Original Research Article

Local perceptions of jaguar conservation and environmental justice in Goiás, Matto Grosso and Roraima states (Brazil)

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A R T I C L E   I N F O

A B S T R A C T

Wildlife conservation often leads to various conflicts with other human activities, resulting in concerns about the justice of conservation. Although species' protection — notably of large carnivores — can have negative consequences for economic interests and human well-being, environmental justice issues related to species conservation are rarely explored. In Brazil, jaguars (*Panthera onca*) have become flagships for a series of conservation initiatives. Whereas jaguars' direct impact on cattle farming has been studied, their influence on other rural stakeholders is poorly understood. Here we study local people's views on jaguars and jaguar conservation across the Cerrado savannah and the Amazon rainforest biomes. Using Q-methodology, we identified five distinct narratives regarding jaguar conservation in relation to environmental justice issues. These were shared among fishermen, tourist guides, cattle breeders, crop farmers and jaguar hunters. Interestingly, we did not find any systematic differences in subjective views, across regions, or professions/livelihood forms. However, our results showed a strong desire among the stakeholders for more local empowerment to influence the management of both jaguars and nature where they live. Moreover, we detected a widespread discontent with the lack of consistent implementation and predictable enforcement of environmental laws.

1. Introduction

Increased focus on biodiversity conservation and the need to ensure sustainable use of natural resources has led to the establishment of various international agreements and conventions (CITES in 1975, CBD in 1992, etc.) operationalized through diverse conservation actions. While the loss of biodiversity continues (Butchart et al., 2010; Rands et al., 2010), a range of conflicts have emerged between conservation actions and other human activities and interests (Redpath et al., 2013). This has raised concerns about the justice of conservation, including the distributional equity of costs and benefits, access rights, decision making processes, and the hegemony of some dominant groups over knowledge production and interactions with nature (Martin et al., 2013). Particularly there has been much focus on the restrictions on land uses associated with protected area establishment (Guha, 1997; Adams and Hutton, 2007). In contrast, although species protection — notably large carnivores — can have negative consequences for human activities and well-being (Sillero-Zubiri and Laurenson, 2003; Treves and Karanth, 2003), environmental justice issues associated with species protection have rarely been explored. Conservation

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programs that focus on large carnivores may induce resentment among local populations about the external influence on their lives, and lead to cultural resistance (see e.g. Skogen et al., 2008). Consequently, existing conflicts *with* large carnivores can become conservation conflicts *over* large carnivores' management with an escalating opposition between different stakeholders (Brox, 2000; Madden, 2004). Wildlife conflicts can also become a focal point for wider fundamental conflicts between social groups (Nie, 2003). Not least where the costs of conservation are unevenly distributed, where carnivore conservation is associated with protected areas (Ghosal et al., 2013), or where strict protection removes management from the hands of the local populations as well as the potential for reciprocity in the human − animal relationship (Lescureux and Linnell, 2010). As a consequence, large carnivore conservation could potentially be strongly linked to environmental justice issues, as defined by Schlosberg (2013).

According to Schlosberg (2013), the environment can be considered as places "where we live work and play", including "the larger natural world", but also including policies and practices. Justice is defined in terms of three dimensions: equity, recognition, and participation (Schlosberg, 2013). Therefore, the equity of distribution of the costs (notably associated with depredation on livestock) and benefits associated with carnivore conservation can be questioned (equity), as well as the recognition of the legitimacy of various stakeholder practices and knowledge (recognition), and finally the participation of these stakeholders and the possibility to be heard in the process of decision making concerning carnivore management (participation). In addition, environmental justice is not only about people living within and depending upon ecosystems, but also about the recognition of intrinsic and existence values associated with biodiversity and the functioning of ecosystems (Agyeman, 2005; Sze et al., 2010; Ross and Zepeda, 2011). Indeed, we may do injustice to both humans and non-humans by corrupting, defiling or interrupting the potential functioning of ecological systems. Hence, the disruption, and increasing vulnerability of the integrity of ecosystems can be at the heart of the injustice (Schlosberg, 2013).

