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II. CONFLICTOS ENTRE FELINOS Y HUMANOS EN AMÉRICA LATINA

Carlos Castaño-Uribe, Carlos A. Lasso, Rafael Hoogesteijn, Angélica Diaz-Pulido y Esteban Payán
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Human-jaguar conflicts in Brazil: a human dimensions perspective

Silvio Marchini, Emiliano E. Ramalho, Wezddy Del Toro-Orozco & Katia M. P. M. B. Ferraz

Abstract. To better understand and manage our problems with iconic animals like the jaguar, we must first acknowledge that human-wildlife conflict (HWC) is a complex phenomenon composed of three parts: wildlife damage, persecution/killing of the problem wildlife, and clashes of opinion between social groups about how to deal with the damage and the persecution. The first part is ultimately an ecological fact (competition, herbivory, predation), and because most professionals dedicated to HWC come from the ecological sciences, that is the part that has received the most attention. The human behavior of killing wildlife and the social conflicts over wildlife management, however, require an approach that goes beyond ecology. The three parts of HWC are closely related and may happen at the same time, but clumping them together under a strictly ecological understanding of HWC may constrain the way problems are defined and limit the array of potential solutions available: methods used to resolve wildlife damage problems differ from the solutions to wildlife killing and social conflicts. In this chapter we present an interdisciplinary approach to understand and manage conflict with jaguars, one that incorporates the perspective of "human dimensions". Human Dimensions of Wildlife is an emerging field of research and application that aims to describe, understand, predict and change human thoughts and actions towards wildlife. We outline how this approach has been used in Brazil to understand human-jaguar conflict with an eye to preventing the killing of jaguars (e.g. through incentives and social marketing) and contributing to public policies and systematic planning for human-jaguar coexistence.

Key words. Behavior change. Ecotourism. Policy. Social marketing. Systematic conservation.

Resumen. Para entender y manejar mejor nuestros problemas con animales emblemáticos como el jaguar, debemos reconocer primero que el conflicto humano-vida silvestre (HWC por sus siglas en inglés) es un fenómeno complejo que consta de tres componentes principales: daños causados por animales silvestres, la persecución/matanza de la fauna problema (por razones preventivas, represalia y otras razones); y los enfrentamientos de opinión entre los grupos sociales sobre cómo hacer frente a los daños y a la persecución. El primer componente es, en última instancia, un hecho ecológico y dado que la mayoría de los profesionales dedicados a HWC provienen de las ciencias biológicas, ese es el componente que ha recibido la mayor atención. El comportamiento humano de matar a la vida silvestre y los conflictos sociales por el manejo de la misma, requieren, sin embargo, un enfoque que va más allá de la ecología. Los tres componentes de HWC están estrechamente relacionados y pueden ocurrir al mismo tiempo, pero agruparlos todos bajo un concepto estrictamente ecológico de HWC, puede limitar la forma en que los problemas son definidos y por lo tanto limitar la gama de las potenciales soluciones disponibles: los métodos utilizados para resolver problemas de daños de la fauna difieren de las soluciones sobre matanza de vida silvestre y de los conflictos sociales. En este capítulo se presenta un enfoque interdisciplinario para entender y manejar los conflictos con jaguares,

uno que incorpora la perspectiva de las "dimensiones humanas". Las dimensiones humanas de la vida silvestre es un campo emergente de investigación y aplicación, que tiene como objetivo describir, entender, predecir y cambiar los pensamientos y las acciones humanas hacia la vida silvestre. Se describe cómo este enfoque se ha utilizado en Brasil para comprender el conflicto humano-jaguar, con miras a impedir la matanza de jaguares y contribuir a las políticas públicas y a la planificación sistemática para la coexistencia entre seres humanos y jaguares.

Palabras clave. Cambio de comportamiento. Ecoturismo. Marketing social. Planificación sistemática de la conservación. Política.

