

## WILDLIFE CONSERVATION, PERCEPTIONS OF DIFFERENT CO-EXISTING CULTURES

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### Abstract

*Different cultures have different relationships with nature, and these relationships have many dimensions which shape people's perceptions towards nature. Therefore, perceptions may vary between different cultures within the same territories. Understanding each culture's relationship with the surrounding environment is of extreme importance for the correct allocation of conservation resources, and for the development of efficient conservation actions. In this study, we discuss the perceptions of two different cultures regarding large and medium-sized mammal conservation in an endangered region of Argentina, called the Dry Chaco. These two cultures are peasants, or Criollos, and the indigenous Wichís; we assessed and compared their perceptions on local extinctions, conservation problems, conflicts with wildlife and possible solutions for these issues. We found that although both cultures inhabit the same territory and report local extinctions, their perceptions on which species were locally extinct differed. Another difference was the perceived time-period in which disappearances occurred. We also found that most respondents recognize conservation problems and possible solutions, although these differ between both cultures. Management for conservation of these species should be specific to each culture, and understanding local perspectives allows the inclusion of a broader view of human needs, perceptions and knowledge in conservation programs.*

**Keywords:** Local perceptions; Chaco; Indigenous; Peasants or Criollos

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### Introduction

Most regions and species of the world are endangered as a consequence of human activities [1, 2]. Long-term persistence of ecosystems and species should be based on efficient plans and actions that balance human needs with those of selected natural elements [3-6]. These plans can be designed at regional scales but their application always requires considering local characteristics [4]. In many landscapes, the human population's livelihoods are interconnected with nature, and in those cases conservation actions are more prone to succeed when local inhabitants are included as key actors [7-9]. However, involving local people in conservation

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attempts is not easy. Accomplishing this objective means understanding local perceptions towards nature, identifying factors that motivate behaviours and correctly diagnosing their predictors [9, 10, 12]. Consequently, studying the local culture's perceptions of nature and of its elements can help in the correct allocation of resources when developing conservation actions [7, 11, 12]. These studies transcend local boundaries, for they contribute to diversify conservation concepts and to elaborate more complete, bottom-up, conservation plans at different scales [9, 11, 13, 14].

Most studies on local cultures have focused on economical values of hunting and impacts of this activity on wildlife, e.g. [15, 16]. Lately, it has been acknowledged that the importance of investigating the particular relationships human populations have with wildlife, their perceptions, conflicts and proposed solutions regarding conservation and nature [12, 14]. Perceptions of nature are site-specific but may not be homogenous inside a territory [7, 14, 17-23]. Areas rich in cultures usually coincide with those rich in species [24] and are, therefore, the focus of conservation efforts [3, 4]. However, lack of knowledge of the particular perceptions of local cultures makes it challenging for governments and organizations to include local inhabitants in conservation and management plans as key stakeholders [25- 28]. Therefore, conservation actions for these areas are usually designed and applied in top-down schemes, which are usually not efficient, and carry the risk of being locally illegitimate or of disrupting pre-existing norms that regulate use or access to natural resources for the native groups [9].

A common co-existence of cultures in South America is that of indigenous groups living alongside mestizos, i.e. rural people that descend of immigrant peasants and are related to western-christian world views, but have a distinctive culture [15, 20, 22, 29]. Although sharing the same territories, each human group may have different perceptions and needs regarding natural resources and conservation issues [7, 12]. With our study, we investigate how different cultural backgrounds engender different perceptions on conservation issues; we hypothesize that two different cultures, although sharing the same territory, have different perceptions on the conservation problems that exist, and on the possible solutions for these problems. We worked on an area inhabited by mestizo peasants –*Criollos*- and indigenous *Wichí* people, two cultures that live alongside and use natural resources in a subsistence manner [15, 18, 22, 30]. We focused our research on how these cultures perceive the conservation situation of large and medium-sized wildlife species because some of these species can be used for regional conservation planning; e.g. landscape species or umbrella species [31-33] provide important ecosystem services [34-38], are important protein sources for local inhabitants [15, 34, 37, 40], and are vulnerable to human impacts [30, 37, 39]. We end our study by discussing measures that could add to the long-term conservation of these species and this region, and that are based on each culture's characteristics.

