

Human-wildlife conflict in indigenous communities of the Nairi Awari Indigenous Territory of East Central Costa Rica

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Abstract. Sáenz-Bolaños C, Fuller TK, Sievert L, Carrillo E. 2022. Human-wildlife conflict in indigenous communities of the Nairi Awari Indigenous Territory of East Central Costa Rica. *Biodiversitas* 23: 2238-2244. Human-wildlife conflict is essential for conservation because it is necessary to maintain the balance of requirements needed by humans and wildlife. Indigenous territories are not exempt from interactions with wildlife, and in this study, we focus on one indigenous territory of the Cabécar Indigenous Group of Costa Rica called Nairi Awari. We wanted to know which are the most common wildlife species, which interactions with these species the Nairi Awari consider negative, and what are the possible solutions to these interactions. To do this, we administered 24 semi-structured questionnaires to indigenous people from March-August 2019. The results showed 16 species as “problematic animals”, the jaguar (*Panthera onca*) being the most common, followed by hawks. Of the six problem categories identified, predation on poultry was the most cited category, but it raised fewer negative feelings among respondents than some other problems. Possible solutions to pig or cow predation, problems which most maddened respondents, included improved management (48%), scaring animals (12%), and killing big cats (16%). It is important to understand these perceptions in order to address future management to benefit conservation and human welfare. In particular, there is potential to work in the long term to improve the management of domestic animals.

Keywords: Conflict, indigenous, Nairi Awari, perception, predation

INTRODUCTION

More than 10% of the 37.9 million km² of indigenous territories around the world are in Latin America (Garnett et al. 2018). In these territories, there are more than 826 Indigenous Peoples groups that in 2010 represented more than 8% of the human population in Latin America (United Nations 2019). Moreover, the five great masses of tropical forest in the world occur in large part of indigenous territories, which is true in Central America (Euroclima 2019). In Costa Rica and Panama, widespread tropical forest occurs in the Talamanca region, which includes a considerable area of indigenous territories.

In Costa Rica, there are 24 indigenous territories covering 6.6% of the national territory (UNICEF-Costa Rica 2010, Ortiz-Malavasi 2014) and representing 2% of the country’s human population (Guevara and Ovarés 2015). The indigenous territories of Costa Rica are home to eight native groups, the two largest of which are the Bribri and Cabécar, with marked differences in language, customs, and traditions. Our focus is on the Cabécar group, the second-largest in size, with a population of 13,993 (12,707 indigenous and 1,286 not indigenous) people distributed over eight territories in approximately 1,800 km² (MIDEPLAN 2015; Ortíz-Malavasi 2014). The Cabécar group has 8 of 24 territories in the country and the Nairi Awari is one of them, where we focused this study.

For the Cabécares, animals are very important in their culture because of their role in stories as spiritual guides. Nature also plays an important part in the harmonious and respectful way that they live with the environment. Moreover, domestic animals such as cows, sheep, chickens and, especially, pigs are also valuable to them, as they are an important part of the diet, economy, and/or spiritual traditions (Ayalew et al. 2011; Guerrier et al. 2013; Maly et al. 1998; MEP 2014; Nahar et al. 2015; Simon 2015.). The way pigs are raised in the Cabécar culture is free-ranging, but like the pua’a (Polynesian pig), they have a very strong relationship with human families (Guerrier et al. 2013; Maly et al. 1998). For example, Cabécar houses are raised on posts, allowing the area under the dwelling to house animals. Animals roam free in the grasslands or in the jungle, where they search for food during the day, and they return to their houses at night; for that reason, they are seen as members of the family.

This way of pig management allows pigs to go inside the forest for a number of kilometers, where wild predators are also looking for food. This situation sometimes causes some losses for the people and therefore, they become annoyed with predators, as Montalvo et al. (2016) reported with livestock. As a result, wildlife-human conflict usually occurs in the villages close to the forest, especially the degraded ones (Gunawan et al. 2017; Permana et al. 2020). For that reason, we wanted to know if Nairi Awari Indigenous Territory inhabitants feel that wildlife generates

negative impacts and if they consider big cat predation on pigs as a big issue. We also wanted to know if they use methods to repel the wildlife from their properties to protect their animals, for example as described in Hoogesteijn and Hoogesteijn (2014). If they use such methods, then how efficient is the method, or if they do not use it, why not? It is important to understand human relationships with nature, but it is also important to work together for the well-being of communities, domestic animals, and wildlife; it is important to keep a healthy and balanced ecosystem and a thriving culture of native people. Here we focus on human-wildlife conflict and possible useful solutions to conflicts in the area. We wanted to know what species are considered problematic and what problems they cause, what the people perceive the trend will be in the future for the problems, what some possible solutions to the problems are, and how management can be changed to create better conditions for all the pieces of the big puzzle.