INTRODUCTION

A widespread assumption among conservationists and wildlife managers is that intolerance and persecution of jaguars (*Panthera onca*) are motivated by economic losses associated with livestock depredation. It follows from this premise that those who raise cattle, goats, sheep and pigs will be more tolerant to jaguars, and eventually stop persecuting them, as livestock depredation by these big cats decreases; in the absence of attacks to domestic animals, the presence of jaguars would be tolerated. There is growing evidence, however, that personal factors such as beliefs and feelings (e.g. fear), as well as social motivations, may also influence the persecution and killing of jaguars (Zimmermann and Walpole 2005, Marchini and Macdonald 2012, Marchini 2014). In addition, conflicts involving wildlife are often manifestations of conflicts of interest between groups of people or institutions, such as between the environmental authorities and local populations (Dickman *et al.* 2013). As the jaguar is an endangered species in Brazil [critically endangered in the Atlantic Forest (Galetti *et al.* 2013) and Caatinga (Morato *et al.* 2014)], which is home to the largest population of this feline and where killing is a major threat (ICMBio 2011), the conservation of this species depends not only upon our knowledge of the ecological and economic aspects of the depredation of domestic animals, but also on our ability to understand, predict and change the human behavior of killing jaguars in this country. The conventional approach to wildlife management and conservation, with its emphasis on animals and their habitats, is insufficient to deal with the psychological and social nature of the problems involving these cats. In this chapter we present a more promising approach to understand and manage conflict with jaguars, one that incorporates the perspective of "human dimensions". In this chapter we present a more promising approach to understand and manage conflict with jaguars, one that incorporates the perspective of "human dimensions", and illustrate it with examples from Brazil.

Human Dimensions of Wildlife

Human Dimensions of Wildlife is an emerging field of research and application that aims to describe, understand, predict and change human thoughts and actions towards wildlife (Manfredo *et al.* 1996). Instead of the conventional look at the species-habitat relationship, the approach of human dimension takes into account the stakeholders and adopts as the unit of analysis and intervention the wildlife-habitat-human system (Decker *et al.* 2012), thus expanding the information base for making management decisions, planning for conservation and coexistence, and designing public policies about wildlife.

UNDERSTANDING THE CONFLICT

To better understand – and consequently better manage - problems with iconic animals like the jaguar, we must first acknowledge that human-wildlife conflict

(HWC) is a complex phenomenon composed of three parts. The component of HWC that has received most attention is the damage that wildlife causes to domestic animals, cultivated plants and human health and safety. The second component is the persecution of the problematic animal, which can be preventive or retaliatory, although it usually has also other motivations. Finally, HWC involves clashes of interests between groups of people over management goals and alternatives.

Wildlife damage is, ultimately, an ecological process. The depredation of domestic animals and its impacts on human livelihood can be understood under the well-established ecological theories of predator-prey dynamics and inter-specific competition. Because most professionals dedicated to understanding and managing HWC have a background in the natural sciences (e.g. ecologists and veterinarians), it is no surprise that wildlife damage is the component of the conflict that has received the most attention. Wildlife killing, however, is a human behavior, and ecology is not the right scientific discipline to help us understand and influence human behavior; behavioral sciences e. g. cognitive and social psychology and neuroscience- are the proper basis for addressing this component of HWC. Likewise, the clashes of interest between social groups about how to deal with wildlife damage and wildlife killing are ultimately social conflicts and, again, ecology provides information about just one component of the conflict; we also need social sciences to understand and tackle the social component of the conflict. The following is a brief description of what is known about these three components of HWC in Brazil.

Damage caused by jaguars

Damage to livestock

Researchers have assessed jaguar damage to livestock in areas of Brazil where cattle ranching is a major economic activity. Average losses attributed to jaguars in those areas range from 0,2 – 2,3% of livestock holdings (Conforti and Azevedo 2003, Michalski *et al.* 2006, Azevedo and Murray 2007). Documented losses of cattle to jaguar predation are generally fewer than those attributable to accident, snake bite, disease, parturition problems, flood (Azevedo and Murray 2007) and even theft (Hoogesteijn and Arenas 2008).