## Materials and Methods

### *Study Area*

The Gran Chaco is a plain that covers over a million square kilometres, composed by a mosaic of woodlands, grasslands, and xeric thorn forests [41-43]. It occupies portions of Paraguay, Bolivia and Brazil with the largest portion in Argentina (60%, 675,000 km<sup>2</sup>). It is the second largest phytogeographic unit after Amazonia and possesses the largest dry forest of the continent [42, 43].

The Gran Chaco is rich in biodiversity, and inhabited by many endangered and endemic species [43-45]. It is considered a conservation priority at a regional scale based on its evolutionary and ecological processes, and because of being endangered due to accelerated habitat loss and degradation [42, 43, 46].

According to its western-eastern pluvial gradient, the Chaco has been divided in three sub-regions of which the semiarid is the driest. It has a marked seasonality, precipitation of

400–800 mm primarily between October and April, and covers 270,000 km<sup>2</sup> [41]. We worked within the Semiarid Argentinean Chaco where temperatures during the summer can reach over 50°C and the winter is normally deficient in water (Fig 1).

The study area was colonized during the 20th century by non-indigenous people, peasants locally known as *Criollos*, who settled on isolated ranches alongside indigenous *Wichí* communities. Currently, Semiarid Argentinean Chaco’s population density is low and mainly rural, and the region is one of the poorest of Argentina –with minimal health, educational or communicational services. *Criollos’* livelihood is based on extensive ranching of goats and, to a lesser degree, cows; small domestic animals are also raised for consumption. Many of them also practice subsistence hunting and logging [15, 22]. *Criollos*, like Venezuela’s *llaneros* or Brazilian Pantanal’s *pantaneiros*, are an example of a non-indigenous human group profoundly connected to and dependent upon the local environment. *Wichís* practice subsistence hunting or fishing - depending on the community - and gather natural resources for living although their main sustenance is the “social plans” given by the Argentinean Government - which means that a small stipend is delivered to every family on a monthly basis. Many *Wichís* also practice logging or have temporary jobs, and a few raise goats.

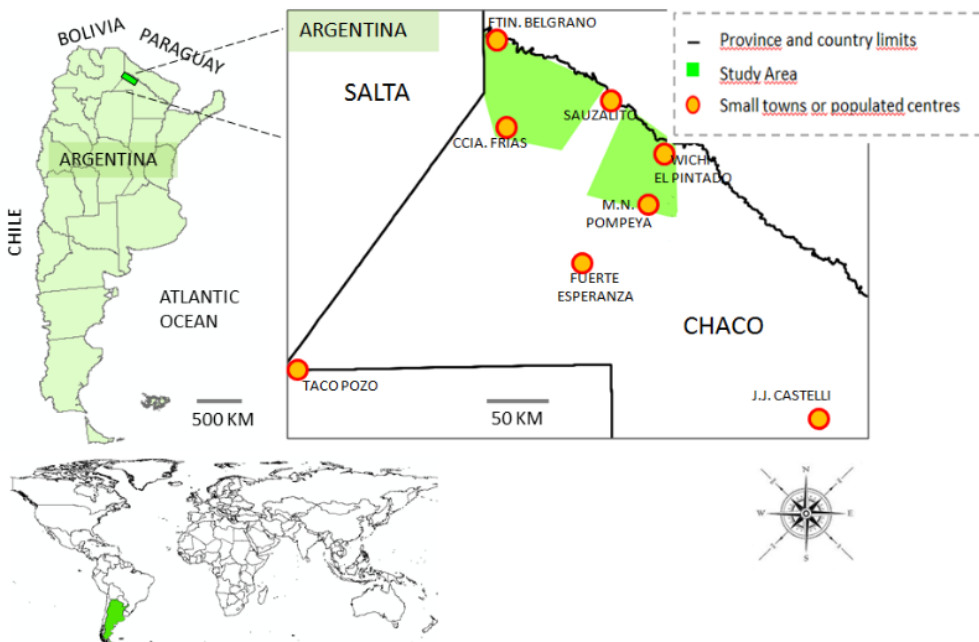


Fig. 1. Study Area located in Chaco Province, Argentina. Salta and Formosa are limiting Provinces, inside Argentina

