejudiced against by
465 some non-Agta, so it is imperative that all park stakeholders are culturally sensitive to the Agta’s
466 livelihood by not imposing their own standards on the Agta, but rather adapting their institutions to

467 maximise Agta participation (Page *et al.* 2018). While increased cultural sensitivity may help
468 empower the Agta, greater Agta participation may benefit the park in other ways. For instance,
469 many individuals interviewed mentioned using a '*gay-gay*' – a length of string tied over a river,
470 traditionally used to prevent people entering an area after someone has died – in an attempt to
471 prevent illegal activities such as electric fishing. Non-Agta are aware of *gay-gays* and generally
472 respect them. Thus, in addition to the Agta's vast local ecological knowledge (van der Ploeg and van
473 Weerd 2010), customs such as *gay-gays* can be embraced and encouraged to help protect natural
474 resources.

475 The Agta are seen as 'guardians' of the NSMNP by park agencies (Minter 2010), yet they lack
476 the knowledge, resources and support to even begin to attempt this, let alone succeed. Although
477 many Agta harbour positive attitudes towards protecting the NSMNP, as a result of their socio-
478 political circumstances they have no power to meaningfully effect change, and are often frightened
479 of retaliation if they do report illegal activities. In effect, they are given much of the responsibility for
480 protecting the NSMNP yet none of the support necessary to achieve this. All inhabitants of the park,
481 not just the Agta, utilise and extract resources from it, so approaches which include all park
482 residents need to be developed. Although the present study did not collect data on non-Agta's
483 knowledge and perceptions, field assistants (who were local non-Agta) had to be trained on the
484 NSMNP prior to fieldwork as they were not aware of park regulations. Protecting the NSMNP should
485 not be solely the Agta's responsibility but rather all inhabitants of the park.

486 This is part of a more deep-rooted problem that the NSMNP is simply a 'paper park' and is
487 not protected adequately (Minter 2010). The protected area status of the park is not taken seriously
488 by its inhabitants and illegal activities are a frequent occurrence. Resources are regularly extracted
489 illegally by the non-Agta, DENR and government officials; one reason the Agta rarely engage in these
490 activities is because of financial restraints on purchasing the necessary equipment. This is made clear
491 by one Agta who said that "poisoning and electric fishing happens by the non-Agta as the Agta do
492 not have enough money to buy the poison". Corruption is rife in the Philippines (Transparency

493 International 2015). This is clear in the NSMNP (Minter 2010), and similar stories of political
494 corruption among park officials hindering the prevention of (or even participating in) illegal activities
495 were observed throughout the present study. One non-Agta woman discussed how she would not
496 attempt to stop someone illegally extracting resources because her husband wanted to become a
497 *barangay* official. This corruption and lack of political will urgently needs addressing, and methods
498 which provide either greater incentives or harsher punishments to prevent it need to be
499 implemented. If these issues are not addressed soon, the future of the NSMNP appears bleak and
500 the largest area of biodiversity in the Philippines, as well as the Agta's unique way of life, may be
501 lost.

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517 **Ethics**

518 Ethical clearance was granted by the University College London Ethics Committee (UCL Ethics code
519 3086/003). Fieldwork permission was granted by local government units, including the Mayors of
520 the Municipalities visited and from the Department of Environment and Natural Resources (DENR)
521 as the research took place in a protected area. Each Agta community agreed to participate and
522 informed consent was obtained from all individuals.

523 **Author contributions**

524 A.B.M. conceived the project. K.M. and D.S. collected the data. D.S. and K.M. analysed the data. All
525 authors wrote the manuscript, contributed substantially to revisions and gave final approval for
526 publication.

527 **Competing interests**

528 We have no competing interests.

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534 helpful comments and feedback.

535 **Data availability**

536 The datasets analysed during the current study are available from the corresponding author on
537 reasonable request.