MATERIALS AND METHODS

Study area

This study focused on one Cabécar territory called Nairi Awari Indigenous Territory (NAIT), located in the northern part of the Talamanca Mountains between Cartago and Limón provinces (Figure 1). Annual rainfall ranges from 3,000 to 5,000 mm, elevation ranges from 170 to 1,107 m,

and temperatures range from 20 to 24°C (Ortiz-Malavasi 2014). This territory divided into two pieces of land, has an area of just over 50 km² and a population of 473 inhabitants, where 223 are indigenous people and approximately 74% are older than 15 years of age (MIDEPLAN 2015). With very few sources of employment, most inhabitants live on their crops and raise animals (Kelly 2019; Sáenz-Bolaños et al. 2015). Some work as day laborers or for the few tourism companies in the adjacent Forest Reserve.

Data collection

After a mandatory meeting with the Nairi Awari association, where we presented the ideas for the project, we asked if they agreed and were willing to be part of the study. After some months, we obtained permission to work in the Nairi Awari Indigenous Territories, first by message text and then several months later by formal letter.

From March to August 2019, we conducted a study using a face-to-face questionnaire in structured interviews (Newing 2011). Respondents were indigenous people ≥ 18 years old, and the majority of them were interviewed inside the Nairi Awari territory, but others in their workplaces (Figure 1). The questionnaire was organized as open-ended questions and Likert scale answers, and we collected relevant quantitative and qualitative data. The questionnaire was approved by the Institutional Review Board of the University of Massachusetts, Amherst (Protocol ID 2018-5066).