### Field Data Collection

We conducted 105 semi-structured interviews (*Criollos*, N=64, and *Wichís*, N=41) between November 2010 and August 2011 with heads of families - males between 17 and 72 years-, from different settlements. We chose settlements randomly using Google Earth (Google, Inc., Mountainview, CA, USA) and satellite (images Landsat 5) images. We only worked in settlements with less than five houses, excluding larger settlements and villages. We conducted semi-structured interviews as informal conversations, and covered a list of topics and questions which focused on: (1) Determining respondent’s perception and understanding of local extinctions and changes in wildlife abundance in a 5-year and a 30-year time period. We chose

these time intervals because we aim to determine local perceptions of changes in wildlife population tendencies in the short and long term. (2) Addressing respondent's perception of explanations for observed changes in species abundance, and the situations they detect as impediments for the long term persistence of medium-sized and large wild mammal populations. (3) Understanding respondent's perception of conservation problems and of potential solutions. When respondents perceived changes as conservation problems, we asked them to propose solutions to reverse these changes. (4) Determining respondent's perceptions of conflicts between wildlife and local people and their ideas for potential feasible solutions to deal with these conflicts.

Conversations were in Spanish and lasted between one and four hours. We often did follow-up visits to review answers or complete information. When answers were ambiguous or doubtful we removed them from the analysis. We chose this sampling design with the aim of covering a broad diversity of perceptions. If we used a snowball design, we had the risked leaving aside groups of people because of geographical or social isolation. We interviewed only males because many *Wichí* women do not speak Spanish.

Before the interview we explained our interests, the aim of our study, the institutions we belonged to and how the information provided was going to be used and published. Interviews only started when we had consent from the interviewee. In the case of underage respondents, we also talked with his legal guardian, and if that was not possible the interview was not performed.

In addition to information collected through the interviews, we also performed non-structured interviews with key informants such as hunters (4), elders (2) and government technicians (2) to deepen our understanding on the above listed topics and the region's situation. We also conducted observations in the households and communities.

### **Data Analysis**

We analysed data using descriptive and inferential statistics, considering data represents frequencies or percentages of answers in each category, for each question. We assessed the differences between *Wichí* and *Criollo* perceptions using contingency tables with the Chi-squared and non-parametric Fisher's tests. We worked on territories where both ethnic groups inhabit to avoid the evaluation of differences between areas (Fig 1).

## **Results**

### ***Perceptions about local extinctions and changes in wildlife species abundances***

Most respondents considered wild animals as part of the environment, and declared themselves as angry or sad if a species went locally extinct (62% of *Criollos*, N = 29, and 65% of *Wichís*, N = 20). For *Criollos*, the feeling about the disappearance of pumas (*Puma concolor*) was an exception, as most reported they would be happy with its extinction (90.6% of *Criollos*, N = 64; more detail in Section "Conflicts between local people and wildlife, and proposed solutions"). *Wichís* however, did not report happiness related with the extinction of any species (N = 20).