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540 **References**

- 541 Agrawal, A. and Redford, K. (2009) Conservation and displacement: an overview. *Conservation and*
542 *Society* 7(1): 1-10.
- 543 Araño, R. R., and Persoon, G. A. (1998) Action research for community-based resource management
544 and development: The case of the Northern Sierra Madre Natural Park conservation project,
545 northeastern Philippines. In *Seminar proceedings 1998, Research in Tropical Rain forests: Its*
546 *Challenges for the Future*. The Tropenbos Foundation, Wageningen, pp. 89–101.
- 547 Bellwood, P. (1999) Archaeology of southeast Asian hunters and gatherers. In Lee, R. B. and Daly, R.
548 (eds.), *The Cambridge Encyclopedia of Hunters and Gatherers*. Cambridge University Press,
549 Cambridge, pp. 284–288.
- 550 Berkes, F. (2009) Evolution of co-management: role of knowledge generation, bridging organizations
551 and social learning. *Journal of Environmental Management* 90(5): 1692–1702.
- 552 Boehm, C. (2001) *Hierarchy in the Forest: The Evolution of Egalitarian Behavior*. 2nd ed. Harvard
553 University Press, Cambridge.
- 554 Borrini-Feyerabend, G., Dudley, N., Jaeger, T., Lassen, B., Broome, N., Phillips, A., and Sandwith, T.
555 (2013) *Governance of Protected Areas: From Understanding to Action*. Best Practice Protected Area
556 Guidelines Series No. 20. IUCN, Gland. Accessed 20 Aug 2017 at
557 [http://cmsdata.iucn.org/downloads/governance_of_protected_areas_from_understanding_to_ac](http://cmsdata.iucn.org/downloads/governance_of_protected_areas_from_understanding_to_action.pdf)
558 [tion.pdf](http://cmsdata.iucn.org/downloads/governance_of_protected_areas_from_understanding_to_action.pdf).
- 559 Borrini-Feyerabend, G., Kothari, A., and Oviedo, G. (2004) *Indigenous and Local Communities and*
560 *Protected Areas: Towards Equity and Enhanced Conservation*. IUCN, Gland. Accessed 20 Aug 2017 at
561 https://cmsdata.iucn.org/downloads/pag_011.pdf.
- 562 Colchester, M. (2004) Conservation policy and indigenous peoples. *Environmental Science and Policy*

563 7(3): 145–153.

564 Cundill, G., Thondhlana, G., Sisitka, L., Shackleton, S., and Blore, M. (2013) Land claims and the
565 pursuit of co-management on four protected areas in South Africa. *Land Use Policy* 35: 171–178.

566 DENR [Department of Environment and Natural Resources] (1992) National Integrated Protected
567 Areas System Act 1992 (Republic Act No. 7586). DENR, Manila. Accessed 20 Aug 2017 at
568 <http://www.wipo.int/edocs/lexdocs/laws/en/ph/ph070en.pdf>.

569 DENR [Department of Environment and Natural Resources] (2001) Management plan for the
570 Northern Sierra Madre Natural Park. DENR, Palanan.

571 DENR [Department of Environment and Natural Resources] (2006) Northern Sierra Madre Natural
572 Park and Outlying Areas Inclusive of the Buffer Zone. Accessed 20 Aug 2017 at
573 <http://whc.unesco.org/en/tentativelists/5037/>.

574 Dyble, M., Salali, G. D., Chaudhary, N., Page, A., Smith, D., Thompson, J., Vinicius, L., Mace, R., and
575 Migliano, A. B. (2015) Sex equality can explain the unique social structure of hunter-gatherer bands.
576 *Science* 348(6236): 796–798.

577 Endicott, K. M., and Endicott, K. L. (2008) *The Headman was a Woman: the Gender Egalitarian Batek*
578 *of Malaysia*. Waveland Press, Long Grove.