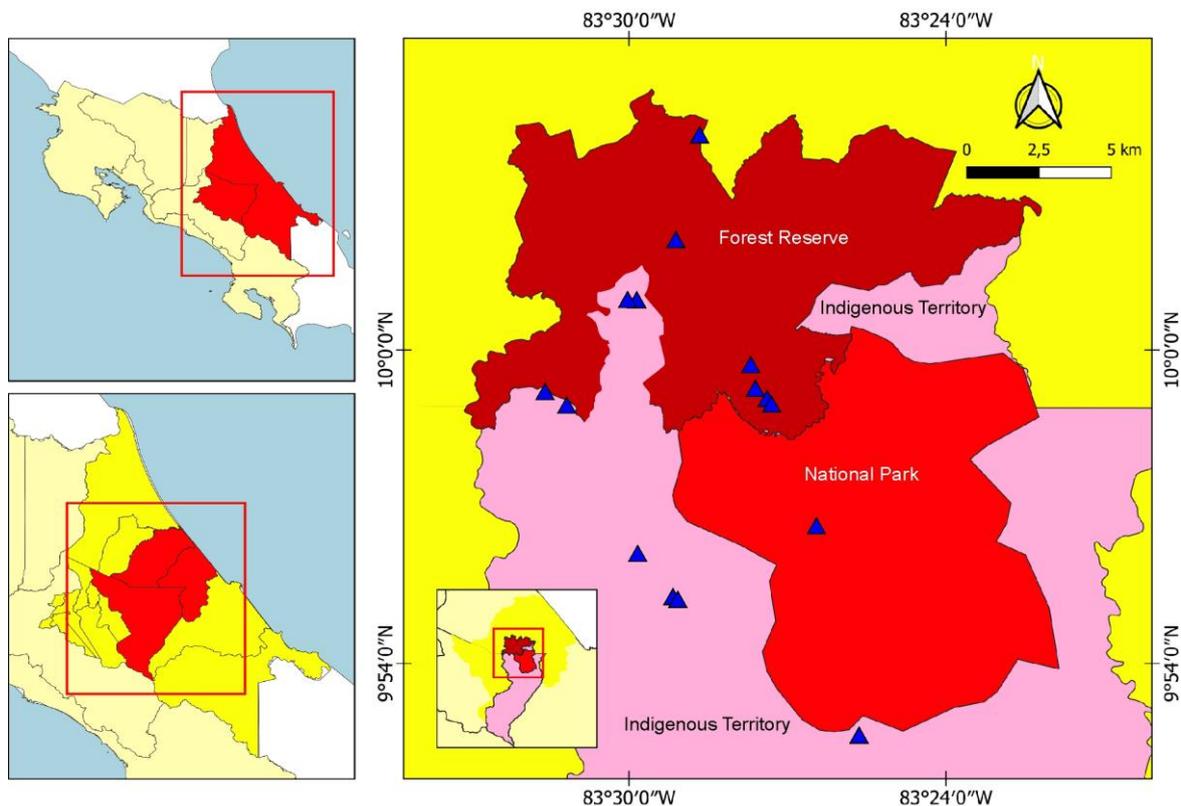


Figure 1. Area covered with the questionnaires applied within the Barbilla Sector in the northern Talamanca Mountains of Costa Rica

Once in the field, we walked in the jungle or gravel roads, and when we found a house, we approached the residents and explained what the survey was about and inquired if they would be interested in participating in the study. Every interviewee was informed about how much time the survey would take, that their participation was voluntary, that their replies were confidential (no names in the instrument), that they could end the survey at any time, and that it was not mandatory to reply to any question. We interviewed both genders, but we did not interview a woman if the husband or partner was present to reduce potentially biased answers (Baker et al. 2014; Korieh 2006); Thus, we interviewed women separately to obtain independence in the responses (Jenks et al. 2014). All the surveys were conducted in the Spanish language. However, in the indigenous territories, we employed a Cabécar assistant who spoke their language and translated for us when they did not understand some questions or if they used some Cabécar words that we could not understand. We wrote answers on a printed questionnaire and then tabulated them in an Excel spreadsheet.

Data analysis

We grouped all answers about wild species they consider causing some problem to people of the community and which problem type they referenced. In this case, the community is a set of properties from different owners in areas inside the indigenous territory. To categorize the problems, we grouped the answers into six categories according to the problems caused by the animal they considered as problematic (i.e., livestock attacks, poultry attacks, crop impact, pig attacks, the physical risk to humans, and others).

We conducted a descriptive analysis of the species cited as problematic and what problems that wildlife causes. For both questions concerning attacks (When was the last time a big cat caused an attack in the community? When was the last time a big cat caused an attack on your animals?), we grouped the answers into four periods when the attacks happened: a) Never, b) \leq one month ago, c) $>$ one month ago but $<$ one year ago, and d) $>$ one year ago.

To know what indigenous people of the Nairi Awari Indigenous Territory consider possible solutions to reduce wildlife interactions and negative impacts on the inhabitants, we categorized the answers into five groups according to their similarities.

RESULTS AND DISCUSSION

Results

Twenty-four questionnaires were completed for 16 indigenous men and 8 indigenous women. Sixteen species were cited as bad in relation to some problem or negative opinion voiced by the respondents (Figure 2), as Marchini (2014) explained. Only the two big cats (jaguar and puma) were considered a problem in different categories. Overall, 70% of indigenous people interviewed (5 women and 12 men) considered jaguar (including "black panther," the melanistic color phase of jaguars) or puma as problematic.

On 12 occasions, jaguar/black panther or puma was stated as a pig predator, 7 times a livestock predator, and once each for poultry attacks, a hazard for humans, and others. The big cats represented 86% of the respondents' answers to the cause of problems with livestock and pigs (Figure 3). Only two people indicated jaguars and pumas as problematic species in more than one category (i.e., both livestock and pig attacks). Thirteen respondents cited eight species as poultry predators (hawk = 5, boa = 4, opossum = 4, coyote = 3, ocelot = 3, tayra = 2, jaguar = 1, and jaguarundi = 1). Eight persons referred to six species (coati, agouti, mice/rats, collared peccary, paca, and red brocket) as crops eaters, and two people cited poisonous snakes and jaguars as species that are a hazard to human beings (Figure 4).