More *Criollos* (42%, N = 50) than *Wichís* (12.5%, N = 40) reported the disappearance of medium sized and large species in the last 5 years ( $\chi^2 = 6.69$ , df = 1,  $p < 0.01$ ). However, a similar percentage of interviewees of both groups perceived the extirpation of one or more medium and/or large species in the last 30-years (62.5% of *Criollos*, N = 56, and 86.7% of *Wichís*, N=15;  $\chi^2 = 1.02$ , df = 1,  $p > 0.05$ ). The extirpation of Giant armadillos (*Prionomys maximus*) was the most frequently reported by both groups ( $\chi^2 = 0.04$ , df = 1,  $p > 0.05$ , Fig 2). Other species detected as locally extinct differed between both human groups. The absence of White-lipped peccaries (*Tayassu peccary*) was noticed by *Wichís* in a significantly higher frequency than by *Criollos* ( $\chi^2 = 7.37$ , df = 1,  $p < 0.01$ , Fig 2), whereas the absence of Jaguars

(*Panthera onca*) was mostly noticed by *Criollos* (Fisher’s exact test,  $df = 1$ ,  $p < 0.01$ , Fig 2). Other species reported as locally extinct during both periods of time were Tapir (*Tapirus terrestris*), and in some highly populated areas where households were more frequently in the forests, Chacoan Cavy (*Pediolagus salinicola*), Southern Three-banded Armadillo (*Tolypeutes matacus*) and Brocket Deer (*Mazama guazoubira*) were also reported as locally extinct.

In terms of changes in species’ abundance, most respondents noticed a decrease in the populations of most large and medium sized mammals for both periods of time, with no statistical difference between both human groups ( $\chi^2$  for the 5-year period = 0.24,  $p > 0.05$ ;  $\chi^2$  for the 30-year period = 0.04,  $p > 0.05$ ).

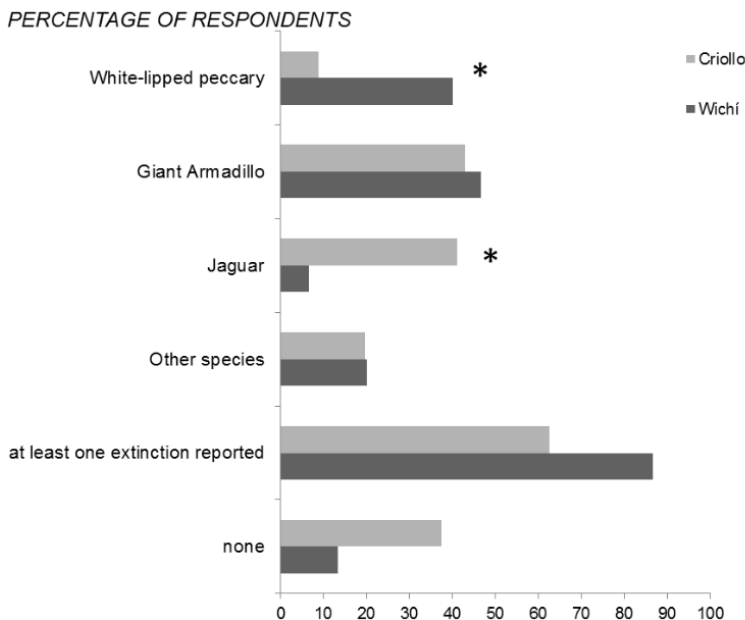


Fig 2. Large and medium-sized mammal species considered locally extinct by local respondents, and percentage of respondents with this perception, in the last 30 years.

All species identified as extinct by a respondent were considered, leading to a sum of percentages that exceeded 100. (\*) Significant difference between the number of Criollo and of Wichí respondents ( $p < 0.01$ ).