Jaguars, once ranging from the southern USA to northern Argentina, are currently listed as Near Threatened with a decreasing population trend on the IUCN red list, and have disappeared from much of their range, including nearly 50% of their Brazilian territory (Caso et al., 2008). Most of the Cerrado biome in central Brazil, has been subject to large-scale forest clearance or degradation. Currently only 20% of the Cerrado is in its original state and a mere 3% under state or federal protection, mainly in small, fragmented units (Plano de Manejo do PARNA das Emas/GO-MS-MT). In contrast, the Brazilian Amazon still holds relatively large primary forests, and 43.9% of its territory is under some sort of legal protection (IMAZON/ISA, 2011).

In Brazil, jaguars (*Panthera onca*) have become flagships for a series of conservation initiatives, including the Araguaia corridor project, aimed to secure protected areas and their connectivity (c.f. http://www.black-jaguar.org/Jaguar-Corridor-Project). Whereas, protected area establishment commonly generates site specific controversies, not least when considering Brazil's complex mixture of indigenous and colonialist land tenure rights (Hochstetler and Keck, 2007; Osorio, 2009), jaguars can affect local people negatively through livestock depredation and attacks on people across wide areas, both inside and outside protected areas (Zimmermann et al., 2005; Michalski et al., 2006; dos Santos et al., 2008; Palmeira et al., 2008). However, while jaguars' direct impact on cattle farmers has been relatively well assessed (The Jaguar Conservation Fund, 2008; Cavalcanti et al., 2010), their influence on other rural stakeholders is poorly studied. Yet, conservation success often directly depends on the attitudes of local people living and working in the proximity of protected areas and wildlife (Palmeira and Barrella, 2007; Santos et al., 2008; Marchini and Macdonald, 2012; Soto-Shoender and Main, 2013). Hence, to improve our understanding of local stakeholder perceptions about jaguar conservation in relation to environmental justice (as defined in Schlosberg, 2013) we used Q methodology to explore the views of primary resource users living and working in the proximity of jaguars in the Cerrado savannah, central Brazil, and the Amazon rainforest, northern Brazil (Fig. 1).

2. Methods

2.1. Study sites and key stakeholders

Brazil is a hugely diverse country stretching across six distinct biomes and a variety of socio-economic and cultural contexts. Thus, local conditions differ greatly both in terms of ecology (in Brazil jaguars occur in four of six biomes) and socio-economy. Nevertheless, the same laws centrally govern jaguar conservation and nature management throughout Brazil. Because, of this discrepancy between vastly variable local conditions and standardized nature management, we wished to see if local stakeholder views regarding jaguar conservation in a Brazilian environmental justice context varied systematically across livelihoods and/or regions. Hence, we chose to work in two contrasting areas in central and northern Brazil (Fig. 1). These areas represent some of Brazil's most important jaguar habitats, and two of the world's biodiversity hotspots, the Cerrado savannah and the Amazon rainforest (ICMBio, 2010). We identified key stakeholders as primary resource users who lived and worked in the proximity of protected areas and jaguar habitats. Consequentially, we chose four communities in the Cerrado biome in Goiás and Mato Grosso states and four communities in the Amazon biome in Roraima state. All communities were in close proximity to protected areas where jaguars occur.

Because Goiás and Mato Grosso states have been subject to large scale forest clearance, our study areas here were inevitably largely dominated by intensive agriculture (Sano et al., 2007), including crops (mainly soy and cotton) and very large-scale cattle production (Costa and Rehman, 1999), although jaguars were present in the landscape. In northern Goiás, we interviewed people form Luiz Alves and São Miguel do Araguaia. These communities border the Natural Protected Area Meandros do Araguaia, which has a special focus on the protection of jaguars (Decreto 02 de Outubro de 1998, 1998). In

Fig. 1. Map of Brazil showing the study areas.

southern Goiás and Mato Grosso we interviewed people from Mineiros and Alto Taquarí, two towns close to Emas National Park, a UNESCO Biosphere Reserve (GO-MS-MT, 2004).

In contrast to the intensive agriculture of central Brazil, there are extensive protected areas in Roraima state (Governo do Estado de Roraima, 2013). In Roraima, we interviewed people from Boa Vista, Caracaraí, Petrolina, and Rorainópolis. The state capital Boa Vista is surrounded by a network of protected areas including indigenous reserves, ecological stations and National Parks (IBAMA, 2006). Caracaraí is the nearest major town to Viruá National Park, Caracaraí, and Niquiá ecological stations. The closest settlement to Viruá National Park is Petrolina. Further south, Rorainópolis sits next to the Anauá National Forest reserve. Except for Viruá National Park, which allows some ecotourism, the protected areas around Boa Vista and Caracaraí are not open for visitation but allow research (Presidência da República, 1985, 1998; ICMBio, 2014). In contrast, the Anauá National Forest reserve promotes sustainable multiuse of forest resources (MMA and ICMBio, 2005).