To evaluate the perception of risk or losses, we first asked about ownership of livestock or pigs; 79% responded positively, having mostly cows or pigs but in low numbers (Table 1). The person who had more cows owned 21 animals, and for pigs, the highest number was 35. Horses and sheep were also owned by some interviewees, but on many fewer properties and the numbers were much lower. For example, those interviewed with the most horses had only 8, and those with the most sheep had only 7 animals (Table 2).

Only two people who considered jaguars/black panthers or pumas a cause of predation on livestock or pigs also cited them as other problems (i.e., risk for humans and others). Regarding the timing of the last attack, only 5 respondents indicated either never or that they did not know if that problem happened, whereas 19 indicated some timing of occurrence in the community.

Referring to how they perceive the situation in the future, 68% of respondents considered the problem would be the same, 20% opined there would be less (the number of attacks would decline), 8% considered interaction would be greater (attacks will go up), and 4% indicated they did not know. What they considered as possible solutions were to improve management (48%), kill the feline (16%), scare it away, do nothing (12% each), don't know (8%) and others (4%) (Figure 5).

Discussion

The interviewees identified problematic species as attacking their animals, feeding on their crops, or being a hazard to humans. The 16 species considered responsible for causing negative impacts commonly are problem species in many areas; for example, the species cited as causing poultry attacks are well known to cause such attacks in most places where poultry occur (Amador-Alcalá et al. 2011; Andelt 1976; Lloyd-Alcock 2020). Nevertheless, the majority of this happens because people do not have a place with adequate conditions to avoid the interactions, especially at night when it is more common to have visits of wildlife to the areas with poultry (Amador-Alcalá et al. 2011; Jacob et al. 2017; Ohionline 2018). But interestingly, even when the poultry attacks were more cited, people had fewer negative feelings about the predators, perhaps because the chickens are easier to replace and culturally are not important as pigs. Because

big cats cause more fear (Marchini and Macdonald 2012), than the other predators, to have few cows or pigs and lose one due to big cat predation more strongly affects the owner, which is probably one reason they have more negative feelings than individuals with poultry predators. As other authors say that when the economic losses are important for the owners of animals, the perceptions could change and influences the behavior (Fendt 2014; Kelly 2019).

Most people considered big cats a problem for pigs and cattle, but a few people considered them a hazard for humans or poultry, as well, even though in the country or Central American Region, there are no reports of attacks on humans (Kelly et al. 2019). As in many countries with wild big cat-human interactions, problems occur as a result of the management of domestic or production animals (Amador et al. 2011; Polisar et al. 2003; Tiger Guard

2020). For example, domestic animals are allowed to enter the forest searching for food or water, or people do not control their animals during the calving or farrowing season and both wild and domestic animals share the space (Marchini et al 2017). This study in the Nairi Awari Indigenous Territory is no exception. The culture of this indigenous group is that they believe that pigs must be managed as free-ranging, as their ancestors did. And though cultural legacy is one reason for this practice, these people also find that this kind of management is an easy way to have animals and not think too much about what they are going to feed them. One interviewee said, "In my home community that it is also Cabécar, my people work hard to keep animals fed, so they produce what the animals eat. But here, people do not want to work on that; they know it is necessary but prefer not to do it".

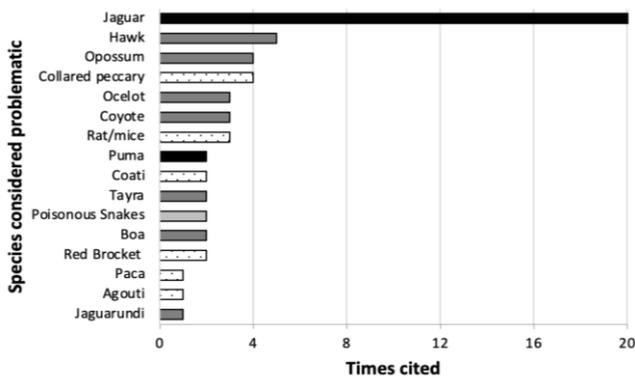


Figure 2. Species are considered problematic by inhabitants of the Indigenous Territory. Black bars indicate more citations for livestock attacks, dark grey bars poultry attacks, light grey bars cited as a hazard to humans. Spotted bars species more cited as crop eaters