**Explanations for local extinctions and perceptions of conservation problems**

The reasons most frequently given by local respondents to explain the decrease in abundance and the disappearances of wild species were hunting and habitat loss. The number of *Criollos* and *Wichís* reporting these reasons did not differ (*Criollos* N = 34, *Wichís* N = 29,  $\chi^2_{\text{hunting}} = 0.21$  and  $\chi^2_{\text{habitat loss}} = 0.38$ , both with  $df=1$ ,  $p>0.05$ ) (Table 1). *Wichís* reported more spiritual and religious explanations than *Criollos* (*Criollos* N=34, *Wichís* N=29, Fisher’s exact test,  $df = 1$ ,  $p < 0.01$ ). These spiritual and religious explanations were: (1) Spirits that own wildlife species have disappeared and when this happens animals go away; (2) Shamans no longer exist. Only *Criollos* perceived changes in local weather conditions as a reason of the general decrease in species abundances (Table 1). Reasons listed as “other reasons” (Table 1) included explanations such as: predators ate so much prey that it led prey-species to extinction, competition with other wildlife species (e.g. jaguars disappeared because pumas do not leave animals for them to hunt), or the lack of cause-effect explanations.

**Table 1.** Perceived reasons for observed changes in wildlife abundance and in local extinctions, and percentage of respondents that mentioned each reason.

Reason	Percentage of Respondents	
	<i>Criollo</i> (n = 34)	<i>Wichí</i> (n = 29)
Hunting and over-exploitation	53	45
Habitat loss	56	45
Climate Change	26	0
Spread of diseases	15	21
Animals did not disappear, they are hidden or left	6	7
Spiritual and religious reasons	3	21
It is a stage in the natural cycles	3	7
Other reasons	9	7

In grey: reasons locally perceived as impediments or problems for the long-term persistence of these species. Some respondents included more than one explanation for observed changes and thus total percentages may exceed 100.

Most respondents find impediments for the conservation of large and medium-sized wildlife species (in grey in Table 1), and we found no difference between the two human groups in these perceptions ( $\chi^2 = 0.6$ ,  $df = 5$ ,  $p > 0.1$ ).

**Solutions for observed conservation problems**

A majority of interviewees who identified problems for the long term persistence of wildlife in the region mentioned possible solutions to minimize or solve these problems (61% *Criollos*, N=41, and 68% *Wichís*, N=22). Given the small sample sizes we performed, no statistical test was done to evaluate the difference between the two human groups in proposed solutions. However, we can see that *Wichí*'s most popular solutions were related to behavioural changes of hunters to make hunting sustainable while *Criollos* found the implementation of new laws and regulations to be more important, specifically the prohibition of hunting by non-locals (Table 2).

Education and conservation actions in the area were also proposed as solutions for existing problems by both human groups (Table 2). The idea of creating strict protected areas to conserve low-abundance species and their habitats was not very popular among any of the groups (Table 2).

**Table 2.** Proposed solutions for wildlife conservation and percentage of respondents who identified these solutions (*Criollos*, N = 41; *Wichís*, N = 22).

	Proposed solutions	Percentages		
		<i>Criollo</i>	<i>Wichí</i>	Total
1	<i>Hunting restrictions</i>	24.39	54.6	41.09
1.1	Not hunting when females are pregnant or in breeding season	12.2	27.27	20.55
1.2	Not hunting more than what is needed	12.2	27.27	20.55
2	<i>Enforcement or creation of laws and regulations</i>	46.3	18	34.25
2.1	Prohibition of hunting by non-locals	19.5	4.54	12.33
2.2	Creation of protected areas	9.8	9.09	9.59
2.3	Improvement of hunting law enforcement	12.2	0	6.85
2.4	Temporary prohibition of hunting of a selected group of species	4.9	4.54	5.48
3	<i>Education or conservation actions</i>	19.5	22.72	21.92
3.1	Education on sustainable hunting practices and the importance of caring for natural habitats	12.2	18.18	15.07
3.2	Restoration of natural habitats	7.3	4.54	6.85

***Conflicts between local people and wildlife, and proposed solutions***

The majority of *Criollo* respondents (97%, N = 69) reported serious conflicts with pumas, in contrast with few *Wichís* (4.9% N = 41,  $\chi^2 = 18.6$ , df = 1,  $p < 0.001$ ). Pumas kill goats raised in extensive ranching and sometimes kill many individuals at once; they may also kill pigs and young horses. Most of the *Criollo* interviewees (88%) who declared conflicts with pumas said they hunt the conflictive individual for control, and 68% said they hunt pumas whenever they can even if there has not been predation. Most *Criollo* respondents also perceive a high density of pumas inhabiting the study area (80%, N = 64).