2.2. Q methodology

To get a broad view of existing perspectives shared among local stakeholders regarding jaguar conservation in a Brazilian environmental justice context and gain insights into their reasoning, we used Q methodology. Q methodology developed within the field of psychology to study people's subjectivities (Brown, 1980). By asking for people's subjective views, Q

methodology embraces the subjective nature of attitudes (Cross, 2005). Based on a combination of a relatively robust statistical analysis and flexibility in the interpretations of results, Q methodology thus enables relatively unbiased descriptions of respondents' views and is useful for exploring the range of narratives that exist in a population (Brown, 1980).

Through the clustering of respondents, Q methodology allows the exploration of potentially systematic differences in views, e.g. among local stakeholders across regions or livelihoods. Because the analysis of Q sorts does not adhere to any predefined respondent categories (e.g. based on profession, age, or gender), respondents factorize themselves according to their subjective views (Brown, 1980; Barry and Proops, 1999; Webler et al., 2009). Thus, an exploration and description of the clustering of respondents around shared views (narratives) is only possible after identifying the narratives. Another advantage of Q methodology is the relatively small sample size required to explore existing views and associated consortia of people. Typically, a Q study should involve fewer respondents than Q statements (Brown, 1980). Adding to this, the inherent identification of areas of differences and areas with similarities across a diversity of views, the Q methodology has potential for fostering understanding across stakeholder groups, making it increasingly popular within the environmental sciences (Chamberlain et al., 2012; Curry et al., 2013). Q methodology is increasingly used within the conservation literature, to reveal the plurality of views among conservationists about conservation values, the role of science in conservation, or the perception of success in conservation projects, etc. (Sandbrook et al., 2011; Cairns, 2012; West et al., 2016). It thus reveals the subjectivity in conservation actions and questions the implication of other stakeholders in management and conservation projects. Finally, one of the main challenges in problem solving appears to be the different conceptions of (in)justice and the difficulties to negotiate between them at different scales, from community to states through stakeholder groups or corporations (Schlosberg, 2013). In our case, Q methodology may help by shedding light on the different conceptions, but also on shared views or narratives, that exist about jaguar conservation in an environmental justice context; by allowing for recognition of potential conflicts of interests or injustices; and by informing conservation professionals and politicians of areas in need of greater attention or intervention.

2.3. Q statements

We selected Q statements to cover a broad range of potential justice issues related to jaguars and their conservation in Brazil, which local primary resource users were likely to have an opinion on. We based the statements on a previous study about land-use interests and jaguar conservation issues at an institutional level in central Brazil (Bredin et al., 2015b) and a series of *a priori*, in depth interviews with fishermen, tourist guides, farmers and cattle breeders in central Brazil. The statements thus derived from peer-reviewed articles, online Brazilian news reports, expert opinions and primary resource users' opinions. We included 37 Q statements, both positively and negatively worded. We empirically categorised these as primarily focusing on (i) wildlife and jaguar management, (ii) land management, and (iii) governance, laws and implementation (Table 1). We ensured that Q statements were understandable by running them through one of our local contacts, and testing them in the field.

2.4. Q sorts

For this study, we contacted the stakeholders personally, often through a local contact that they knew personally. Typically, our local contact would take us to the stakeholders in their homes or workplaces and introduce us (i.e. that we were researchers interested in jaguar conservation doing interviews with people who worked in proximity to jaguars). The local contact would then ask the stakeholder to confirm that s/he worked with for example fishing in a locality of our interest and ask if the stakeholder would be willing to talk to us. If the stakeholder consented, we would explain our study in more detail referring to the issues of the Q statements. We informed the stakeholders that they could withdraw from the study at any point if they so wished, and that their contributions would be completely anonymous. All stakeholders freely agreed to participate in this study. We performed 31 interviews in person, between October 2012 and February 2013. We distributed the Q sorts as a card game, encouraging the stakeholders to ask about any confusion regarding the statements. Both to ensure that the stakeholders had understood the exercise and the Q statements, and that we had understood the stakeholders' views, we asked the stakeholders to explain how and why they had placed the statements in their particular ways by reflecting openly on the topics of the statements and to give us examples, illustrating their rational.