In central Amazonia, however, where cattle ranching is not the main economic activity, depredation of domestic animals by jaguars may still have a significant socio-economic impact, as rural residents belong in the lower income range, raise few domestic animals for subsistence or financial security purposes, and are stocked with small herds that are usually left unattended in communal pastures where they are more exposed to interactions with wild predators (Del Toro-Orozco unpublished data). In an ongoing study in central Amazonia, for instance, interviews revealed that 42% of the communities report at least one event of livestock depredation by felines within two years prior to the interview date. In 83% of the cases the predator was the jaguar (Del Toro-Orozco unpublished data).

Threat to human safety

Despite the anecdotal accounts of jaguar attacks on people reported throughout Brazil, these events are rare and usually related to people approaching jaguars deliberately or by accident, and mostly caused by animals cornered during hunting events (Paula *et al.* 2008, Hoogesteijn *et al.* 2011, Hoogesteijn *et al.* 2014a, Hoogesteijn *et al.*, capítulo 31 de este volumen). There are only two cases reported in the scientific literature about predatory attacks of jaguars on people in Brazil. The first occurred in June of 2008, in the Pantanal (Paula *et al.* 2008). In this case a fisherman was attacked and killed while sleeping in a tent on the banks of the Paraná River, in Cáceres, Mato Grosso State. It is thought that this attack occurred because people had been using bait to attract jaguars to the river's banks so that tourists could see them better and more frequently. Jaguar observation tourism

is an important economic activity in the region. The second predatory attack occurred when fishermen were returning from a fishing trip in Caceres (Neto *et al.* 2011). In this case witnesses reported that a jaguar jumped out of a ravine on to the boat and bit the victim on the right shoulder, tipping him into the water. The jaguar then surfaced with the victim's head in its mouth, only releasing it after the boat's skipper hit it an iron pipe.

Killing of jaguars

Killing has been reported to be the greatest source of mortality for many large carnivore species, and is recognized as one of the most important threats to the survival of the jaguar in Brazil and most other countries where the species occurs (Sanderson *et al.* 2002). Although researchers and wildlife managers have emphasized the problem of livestock depredation by jaguars, from the conservation perspective it is the killing of jaguars what ultimately matters, and little has been done to understand the link between jaguars killing livestock and people killing jaguars (Zimmermann and Walpole 2005). The killing of jaguars is not strictly retaliatory and has motivations besides the economic. Marchini and Macdonald (2012) used the Theory of Planned Behavior to examine the role of ranchers' perceptions of social norms, attitudes and intentions concerning jaguar killing, in determining their jaguar-killing behavior in Amazonia and Pantanal. They also investigated the influence of: (1) descriptive norm (i.e. belief about the proportion of people that kill jaguars: "if most people do it, I will do it too") and social identity ("*pantaneiros* hunt jaguars, I am a *pantaneiro*, then I have to hunt jaguars") on ranchers' intention to kill jaguars on their properties; and (2) the effect of perceptions of jaguar impact on human livelihoods (livestock and human safety), and of property size, on the variables that influence intention to kill. Results revealed that the impact of jaguars on livestock is not the only predictor of a rancher's intention to kill jaguars. Fear, personal and social motivations, and internal and external barriers to killing jaguars can also influence jaguar killing.