The most popular solution proposed by *Criollos* to solve this conflict was to exterminate pumas (41.5%, N = 65), whereas 27.7% perceive changing livestock management practices as a possible solution. Fewer (20%) see deforestation as a driver of the puma's movement into their areas; they believe that there are more pumas now than before in the vicinity of their houses, and proposed control of deforestation as a solution. However, others (10.8%) see natural habitats as refuges and sources of pumas, and would rather get rid of natural habitat assuming that this would force predators to go away.

A majority (70.9%) of *Criollos* as well as *Wichís* also perceived conflicts with foxes (*Lycalopex gymnocercus*; *Cerdocyon thous*) (Chi = 0.32,  $p > 0.1$ , N = 60). And many (55.5%, N = 110) considered them as a serious threat as they predate on domestic chickens, eggs, and newborn goats or domestic animals. Other species named as conflictive for these same reasons were: *Didelphis albiventris*, *Leopardus geoffroyi* and *Conepatus chinga*. Species considered a problem for damaging crops were plains viscachas (*Lagostomus maximus*) and white-lipped peccaries

**Discussion**

In this study we found that two different cultures that inhabit a territory dominated by natural environments have a close relationship with wildlife and perceive wild animals as part of the environment and of their daily lives, declaring themselves as angry or sad if a species goes locally extinct. Despite sharing the same areas, we found that each cultural background engenders different perceptions on conservation issues and that each group has different perceptions on the conservation problems that exist, and on the possible solutions for these problems. Therefore, although most respondents perceive local extinctions and a decrease in the abundance of most wild species, *Criollos* reported these situations more frequently than *Wichís* when considering a five-year time period. Species may have disappeared earlier in *Wichís*' territories where people live in larger settlements and use common and pre-established hunting places, whereas *Criollos* live and hunt in larger and more isolated areas. *Wichís* used to be transhumants, hunting and gathering in an area until natural resources were scarce, and then they changed their location; after becoming sedentary societies their cultural behaviour towards natural resources may be adapted to an environmental context that is not the present one [17, 18, 47].

More *Criollos* than *Wichís* acknowledged jaguar's local extinction, which is in accordance with recent studies that have shown the collapse of this species' population in the region [48]. This probably occurs because *Criollos* are more aware of the presence of this species given its possible attacks on their cattle. It is also possible that the different perception is based on how the *Wichís* connect at a spiritual level with wildlife. Jaguars have a symbolic meaning for many cultures of the Neotropics [49, 50]. For indigenous people of the Gran Chaco ecoregion, shamans can transform themselves into jaguars, making this species one of the most powerful beings [51]. Therefore, jaguars exist for these cultures on a phenomenological level and as invisible beings that co-exist with humans [51]. This different symbolic meaning could also explain the divergent perceptions of the extirpation of white-lipped peccaries, but this needs further anthropological research. Another explanation for this

contradictory perception may be a true reflection of local wildlife abundance, due to past hunting pressure; peccaries are one of *Criollos'* preferred meats and they have heavily hunted the species since the colonization of the region [15, 30, 52], whereas *Wichís* do not put special attention to its presence and do not hunt it as much because of the lack of access to guns and the risks associated with its hunting [53]. However, the large area requirements of these species give weak support to this last hypothesis [55].

Local perceptions and scientific opinion coincide in that there is a general decline of abundance of most species with some local extirpations [15, 22, 52, 48]. Local extirpations reported by interviewees in this study include many species that are endangered at the national level such as white-lipped peccaries, giant armadillos, tapirs, chacoan peccaries (*Catagonus wagneri*) and jaguars [54]. Although peccaries and jaguars have been studied recently [15, 30, 48, 52], there is almost no information on other vulnerable game species in terms of their status, trends or distribution, or their ecological needs in the region [55]. Research on these topics is urgently needed in the Semiarid Argentinean Chaco.