2.5. Analysis

To analyse the Q sorts, i.e. ordering of statements, we used the PQmethod software (Schmolck, 2013). We used the Principal Components option (PCA) performing a Varimax rotation for factors with eigenvalues greater than 1 and used the pre-flagging option for the correlation analysis (Brown, 1980; O'Leary et al., 2013). To describe the narratives and associated stakeholder clusters we combined the quantitative analysis with the stakeholders' reflections through a constant comparison (Van Exel and de Graaf, 2005; Webler et al., 2009). This stage was also very important for informing our choice of factor solution as we put much weight on the qualitative interpretability of factors.

Table 1

List of the 37 Q-statements divided into justice themes with rankings (Z-SCORES) for the five narratives.

Theme	Q-Statements 1−37, used in the survey	Z-Scores					Consensus
		N1	N2	N3	N4	N5	
WILDLIFE AND JAGUAR MANAGEMENT	13. Jaguars have the right to exist in Brazil.	1,16	1,48	1,12	0,60	0,39	CS
	27. Jaguars are important for tourism in Brazil.	0,31	1,03	0,44	0,37	−0,09	CS
	36. Jaguar conservation, in Brazil, should be better implemented.	0,29	0,64	0,84	0,43	−0,35	
	17. The killing of jaguars should always be prohibited.	1,33	0,06	−0,67	0,50	0,57	
	35. There are people that hunt jaguars in Brazil.	0,94	0,06	−0,76	0,89	0,39	
	19. Farmers should be compensated for losses incurred by wild animals.	−0,97	0,58	1,60	−0,08	−0,84	
	37. Jaguars that kill livestock should be captured and released somewhere else.	−0,23	−0,12	0,61	−0,69	0,39	
	8. Hunting should always be prohibited.	**1,83**	−0,84	−1,12	−0,85	**0,83**	
	7. Retaliatory killing of jaguars by ranchers is a major threat to jaguar survival.	0,31	−0,64	−0,78	0,34	−0,35	
	12. Jaguars should be allowed to survive throughout Brazil, even in human modified environments.	0,17	−0,06	**1,22**	**−1,04**	**−2,01**	
	28. To hunt for jaguars is an act of bravery and skill.	−1,23	0,00	−0,05	−1,26	0,44	
	18. Ranchers should be allowed to kill jaguars that kill cattle.	−1,70	0,21	0,00	−1,62	0,91	
	11. The presence of jaguars prevent depredation on crops by other wild animals.	−0,48	−0,45	−1,05	−0,06	−0,61	CS
	16. Jaguar conservation benefits the rich while the poor pay the price.	0,07	−1,48	0,21	−1,06	−0,52	
	22. Jaguars' conservation represents a serious obstacle to rural/economic development in Brazil.	−1,19	−0,57	−0,06	−1,61	−0,57	
	14. Jaguars are a threat to human safety.	−1,48	−1,29	−0,44	−0,92	−1,05	
	23. Jaguars represent a major threat to the economic viability of cattle ranching.	−1,63	−0,51	−1,94	−1,11	−1,27	
LAND MANAGEMENT	4. Forest fires are a serious threat to the environment in Brazil.	1,36	0,90	1,33	1,57	0,43	
	10. Brazil's rich nature, fauna and flora are important for attracting tourists.	*0,71*	*0,90*	*0,99*	*0,99*	*0,92*	CS
	9. Conservation of native vegetation is important for the conservation of rivers in Brazil.	0,76	0,51	0,55	**1,93**	0,74	
	24. It is important to establish protected areas in Brazil.	*0,84*	*0,38*	*0,66*	*1,09*	*0,83*	CS
	32. It is necessary to increase cultivated areas in Brazil to feed people.	−1,47	1,79	−0,72	0,05	1,44	
	33. It is necessary to increase pasture areas in Brazil to feed people.	−1,16	0,45	−0,17	−1,15	0,60	
	26. The obligation of setting aside land for legal reserves prevents the economic development of Brazil.	−0,57	0,96	**−1,88**	−0,43	0,36	
	1. Forests in Brazil are dangerous places.	−1,70	−0,39	0,06	−0,48	−1,79	
GOVERNANCE, LAWS, AND IMPLEMENTATION	2. Environmental laws should be better implemented.	1,39	1,60	0,17	1,13	1,39	
	21. Nature conservation should be primarily based on scientific knowledge.	−0,01	1,27	1,71	1,41	0,01	
	29. Corruption is one of the major threats to environmental conservation in Brazil.	1,66	**−1,60**	1,10	0,98	1,52	
	25. Decisions about nature conservation should be taken at the local level.	0,38	0,38	0,55	−0,05	**2,14**	
	3. Laws are in general not respected in Brazil.	0,15	**−1,85**	2,05	1,40	−0,17	
	15. Brazil has an international obligation to conserve its nature.	0,78	−0,78	−0,82	0,59	−0,31	
	5. Jaguar conservation, in Brazil, brings unwanted involvement from foreign organisations.	−0,16	−0,26	−0,06	−1,10	0,96	
	30. Brazilian environmental laws are unfair/unrealistic.	**0,24**	**1,47**	−0,95	−0,72	−0,91	
	6. Brazil has a major international obligation to ensure that jaguars survive.	0,04	−0,19	−0,66	0,54	−0,96	
	34. Conservation (environmental) laws are generally not respected in Brazil.	0,04	**−2,24**	−1,21	**1,02**	−0,30	
	20. Foreign agencies have too much influence over environmental policies in Brazil.	−0,08	−1,21	−0,99	−0,10	−1,83	
	31. The Brazilian state spends too many resources on nature conservation.	−0,72	−0,18	−0,89	−1,48	−1,35	