The killing of jaguars have also been addressed in the context of hunting (Antunes *et al.* 2016), here defined as the legal or illegal pursuit and/or trapping of animals by humans with the intent of killing them for food, management, cultural norms, status, sport, or trade. The commercial hunting of jaguars in Brazil is thought to have been significantly reduced after the creation of the Brazilian Fauna Protection Law, which made illegal the hunting of jaguars for commercial purposes in Brazil, and the inclusion of the jaguar in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and changes in fashion trends. Despite the effective result of these conservation actions, illegal commercial hunting of jaguars continues in Brazil due to market demand for illegal trophy hunting of jaguars, buying jaguar parts as souvenirs (i.e. pelts, skull and teeth), meat for food, and raising cubs as pets. In the last few years there have also been rumors of jaguar parts being traded to Asian black markets to substitute the shortage of tiger parts. Illegal hunting of jaguars for other motivations is still widespread in Brazil,. In Amazonia, for example, at least 32 jaguar were killed Tapajós-Arapiuns Extractive Reserve between 1998 and 2008 (Carvalho and Pezzutti 2010) and over 100 jaguars are estimated to be killed per year in Mamirauá and Amanã Sustainable Development Reserves (Ramalho 2012).

Social conflict over jaguar management

A review of 100 recent articles on HWC revealed that 97 were between conservation and other human activities, particularly those associated with livelihoods (Redpath *et al.* 2015). In other words, what has been called "human-wildlife conflict" is mostly human-human conflict over wildlife management. Nonetheless, social conflict is the component of HWC that has received least attention.

The human dimensions literature describes a number of tools that can be

used by wildlife professionals to describe, understand and manage social conflict over wildlife management. A particularly promising tool is the one used by Engel and collaborators (2016) to measure the consensus regarding the acceptability of killing jaguars in the Atlantic Forest: the Potential for Conflict Index (PCI^2).). The authors explored the overall acceptability of killing big cats in different scenarios of people-big cat interactions, and the influence of attitudes toward jaguars and pumas on acceptability. They found that as the severity of people-big cat interactions increased, the level of consensus decreased. From a managerial perspective, these findings highlight the range of acceptability of killing big cats, as well as the level of consensus among groups with positive, neutral and negative attitudes. Knowing whether killing a big cat is acceptable or unacceptable by the public in situational specific settings can assist managers to anticipate conflict and avoid illegal killing of big cats.

At a broader scale, social conflict can arise between large segments of the society that hold different views about human domination over wildlife and concerns about animal well-being. The killing of Juma–the jaguar featured at an Olympic torch ceremony that was shot dead by a soldier shortly after escaping from its handlers, following the event in the Brazilian Amazon city of Manaus in June 2016–revealed the conflict of interests between part of the society that enjoys the use of once-wild animals as mascots in ceremonies and another part that condemns this practice (Marchini 2016). The case had a great repercussion, stirring up a furious reaction on social networks and among animal rights campaigners, and prompting the call for restrictions on the showcasing of wild animals.

MANAGING THE CONFLICT

Technical solutions to livestock depredation by jaguars have focused mostly on better husbandry practices. Recommendations on how to protect livestock from the attack of jaguars have been synthesized in several manuals (Figure 1) (Hoogesteijn and Hoogesteijn 2005, Marchini and Luciano 2009, Marchini *et al.* 2011, Hoogesteijn and Hoogesteijn 2014b). Examples of such recommendations range from the use of electric fences to the more affordable construction of communal corrals, like the ones implemented by *Projeto Amigos da Onça* in the Caatinga, northeastern Brazil (Campos unpublished data). In central Amazonia, where free-ranging, unattended livestock belonging to different owners forage together in areas with high risk of predation by jaguars, the adoption of collective livestock management practices and the construction of communal corrals might be a cost-effective solution to depredation (Del Toro-Orozco unpublished data).

Nonetheless, wherever jaguars and domestic animals share the space, the risk of depredation will exist to some extent, persecution will ensue, and groups of people will disagree on how to deal with that issue. Technical solutions may be necessary, but are seldom enough to resolve human-jaguar conflict. Below we outline some of the approaches explored in Brazil that incorporate a human dimensions perspective. At the individual level, the emphasis is on behavior change to prevent jaguar killing and at the social/institutional level it is on better decision-making regarding the management of human-jaguar interactions.