Most interviewees recognized that these decreases in abundance and local extinctions are related with conservation problems associated with human activities. Hunting is perceived as one major driver of local extirpations and a deeper discussion of how local cultures.

Habitat loss and degradation was another conservation problem recognized by both groups as an important driver of local wildlife extinction. Again, local perceptions coincide with scientific opinion: Habitat loss and degradation in the Gran Chaco are considered accelerated processes that endanger the region [42, 43, 46, 56]. Other studies have shown that habitat degradation could be reduced by improving *Criollos'* livestock management [42]. However, other drivers of habitat degradation such as *Criollo's* and *Wichí's* logging would not be solved with these types of measures; this practice follows the market requirements and local people get a small amount of money for this activity (*pers. obs.*). This means they have to extract many more trees than the number that would be extracted if commerce and trade was fair; therefore developing means to participate in fair trade would help in the excessive extraction of this resource and could, therefore, decrease habitat degradation. Also, diversification of local products could decrease the process of habitat degradation generated by the unsustainable extraction of natural resources that follow national and international markets [57]. Non-timber products and both human groups' handicrafts are highly valued outside the region and yet locals make an insignificant profit from this market. Habitat degradation could also be reduced if local inhabitants had their property deeds because that increases the incentive to take better care of natural resources [22, 57]. In contrast, reducing habitat loss produced by intensive soy monoculture or intensive cattle raising – problems related with agriculture expansion – depend on government decisions; however, these practices could be less destructive if there is a carefully designed, spatially explicit conservation landscape [56, 59].

Other reported conservation problems require further research, *e.g.* on the dynamics of parasites and spreading diseases in the past, which were acknowledged during this research. For example, deaths of many individuals of giant armadillo, chacoan cavy and giant anteater (*Myrmecophaga tridactyla*) were reported as a result of diseases.

Spiritual reasons for species disappearances and decreases were reported in abundance, for indigenous communities of Chaco Shamans interact with the spiritual world and communicate with animal-owner spirits through practices of altered states of consciousness [18, 47, 51]. They then inform hunters if hunting of a particular species was allowed that day and the number of individuals they are allowed to hunt. The relation between hunting, humans and wildlife in a spiritual dimension is discussed in another study.

Most respondents believe there are solutions for conservation problems, which indicates that well explained and culturally coherent conservation-measures could be applied and succeed in the study area. However, we found a lack of agreement for a particular solution of observed conservation problems, and lack of consensus was already reported for *Criollos* in this area



[22]. Nonetheless, our results differ from those of other communities of Chaco, where proposed solutions for conservation problems were homogeneous; e.g. Guaraní communities of the Bolivian Chaco [60].

Although both human groups' most popular solutions focused on solving over-hunting, *Criollo's* preferred solutions were not seen as solutions by *Wichí* respondents. These solutions were: (1) prohibition of outsider hunter's entrance and (2) increasing control and enforcement of hunting laws. A probable explanation for this difference is that *Wichí* communities have their properties enclosed while *Criollos* do not and thus foreign hunters enter frequently into *Criollo's* properties but almost never in *Wichí* territories. The enforcement of regulations to control outsiders could be difficult if it requires the involvement of governmental institutions, given the high degree of isolation of the study area and the weakness of government institutions. These controls could be attained, however, by social restrictions applied by local people who could reject the allowance of outsiders [12].