Numbers shaded in grey indicate distinguishing statement (p < .5, if number in **bold** p < .1) for each factor/narrative. In the rightmost column, "Consensus", "CS" indicates consensus statements, i.e. statements non-significant at p > .1 (p > .5 if in *italic*).

3. Results

3.1. Stakeholders

Between September 2012 and February 2013, we interviewed 31 local resource users in Goias, Mato Grosso and Roraima. In total, 25 respondents completed the interviews. In Luiz Alves, we interviewed four local fishermen operating as tourist guides, typically employed on a seasonal basis by the hotels, four rice farmers leasing land within a large irrigation project,

Table 2

Factor matrix with factor loadings, including information about the informants' locations and activities (A = agriculture; CB = cattle breeding; F = fishing; FT = fishing tourism; JH = jaguar hunting; T = tourism). Shaded cells indicate defining sorts for the corresponding factor. For Q sorts removed from the analysis (c.f. Analysis) there are no factor loadings.

ITV n°	Respondent	Place	State	Activity	Factor				
					1	2	3	4	5
1	agr.M.1	Mineiros	Goiás	A	0.1214	−0.0012	0.2827	0.7489	0.0918
2	agr.AT	Alto Taquarí	Mato Grosso	A	0.4076	0.0355	0.4089	0.6200	−0.1153
3	agr.AT.3	Alto Taquarí	Mato Grosso	A	0.1449	0.7848	−0.1161	0.2589	0.1502
4	sma.SM.1	São Miguel do Araguaia	Goiás	A	0.7417	0.0714	−0.1605	0.0026	0.3196
5	cat.SM.2	São Miguel do Araguaia	Goiás	A, CB	0.6687	0.4547	0.2823	−0.1852	0.1234
6	cat.SM.4	São Miguel do Araguaia	Goiás	A, CB	0.6380	−0.0284	0.4392	0.2945	0.0712
7	cat.SM.5	São Miguel do Araguaia	Goiás	A, CB	0.6739	−0.1250	−0.0058	0.3985	0.1821
8	cat.LA.1	Luiz Alves	Goiás	A, CB	0.2016	−0.1695	0.2289	0.4539	0.4687
9	cat.LA.3	Luiz Alves	Goiás	A, CB	0.7121	−0.1135	0.1051	0.3205	−0.1791
10	agr.LA.1	Luiz Alves	Goiás	A	0.5676	0.4177	0.0864	0.3890	0.0500
11	agr.LA.2	Luiz Alves	Goiás	A	0.1116	0.0803	0.7098	0.0920	0.1761
12	agr.LA.3	Luiz Alves	Goiás	A	0.5242	−0.2771	0.5172	0.2691	0.2787
13	f.t.LA.2	Luiz Alves	Goiás	FT	0.6888	−0.0293	−0.1925	0.5770	0.0413
14	agr.LA.4	Luiz Alves	Goiás	A	0.6673	−0.0355	0.3562	0.1481	0.3086
15	f.t.LA.3	Luiz Alves	Goiás	FT	0.3575	0.1096	−0.1059	0.8119	0.1870
16	f.t.LA.4	Luiz Alves	Goiás	FT	0.6313	−0.1375	0.2271	0.3823	0.2442
17	jag.RR.1	Caracaraí	Roraima	JH	−0.1305	0.1886	0.5805	0.3967	−0.2691
18	cat.RR.1	Caracaraí	Roraima	CB	−0.2361	0.7291	0.2019	−0.1228	0.0763
19	cat.RR.2	Caracaraí	Roraima	CB	−0.0040	−0.0115	0.0835	0.7137	0.1593
20	jag.RR.2	Petrolina	Roraima	JH	−0.0694	0.4749	0.1634	−0.1472	0.6300
21	cat.RR.3	Rorainópolis	Roraima	CB, JH	0.2717	−0.0219	−0.0910	0.2376	0.7542
22	sma.RR.1	Caracaraí	Roraima	F	0.1267	0.2720	0.1569	0.1342	0.6258
23	agr.RR.1	Caracaraí	Roraima	F	0.4024	0.0095	0.2531	0.6432	−0.0281
24	t.RR.1	Boa vista	Roraima	T	0.3985	0.0097	0.2122	0.6668	0.1330
25	cat.RR.4	Boa vista	Roraima	CB	0.4218	0.2141	0.4990	0.3213	0.3162
26	agr.M.2	Mineiros	Goiás	A	–	–	–	–	–