579 Gardner, P. M. (1991) Foragers' pursuit of individual autonomy. *Current Anthropology* 32(2): 543–
580 572.

581 Harmon, D., Figgis, P., and Crofts, R. (2008) *For Life's Sake: How Protected Areas Enrich our Lives and*
582 *Secure the Web of Life*. IUCN, Gland. Accessed 20 Aug 2017 at
583 <https://www.iucn.org/sites/dev/files/import/downloads/pasforlifesake.pdf>

584 Headland, T. N., and Headland, J. D. (1997) Limitation of human rights, land exclusion, and tribal
585 extinction: The Agta negritos of the Philippines. *Human Organization* 56(1): 79–90.

586 Jentoft, S. (2000) Legitimacy and disappointment in fisheries management. *Marine Policy* 24: 141-
587 148.

588 Kothari, A. (2008) Protected areas and people: the future of the past. *Parks* 17(2): 23–34.

589 Kreft, I. G. G., and de Leeuw, J. (1998) *Introducing Multilevel Modelling*. Sage Publications, London.

590 Larsen, B. P., and Oviedo, G. (2006) Reconciling Indigenous peoples and protected areas: rights,
591 governance and equitable cost and benefit sharing. IUCN, Gland. Accessed 20 Aug 2017 at
592 https://cmsdata.iucn.org/downloads/iucn_reconciling_ip_and_pa.pdf.

593 La Viña, A. G., Kho, J. L., and Caleda, M. J. (2010) *Legal Framework for Protected Areas: Philippines*.
594 IUCN, Gland. Accessed 20 Aug 2017 at <http://cmsdata.iucn.org/downloads/philippines.pdf>.

595 Leisher, C., Temsah, G., Booker, F., Day, M., Samberg, L., Prosnitz, D., Agarwal, B., Matthews, E., Roe,
596 D., Sunderland, T., and Wilkie, D. (2016) Does the gender composition of forest and fishery
597 management groups affect resource governance and conservation outcomes? A systematic map.
598 *Environmental Evidence* 5: 6.

599 Maffi, L. (2005) Linguistic, cultural, and biological diversity. *Annual Review of Anthropology* 29: 599–
600 617.

601 Minter, T. (2010) *The Agta of the Northern Sierra Madre. Livelihood Strategies and Resilience among*
602 *Philippine Hunter-Gatherers*. Leiden University.

603 Minter, T., Cureg, M. C., van der Ploeg, J., Bagunu, A. M., Aggabao, M. R., Valencia, J. G., Aquino, D.
604 M., and Ranay, M. L. (2005) *Ako ay Agta, Ako ay Pilipino! Proceedings of the Agta Workshop*. Golden
605 Press, Tuguegarao City.

606 Minter, T., van der Ploeg, J., Pedrablanca, M., Sunderland, T., and Persoon, G. A. (2014) Limits to
607 indigenous participation: the Agta and the Northern Sierra Madre Natural Park, the Philippines.
608 *Human Ecology* 42(5): 769–778.

609 Page, A. E., Minter, T., Viguier, S., and Migliano, A. B. (2018) Hunter-gatherer health and
610 development policy: How the promotion of sedentism worsens the Agta's health outcomes. *Social*
611 *Science and Medicine* 197: 39-48.

612 Persoon, G. A., van Est, D. M. E. and Sajise, P. E. (2003) Co-management of natural resources in Asia.
613 A comparative perspective. NIAS Press, Copenhagen.

614 Peterson, J. T. (1978) Hunter-gatherer/farmer exchange. *American Anthropologist* 80(2): 335–351.

615 Premauer, J. M., and Berkes, F. (2015) A pluralistic approach to protected area governance:
616 indigenous peoples and Makuira National Park, Colombia. *Ethnobiology and Conservation* 4: 1–16.

617 R core Team (2015) R: A language and environment for statistical computing. R Foundation for
618 Statistical Computing, Vienna.

619 Toledo, V. M. (2001) Indigenous peoples and biodiversity. In Levin, S. (ed.) *Encyclopedia of*
620 *Biodiversity*. Academic Press, San Diego, pp. 451–463.