Considering some of the misunderstandings that local people expressed in terms of wildlife abundance decrease, we believe that education on ecosystems functioning and the role of wildlife, as well as an enhanced communication and interaction between conservation agencies local inhabitants is crucial. Conservation actions should include workshops for local inhabitants to involve in territory management, and include the seeking of solutions for the problems *Criollos* have with Pumas. A recent study found that Puma densities in the area are low [48]. The combination of low density and high hunting pressure we detected may pose risks for this species in the region. Most *Criollos* hunt pumas frequently, perceive them to exist in high densities and consider their extinction as the best solution to livestock predation conflicts. Conflicts with Pumas occur more frequently with *Criollos*, who practice extensive ranching: cows are free in the natural environment and only occasionally penned, and they sleep and give birth in the forest. Goats are normally kept in corrals during the night but during the day they range free in the forest by themselves or under the care of specialized dogs that are unable to deter pumas attack. These types of cattle management practices lead to high probabilities of carnivore attacks. However, changing cattle management was not seen as a solution by more than 70% of respondents. Thus, we believe that more specific research should be done to find feasible solutions to this problem. Conflicts with carnivores have been widely recorded in different parts of the world, and are especially serious where cattle management is extensive [61, 62].

Other species were mentioned by *Criollo* as conflictive were those considered "destroyers of the fodder" that goats and cows need, or for destroying crops. Although agriculture is not a very popular activity, it is practiced on a small scale in many households and intensively in certain areas. When white-lipped peccaries appear in crops, the owners normally permit their neighbours to enter the property and kill as many individuals as they want. Plains viscachas, on the other hand, are normally killed by the owner or crop keeper using water, guns or fallen branches. Non-carnivore conflictive species have been reported in many studies in the world, e.g. conflicts with elephants and crop damage [63]. In our study area these kind of conflicts do not seem extended but the white-lipped peccary's situation needs further research because crops could act as attractors for the species and, as hunting pressure is high in these places, it could act as an ecological trap. This factor, in addition to the fragmentation problems of the Chaco region, pose a serious risk for the species.

The study area is part of a legally-declared buffer zone of the new National Park created in 2014 ("El Impenetrable", Fig. 1.), and our results show that less than 10% of local respondents find protected areas useful for the long term conservation of wildlife. This new national park is of particular importance, considering the small percentage of the Dry Chaco that is protected (6.4% in Argentina, National Office of Environment) and the fact that habitat destruction occurs at alarming rates [43, 46, 56]. However, local misunderstandings of new protection rules (e.g. no hunting or farming) and access restrictions may exacerbate conflicts

between locals and the National Park Service. This type of conflict has happened in many cases around the world, decreasing the effectiveness of conservation goals [64]. Additionally, the inadvertent breaking down of social norms that we do not know or understand and now could be providing positive management [65]. Protected Areas alone have failed in the long term conservation of different targets, or landscapes, if local people and buffer areas are not correctly managed and protected area remains as an isolated island [66, 67].

## Conclusion

The importance of investigating the particular relationships humans have with wildlife, besides economical values of hunting and impacts of this activity on wildlife populations, has been lately acknowledged [14] and this study joins the research on context-sensitive management plans for implementing conservation [9, 14]. Our research provides insight into the similarities and differences in perceptions of two different cultures regarding wildlife species, conservation problems and potential solutions.

Different cultures in the same territory have different perceptions on conservation issues, and therefore, each culture would require a custom approach if conservation measures are applied.

Particularly for this Chaco region, local cultures identified conservation problems and conflicts with wildlife, and proposed solutions to these situations. Most of the Dry Chaco is inhabited by local *Criollos* and *Wichís* whose perceptions are usually not considered when management actions are implemented. Lack of consideration for the local needs and perceptions of wildlife makes conservation actions in the territory weak and prone to fail [7, 10-12]. In particular, our results indicate that it is urgent to develop solutions for the conflicts *Criollos* have with pumas, as well as the design of a conservation landscape that allows the long term persistence of the species that, although still present in a larger scale, seem to be disappearing (e.g. *Tayassu pecari* or *Priodontes maximus*). New protected areas are recommended for this territory, and workshops with local people are essential for them to correctly understand their role and give their opinions on their creation and design. Additionally, these areas are surrounded by these populations and therefore conservation measures that strengthen local conservation capacities are highly recommended.

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