27	agr.AT.2	Alto Taquarí	Mato Grosso	A	–	–	–	–	–
28	cat.SM.1	São Miguel do Araguaia	Goiás	A, CB	–	–	–	–	–
29	cat.SM.3	São Miguel do Araguaia	Goiás	A, CB	–	–	–	–	–
30	cat.LA.2	Luiz Alves	Goiás	CB	–	–	–	–	–
31	f.t.LA.1	Luiz Alves	Goiás	F	–	–	–	–	–
	% variation explained				21	8	10	19	9

and three cattle breeders practicing subsistence farming. In São Miguel do Araguaia, we interviewed five large-scale cattle breeders practicing subsistence farming and one farmer. In Mineiros and Alto Taquarí, we interviewed five farm owners who typically ran very large arable farms (e.g. farms with many employees). In Boa Vista, we interviewed one large-scale cattle breeder and one tourist guide. Outside the state capital of Roraima, main livelihoods included logging, hunting, fishing, small-scale cattle breeding, subsistence farming, commerce, and commonly, combinations of these different activities including all sorts of small businesses. In Caracaraí, we interviewed two fishermen, two cattle breeders/shop owners and one self-proclaimed jaguar hunter/carpenter. Bordering Viruá National Park, we interviewed a retired jaguar hunter in the small settlement of Petrolina. Outside Rorainópolis, we interviewed a cattle breeder/jaguar hunter.

Apart from farming and cattle breeding, which were comparatively small scale in Roraima (e.g. typically small family farms), another noticeable difference between our study sites in Roraima and central Brazil were the clearly self-proclaimed jaguar hunters[1] who would kill jaguars upon request from local (cattle) farmers, despite this activity being illegal. This group however, was not identifiable in Goiás and Mato Grosso. It is furthermore noteworthy that four of the large-scale cattle breeders/farmers from central Brazil did not wish to provide sufficient information to explain their views during the follow-up discussions. In addition, one subsistence farmer and one fisherman from Luiz Alves failed to complete the interviews. We subsequently removed these six Q sorts from the analyses.

3.2. Identification of narratives

For the identification and exploration of narratives, we tested different models according to the number of extracted factors in the Q sort analyses. Considering the percentage of explained variation for each model, the number of informants retained for each factor as well as the potential narrative behind each factor, we selected the model with five factors as the most relevant among other models. The model with five factors comprised 21 of the 25 Q sorts. Four respondents did not

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[1] Jaguar killing is illegal in Brazil (Lei de Crimes Ambientais - 9.605/98). However, in Roraima we spoke to three self-proclaimed jaguar hunters who would show us pictures or other trophies from their hunts. These jaguar hunters would also sustain themselves through other activities (i.e. carpentry, cattle breeding).