621 Transparency International (2015) Corruption Perceptions Index 2015. Accessed 20 Aug 2017 at
622 <http://www.transparency.org/cpi2015>.

623 United Nations (2007) United Nations Declaration on the Rights of Indigenous Peoples. Accessed 9
624 March 2018 at http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf.

625 United Nations (2015) Transforming our World: The 2030 Agenda for Sustainable Development.
626 Accessed 20 Aug 2017 at
627 <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustai>
628 [nable%20Development%20web.pdf](https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf)

629 van der Ploeg, J., and van Weerd, M. (2010) Agta bird names: an ethno-ornithological survey in the
630 Northern Sierra Madre Natural Park, Philippines. *Forktail* 26: 127–131.

631 van der Ploeg, J., van Weerd, M., Masipiqueña, A. B., and Persoon, G. A. (2011) Illegal logging in the
632 Northern Sierra Madre Natural Park, the Philippines. *Conservation and Society* 9(3): 202–215.

633 Watson, J. E. M., Dudley, N., Segan, D. B., and Hockings, M. (2014) The performance and potential of
634 protected areas. *Nature* 515: 67–73.

635 Young, C. A., and Horwich, R. (2004) History of protected area designation, co-management and
636 community participation in Belize by history of protected area designation in Belize. In Balboni, B. S.,
637 Palacio, J. O. and Awe, J. J. (eds.) *Taking Stock: Belize at 25 years of Independence*. Cubola
638 Productions, Belize, pp. 123–145.

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650 *Table 1.* Descriptive statistics for continuous variables (knowledge score, age and camp distance
 651 from main town) and binary variables (sex, chief, church and municipality). Individual-level variables
 652 ($n=308$) and camp-level variables ($n=20$) are also labelled.

Variable	Variable level	Average	S.D	Minimum value	Maximum value
Knowledge score	Individual	4.17	2.53	0	11
Age	Individual	36.57	14.5	14.62	78.32
Distance from main town (km)	Camp	14.8	6.79	1.88	28.9
Number of cases					
Sex	Individual	Male=151; Female=157			
Chief	Camp	Chief=7; No chief=13			
Church	Camp	Church=4; No church=16			
Municipality	Camp	Palanan=13; Maconacon=7			

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666 *Table 2.* Results of the multi-level model for variables predicting an individual’s knowledge score
 667 ($n=308$, camps=20). Positive coefficients indicate an increase in knowledge score. Significant findings
 668 are highlighted in bold.

Variable	Level	Coefficient	S.E	p-value
Intercept	-	3.05	0.71	<0.001
Sex (ref=male)	Individual	-0.83	0.23	<0.001
Age	Individual	0.05	0.01	<0.001
Distance from main town (km)	Camp	-0.09	0.03	0.003
Chief (ref=no chief)	Camp	1.23	0.46	0.007
Church (ref=no church)	Camp	0.55	0.59	0.347
Municipality (ref=Palanan)	Municipality	0.82	0.48	0.088

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681 *Table 3.* Results of the three logistic regression models predicting perceptions of park involvement.
682 For reporting an illegal activity, a positive value indicates an increase in the likelihood of an
683 individual identifying an individual or agency to report illegal activities to ($n=299$). A positive value
684 for enough information indicates an increase in the likelihood of an individual perceiving that they
685 have enough information on the park ($n=202$). A positive value for enough influence indicates an
686 increase in the likelihood of an individual perceiving that the Agta have enough influence over park
687 management ($n=249$). ‘Reporting illegal activities’ and ‘enough park information’ models are multi-
688 level models, while the ‘Agta influence over park decisions’ model is a non-hierarchical regression
689 (see text). Coefficients and standard errors (displayed in brackets) are log-odd estimates. Odds ratios
690 are presented in text where significant. Significant findings are highlighted in bold. *P*-value codes:
691 $^* < 0.01$, $^* < 0.05$, $^{**} < 0.01$, $^{***} < 0.001$.