Focus on the individual: social marketing and incentives for behavior change

A common assumption in conservation is that lack of knowledge is behind people´s antagonistic behaviors towards wildlife: people kill jaguars because they do not know enough about the importance of the species or the measures to prevent its impacts. Consequently, by providing people with information – facts about the ecological role of jaguars or instructions on how to build a corral – the conservationist would be contributing to change people´s behavior (i.e. tolerate rather than kill jaguars).

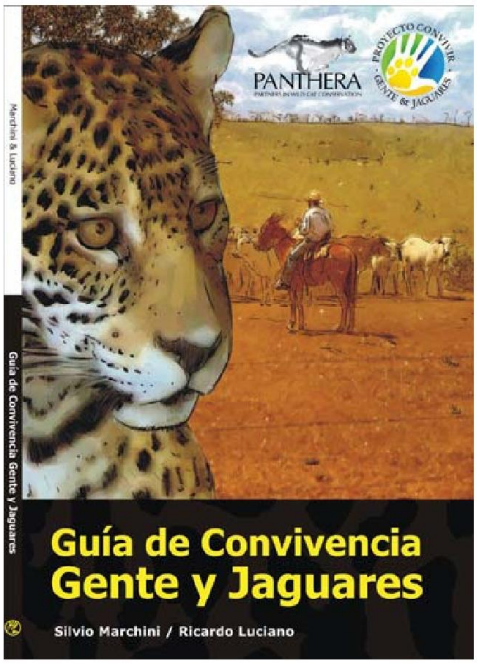

Figure 1. Sample pages and cover of 'People and Jaguars: a guide for coexistence'.

Human dimensions research, however, has demonstrated that lack of knowledge is not always the main driver of wildlife persecution (Treves and Bruskotter 2014). Sometimes people know enough about the issue, but do not care about it. In that case, an information-intensive campaign would not be the best use of (typically scarce) resources. A social marketing approach might be more effective here. Social marketing seeks to develop and integrate marketing concepts with other approaches to influence behaviors that benefit individuals and communities for the greater social good. In contrast to the conventional environmental education approach, social marketing emphasizes social norms rather knowledge. Marchini (2010) conducted a social marketing experiment that evaluated the effectiveness of different strategies to improve the feelings and perceptions of jaguars and, consequently, discourage the

behavior of killing them (Marchini 2010). Parents received information through "People and Jaguars: a Guide for Coexisting" (Marchini and Luciano 2009), an illustrated, colorful book, attractive and easy to understand even for those who cannot read. Another group of adults in the same rural community received the book from the project researchers, identified as representatives of an environmental organization. The impact was greater among parents who received the book through the school, from the hands of their son or daughter: at the end of the experiment, they were less convinced that killing jaguars is as common or socially acceptable. This result suggests that parents' perceptions can be influenced not only by the information explicitly conveyed in the content of the book, but alsoby the implicit message that a community institution (and therefore other community members) supports jaguar conservation more than they had realized.

Human dimensions research can reveal still another situation, where people know enough about the issue, do care about it, but lack alternatives. In this case, the most cost-effective use of resources is to identify and provide alternatives. One example of alternative to jaguar killing is jaguar-based tourism. This type of tourism started for commercial reasons in the Pantanal in 2005 and has developed into a lucrative business in the area. It accounts for the employment of hundreds of people and revenue of a few millions of dollars per year. In 2011, the *Onça-fari* Project started from the partnership between a private ecotourism enterprise and researchers from the National Center of Research and Conservation of Mammalian Carnivores (CENAP) of the Chico Mendes Institute for Conservation of Biodiversity (ICMBio). This initiative combined for the first time in Brazil research and conservation of the jaguar with a private enterprise and has been raising awareness and important scientific information about the species in the Pantanal (Hoogesteijn *et al.* 2015). Another initiative of this kind started in Amazonia in 2013 in the Várzea Floodplain Forests of Amazonia, inside Mamirauá Sustainable Development Reserve (Figure 2). Different from the other two, it is not a private initiative, and it was born from the

Figure 2. Jaguar on tree during the flood season. Mamirauá Sustainable Development Reserve, Amazonia. Foto: Emiliano Ramalho.

partnership between a community-based ecotourism lodge and researchers from Mamirauá Institute for Sustainable Development (IDSM). In this latter case, part of the revenue goes to local people and the other part for continuing the research.