Agree most										Disagree most
5	**4**	**3**	**2**	**1**	**0**	**-1**	**-2**	**-3**	**-4**	**-5**
Narrative 1 (Percent Explained Variance: 21%, Number of sorts: 8)										
8	2	17	*24*	25	12	21	26	22	14	1
29	4	13	15	7	3	20	31	28	23	18
		35	9	27	16	5	19	32		
			10	36	6	37	33			
				30	34	11				
Narrative 2 (Percent Explained Variance: 8%, Number of sorts: 2)										
32	13	21	*10*	9	17	31	23	8	16	**3**
2	**30**	27	4	33	35	6	22	20	**29**	34
		26	36	*24*	28	5	7	14		
		19	25	12	1	15				
			18	37	11					
Narrative 3 (Percent Explained Variance: 10%, Number of sorts: 2)										
3	19	**12**	*10*	25	1	33	35	30	8	**26**
21	4	13	36	9	18	14	7	20	34	23
		29	*24*	27	28	6	15	11		
			37	16	22	17	31			
				2	5	32				
Narrative 4 (Percent Explained Variance: 19%, Number of sorts: 6)										
9	21	2	*10*	15	7	20	8	5	28	22
4	3	*24*	29	6	32	26	14	23	31	18
		34	35	17	25	1	12	33		
			13	36	11	37	16			
				27	19	30				
Narrative 5 (Percent Explained Variance: 9%, Number of sorts: 3)										
25	32	5	**8**	17	37	34	22	6	31	20
29	2	*10*	*24*	28	26	15	11	14	1	**12**
		18	9	4	21	7	19	23		
			33	35	27	36	30			
				13	3	16				

Fig. 2. Optimal Q sorts for Narratives 1−5, regarding local resource users' attitudes about environmental justice issues linked to jaguars and jaguar conservation in Brazil. The sorts are the orderings of Q statements as they would look for persons who completely agree with the respective narratives. Numbers refer to specific Q statements (Table 1); ranked from 5, "agree most", to −5, "disagree most". "Number of Sorts" refer to the number of persons whose views make up each of the narratives. "Percent Explained Variance" describes how much of the total variation among all the 25 individual Q sorts, each narrative explains.

cluster into any factor/narrative. The five narratives (views shared among two or more stakeholders) together explain 67% of the total variance, i.e. all variation among Q sorts/reported views (cf. Table 2; Fig. 2). Making careful use of illustrative quotes, we describe the narratives, as closely as possible, as the respondents expressed them. In order to preserve informants' anonymity, the quotes are linked to each narrative but we do not to link the quotes to the informant or interview number.

3.3. Narrative 1

Narrative 1 comprised the views of two fishermen/tourist guides, two farmers, and four cattle breeders from northern Goiás, explaining 21% of the total variance:

Hunting should be forbidden. Although "*In some cases [jaguar depredation] can be a serious problem*" it is mostly "*insignificant*" and jaguars represent no major threat to the economic viability of cattle ranching. Therefore, retaliatory killing of jaguars should not be allowed. Besides, jaguar hunting is not an act of bravery and skill, and as long as "*jaguars [stay in] their proper place*", they are no threat to human safety. Jaguars have a right to exist in Brazil and their conservation is no serious obstacle to rural or economic development in Brazil.

Forest fires are a serious threat to Brazil's environment. "*The proof is there. Here in our region everything is burned and when the rain comes it takes everything [the soil] with it into the river.*" Although it is necessary "*to make the existing [cultivated] areas more productive*", there is no need to expand agriculture or increase the number of pastures in Brazil to feed people (significantly more negative compared to the other narratives, **P<.05**).