Variable	Reporting illegal activities	Enough park information	Enough Agta influence over park decisions
Intercept	2.03 (1.18) [*]	-1.73 (0.79) [*]	1.21 (0.75)
Sex (ref=male)	0.78 (0.44) [*]	-0.48 (0.31)	0.5 (0.34)
Age	-0.01 (0.02)	0.01 (0.01)	0.01 (0.01)
Distance from main town (km)	-0.02 (0.05)	0.05 (0.03)	-0.03 (0.03)
Chief (ref=no chief)	1.36 (0.78) [*]	0.98 (0.47)[*]	0.46 (0.4)
Church (ref=no church)	0.73 (1.05)	0.48 (0.59)	0.0 (0.51)
Municipality (ref=Palanan)	0.03 (0.71)	0.61 (0.52)	-0.25 (0.43)

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698 *Table 4.* Logistic regressions predicting perceptions of park involvement based on an individual’s
699 knowledge score. A positive value indicates an increase in perceptions of involvement with
700 increasing knowledge score for identifying an individual or agency to report illegal activities to
701 ($n=299$), having enough information on the park ($n=202$), and the Agta having enough influence over
702 park management ($n=249$). ‘Reporting illegal activities’ and ‘enough park information’ models are
703 multi-level models, while the ‘Agta influence over park decisions’ model is a non-hierarchical
704 regression (see text). Coefficients and standard errors (displayed in brackets) are log-odd estimates.
705 Odds ratios are displayed in text where relevant. Significant findings are highlighted in bold. *P*-value
706 codes: $^{\circ}$ <0.01, *<0.05, **<0.01, ***<0.001.

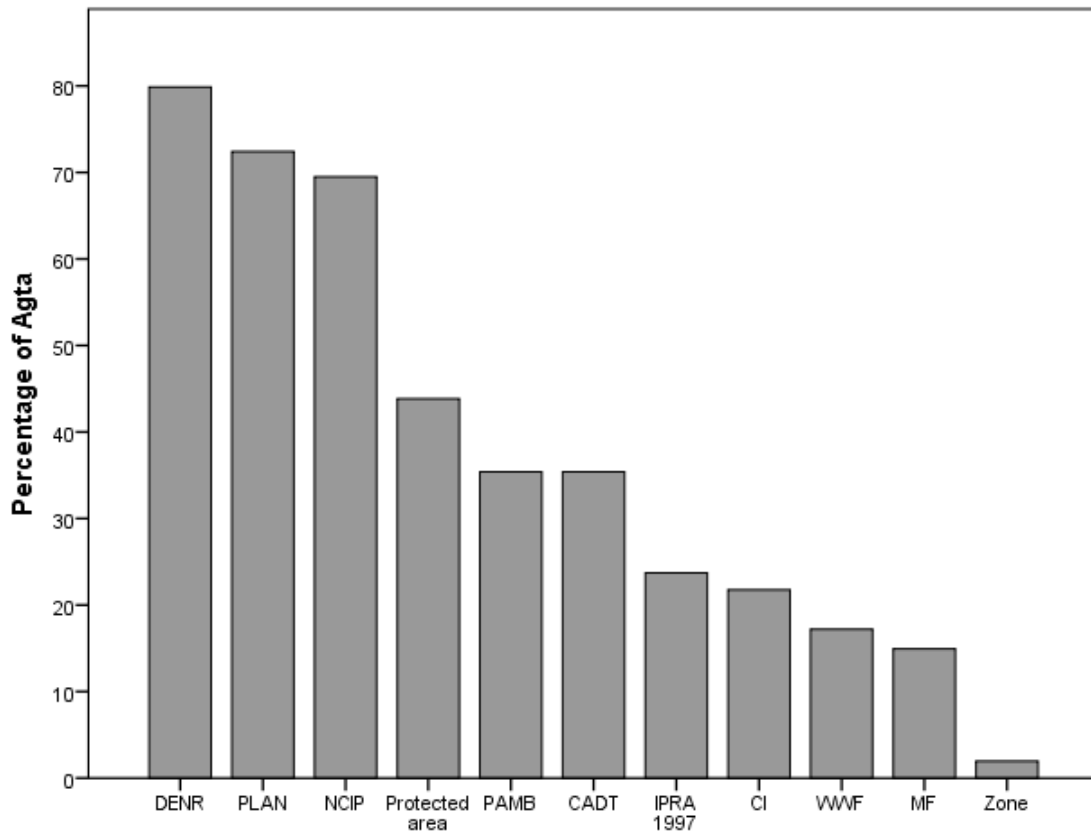
Variable	Reporting illegal activities	Enough park information	Enough Agta influence over park decisions
Intercept	1.8 (0.54)***	-1.86 (0.47)***	0.59 (0.35) [°]
Knowledge score	0.21 (0.11)*	0.37 (0.08)***	0.21 (0.08)**