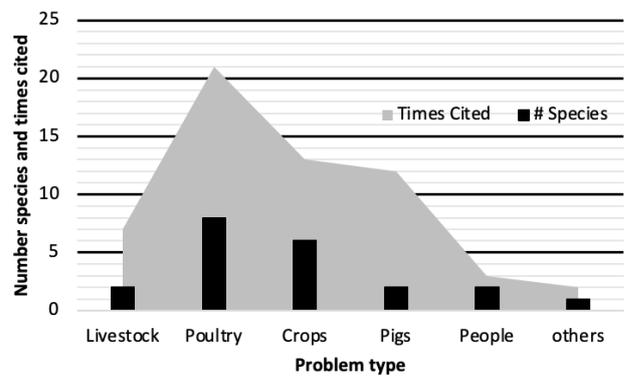


Figure 4. Number of species related by problem category and times a specific problem was addressed by inhabitants of Indigenous Territory

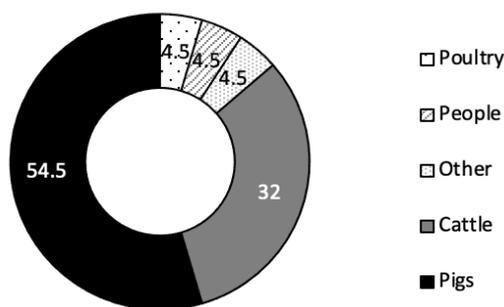


Figure 3. Type of problem percentage caused by big cats according to those interviewed in the Nairi Awari Indigenous Territory



Figure 5. Percentages of possible solutions cited by the inhabitants of Nairi Awari Indigenous Territory to avoid jaguar/black panther or puma attacks on livestock and pigs

Table 1. Summary of owner-managed livestock

	No. of owners	Only pigs	Only cows	Pig/cow	Pig/cow/horse	Pig/cow/horse/sheep
With livestock	19	3	3	8	3	2
With predation	8	2	0	3	1	2

Table 2. List of headof livestock per owner. The asterisk represents the properties with jaguar or puma attacks on specific livestock and in bold are the properties with attacks but more than one year ago

Own pigs?	Relative no. of cows owned	No. of hoofed livestock owned			
		Cow	Pig	Horse	Sheep
Yes	High	21	15	0	0
		20	25	8	0
		17	10	0	0
		17	10	0	0
		15	15	0	0
		13	20	7	0
		13	2*	0	0
		Mean 16.6	Mean 13.9	Mean 2.1	0
		Range 13-21	Range 2-25	Range 0-8	0
		Low	6	6	2
	4		30*	1	7
	4		20*	3	5
	3		12*	0	0
	3		12*	0	0
	2		1	0	0
	0		35	0	0
	0		28*	0	0
	0		16*	0	0
	Mean 2.4		Mean 17.8	Mean 0.7	Mean 1.3
	Range 0-6	Range 1-30	Range 0-3	Range 0-7	
No	Low	8	0	0	0
		5	0	0	0
		1	0	0	0
		Mean 4.7	0	0	0
		Range 1-8	0	0	0

On the other hand, free-ranging pig management forces people to raise crops far away from their houses (for some, kilometers away up or down mountains) to avoid having their livestock destroy and eat the crops. This, however, has consequences; people have less control in monitoring the crops, thus making it easier for some wildlife to cause crop damage. Also, it is more difficult for some elders to carry what they harvest over long distances.

Another consideration is that most (76%) of those interviewed have pigs or cattle, and of those, most owned pigs (84%; Table 2). However, most of the owners of pigs who lost pigs to predation by big cats were those that also had relatively low numbers of cattle (Chi square = 4.39, df = 1, p = 0.036; Table 2). This suggests that for Nairi Awari, husbandry practices differed depending on the relative number of cattle owned, and those practices affected the vulnerability of pigs to predation.