Broadening the scope: cooperation, public policy and systematic planning

The effective management of human-jaguar conflict has to take people into account: not only those who share the space with jaguars and whose behavior immediately determines the course and resolution of the conflict, but also the other stakeholders in order to make better management decisions. The incorporation of human dimensions into large-scale, multi-stakeholder initiatives and in the systematic planning and public policies for jaguar conservation is the next frontier in addressing human-jaguar conflict.

The Jaguar Conservation Alliance (*Aliança para a Conservação da Onça-pintada*) is an example of such cooperative effort. This initiative aims to increase knowledge about the jaguar, to reduce the number of jaguars killed and to improve the livelihood of people that coexist with the species. All of that by (1) connecting institutions and social actors to facilitate scientific cooperation in the study of jaguars, their habitats, their prey and the human dimensions of the jaguar conservation problem; (2) promoting coordinated actions for the conservation of jaguars; (3) reducing livestock depredation by jaguars; and (4) increasing human safety and tolerance to the presence of jaguars. The Jaguar Conservation Alliance was founded in 2014 with 20 jaguar experts from 11 institutions.

At the governmental level, the National Action Plan for the Conservation of the Jaguar had its first workshop in 2009, bringing together 35 participants including biologists, representatives from governments, NGOs, zoos and universities to design an action plan whose general objective was to "reverse the trend of jaguar population decline in each of the five biomes where the species is present and reduce the category of threat in each biome in the next five years". The status of the jaguar population in each biome was reviewed, population viability under various scenarios was modeled using Vortex (Desbiez *et al.* 2012), and a predictive model of the species distribution was drawn to map the distribution of known and potential jaguar populations using Maxent (Ferraz *et al.* 2012a). In 2016, the National Action Plan - Big Cats took a step ahead, bringing together a wider variety of stakeholders, including representatives from the development and infrastructure and law enforcement sectors, to discuss the implementation of the actions to manage conflicts and to save jaguars and pumas in the next five years.

In a more focused approach, jaguar experts have been using spatial modeling - species distribution modeling, in particular (Ferraz et al. 2012b) - to identify priority areas for jaguar conservation (e.g. Jaguar Conservation Units - JCUs) and suitable habitats for corridors that connect isolated populations in the Atlantic Forest (Ferraz et al. 2012, Paviolo et al. 2008) and Caatinga (Morato et al. 2014). These are important steps towards the consolidation of the new and promising field of Systematic Conservation Planning in Brazil. Conservation planning, however, is still an imperfect science that places more importance on ecological considerations than on social ones. Complementing social considerations with an integrated understanding of the ecology of a region is one of the main challenges to be faced by jaguar conservationists in the next years.

CONCLUSIONS AND RECOMMENDATIONS

The human dimensions approach is vital to resolving the social conflicts behind the problems that have been referred to as human-jaguar conflict. The integration of human dimensions into jaguar (and other wildlife) management and conservation can be particularly beneficial in develo-

ping countries with high biodiversity such as Brazil and other Latin American countries. In these places, the combination of economic growth, mounting pressure on natural resources, urbanization, expanding human settlement and agricultural frontier in some regions and wildlife repopulating human-dominated landscapes in other regions, along with the growing ideals of democracy accompanied by greater participation in governance by a growing set of stakeholders, is likely to generate intense conflicts over endangered species as well as natural resources (e.g. water). Capacity building in human dimensions of wildlife and natural resources should be a priority in these countries, so that interdisciplinary, more effective approaches to HWC and biological conservation that integrate ecological and social sciences, can be properly incorporated into research, conservation, management, and public policy.

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