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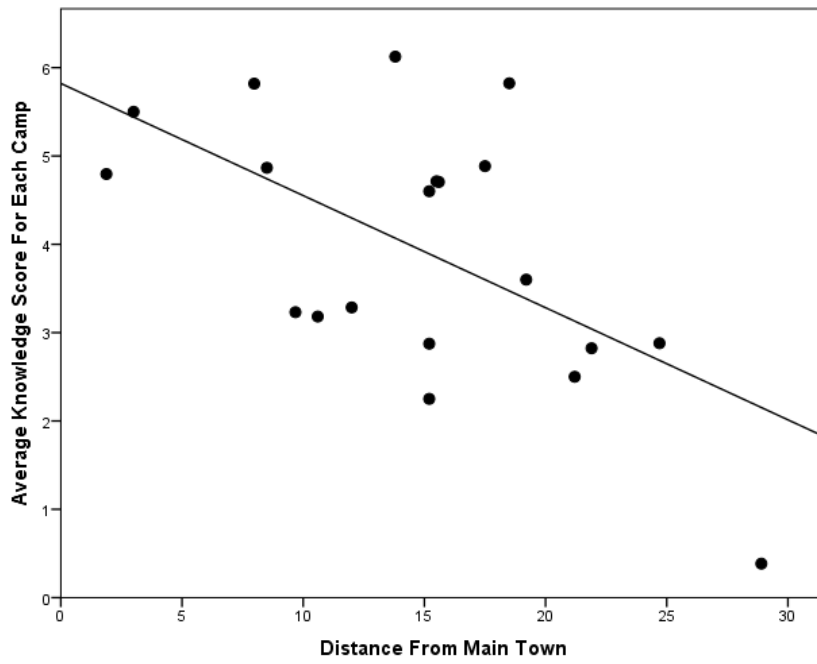
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712 *Figure 1. Percentage of Agta respondents who knew each question asked in the knowledge survey*
 713 *(questions=11; n=308). These questions asked about whether the Agta knew that they were living in*
 714 *a protected area, what zone they were residing in, and had heard of agencies, policies and NGO’s*
 715 *which work in the protected area on conservation projects or to empower the Agta (DENR;*
 716 *Department of Environment and Natural Resources: PLAN International: NCIP; National Commission*
 717 *on Indigenous Peoples: PAMB; Protected Area Management Board: CADT; Certificate of Ancestral*
 718 *Domain Title: IPRA 1997; Indigenous Peoples’ Rights Act 1997: CI; Conservation International: WWF;*
 719 *World Wide Fund for Nature: and MB; Mabuwaya Foundation).*

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722 *Figure 2.* Scatterplot displaying the relationship between the average camp knowledge score and
723 distance from main town (km; $n=20$). As distance to town increases, this is associated with a
724 decrease in knowledge about park rules and legislation.