As many authors suggest, to reduce the negative impacts of wildlife, it is necessary to change the way owners manage their animals (Escobedo 2011; Hoogesteijn and Hoogesteijn 2014; Nyhus 2016; Polisar et al. 2003, Quigley et al. 2015). This study area, like many others in the world, is important for wildlife conservation because there is structural connectivity between wildlife and the cultural values and traditions of indigenous people that are also important to conserve. For that reason, is important to note what Dickman et al. (2013) said about doing more social science to understand the context. Given that the majority (68%) of respondents considered the trend in attacks on livestock or pigs will stay the same, and only two people (8%) considered the trend would be higher in

the coming years, we must work on management options to prevent these negative interactions, based on the information we get from interviews. For example, more than half of the interviewees considered that the better solution to keep the balance in the ecosystem and the livelihood of inhabitants of Nairi Awari is to improve the management of pigs by using enclosures and feeding the pigs. We agree that it is necessary to install enclosures for animals in the indigenous territory, while always keep large areas to move them from place to place on a regular basis. Nevertheless, the building of enclosures will require indigenous people to implement systematic food production for the animals. This will be a hard task, but it will be an interesting long-term project to implement in some communities and see the effects having some "model" properties, that is, those that have implemented new prevention methods. Another very important action to take is that the indigenous people must know how many pigs they have and control their age distribution. In the words of one interviewee, "they have a lot of pigs that go to the jungle, so they have to sell some and keep only little ones and lock them up". Another said, "is necessary to reduce the number of animals, and plant closer to having food for them (pigs)".

A notable percentage (16%) of people think the best solution is to kill the feline, also was cited by Kelly (2019). This not typical from the conservation point of view, and maybe it sounds like something bad for felid populations; however, many other cultures and even the beginning of wildlife management had the goal of keeping game species, so selective removal of some individuals was the purpose.

In our experience with the Cabécar people, some of them explained to us that when they decide to kill a feline or other animal, they ask for permission from the owner (God) of this species. Once they get permission, they have to kill the animal quickly to avoid the animal suffering, so that way, when the hunter passes away, he will not have to fight with this owner or other feline souls before finding peace in his soul. So for that reason, indigenous people could have been keeping this survival technique to maintain their livelihoods and respect nature and its functionality. Moreover, as Marchini & Macdonald (2012) found in Brazil, the impact on the livestock by jaguars is not the only reason for why people have intention to kill the big cats.

We think it will be important to achieve the real involvement of a group of committed owners that want to implement some enclosures and evaluate the effectiveness of such changes in realizing the long-term coexistence of big cats, indigenous peoples, and their culture. Now, after having surveyed some of the population, we want to implement a test corral study in a community, even by improving old corrals to keep animals (pigs) inside so that people could also plant some feed crops for the animals (e.g., sugar cane, cassava, banana, and other roots) close by. In the beginning, people will need assistance with getting supplementary food until the crops mature, but after initial guidance, there should be people ready and willing to do the work by themselves with limited guidance.

We now know the most common negative interactions with which species are in the indigenous territory; jaguars are the most common livestock and pig predators, hawks and opossums are the main poultry predators, and collared peccaries cause most crop damage. Moreover, people know what they have to do to reduce the conflict, especially with big cats and with nocturnal attacks on poultry. The majority of them cited improved management and the most common method was to keep the animals in enclosures, and also to reduce the animal numbers (especially pigs) to make crop production and the feeding process easier. Other prevention methods included scaring the predator using dogs, as was also reported by Schauer (2021), or using the rifle to make noise, though an interesting percentage indicated that killing the animal is an important management technique. From the conservation point of view, this is not an appropriate way to solve the interactions, but as Manfredó et al. (1998) and Jacobs et al. (2014) argue, the context can change the acceptance of killing a big cat. In this current situation for the Nairi Awari, they may have an attitude or cultural norm that, in their context, removing an animal is seen as a correct option to maintain their livelihood. This overview is important because it permits a better understanding of the social context and people's thoughts about management that could be implemented to reduce domestic animal losses while conserving wildlife and human welfare (Peterson et al. 2008; Peterson et al. 2010). Wildlife managers and practitioners have to understand social constructions in order to address the future actions to be deployed in support of wildlife conservation and human welfare (Chan et al. 2007; Madden & McQuinn 2014; Marchini and Macdonald 2012), and thus work closely

with the owners by giving guidance and support to ideas they could develop together.

Finally, in the future, a long-term comparative management project in communities with high pig predation by big cats will be an important study to do, especially if the inhabitants show interest and are willing to make changes that they believe can help to conserve their culture, livestock, and wildlife.

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