Corruption is a serious problem and a major threat to environmental conservation in Brazil. In particular, "*the laws must be for everyone, because to be just, they must be just in general.*" "*If there had not been any corruption, our country would have been powerful*". "*Environmental institutes sometimes have resources but do not make good use of them, [maybe] because Brazil is a very corrupt country.*" Whereas some Brazilian environmental laws may be fair/realistic (significantly more indecisive compared to the other narratives, **P<.1**), "*some laws [are] a bit unfair*" with respect to the regional differences in nature types. Hence, "*Laws are sometimes respected, other times not.*" Thus, environmental laws should be better implemented. Moreover, "*the dissemination of information is very important as well as to show that there is law enforcement*". "*I think that, environmental institutions and the local people, the people that live together, must cooperate. I think that inspections must be more preventive rather than reactive. That would be more viable.*"

3.4. Narrative 2

Narrative 2 comprised the views of one farmer from Mato Grosso and one cattle breeder from Roraima, explaining 8% of the total variance:

"*Some hunting can be OK*". In fact, there are "*plenty of animals that should be opened for hunting.*" Jaguars have a right to exist in Brazil and they are important for tourism since "*a lot of people get very excited and want to see jaguars*". Jaguar conservation does not benefit the rich while the poor pay the price. On the contrary, "*jaguar conservation does not benefit anyone.*" Although fearsome, jaguars are no threat to human safety. "*It is only if we go after the jaguar that the jaguar turns into a threat.*"

It is "*important to consider regional conditions and the connectivity of protected areas when establishing new protected areas because not just any area should be designated for protection*". In addition, the obligation to set aside land for legal reserves prevents the economic development of Brazil. For example, "*Many people work their entire lives, then IBAMA, the government, or federal police, come and obligate everyone to leave and the people lose everything!*" However, to feed people, the agriculture must intensify because "*Brazil is a bit behind when it comes to utilizing its areas, but the areas don't necessarily have to increase [in size].*"

Corruption is not a major threat to environmental conservation in Brazil (significantly different, **P<.01**). "*In general, the existing laws", including conservation (environmental) laws, "are respected*" (significantly different, **P<.01**). However, "*environmental laws are unclear*" and need better implementation. Many "*existing laws are faulty*". "*There are many bad laws*" and "*many are unrealistic*". "*Every region has its respective characteristics*" and to be appropriate "*laws must relate to, and reflect the reality of today*". Therefore, "*conservation should be based on detailed [scientific] studies from every locality*". (Brazilian environmental laws are considered significantly more unfair/unrealistic within narrative 2, **P<.01**) Whereas "*international organizations have influence […] they are not too important*" to environmental policies in Brazil.

3.5. Narrative 3

Narrative 3 comprised the views of one farmer from northern Goiás and one jaguar hunter from Roraima, explaining 10% of the total variance:

Jaguars are no major threat to the economic viability of cattle ranching. Jaguars have the right to exist and should be allowed to survive throughout Brazil, even in human modified environments (significantly different, **P<.01**). However, hunting in general, and the killing of jaguars in particular, should not always be prohibited.

It is uncertain whether it would be necessary to increase cultivated areas in Brazil to feed people (significantly more indecisive, **P<.05**). However, the obligation to set aside land for legal reserves does not prevent the economic development of Brazil (significantly different, **P<.01**). Partly because "*productive areas [are never designated] as reserves, only unproductive areas*", and partly because even if "*it prevents the economic development on the one side [it is] necessary on the other*". Yet, farmers should be compensated for losses incurred by wild animals (significantly different, **P<.05**).

Foreign agencies do not have too much influence over environmental policies in Brazil. In Brazil, people comply with conservation (environmental) laws (significantly more positive, **P<.05**), but generally "*by obligation, not because of culture*". Nature conservation should primarily be based on scientific knowledge and the Brazilian conservation (environmental) laws are fair/realistic. Although corruption together with forest fires that "*destroy fauna and flora*" are major threats to Brazilian environmental conservation, there is no great need to improve the implementation of conservation (environmental) laws (significantly less weight compared to the other narratives, **P<.05**). However, laws in general are not respected and their implementation is unsatisfactory. People do "*not respect laws if there is no pressure*" and "*the institutions which should enforce/monitor that laws are followed are corrupt, the people are corrupt.*"

3.6. Narrative 4

Narrative 4 comprised the views of three farmers, two tourist guides and one cattle breeder from Mato Grosso, Goiás and Roraima, explaining 19% of the total variance:

It is doubtful whether jaguars could "*adapt*" to survive throughout Brazil, including in human modified environments (significantly more negative compared to perspectives 1, 2, and 3, **P<.05**). Thus, "*jaguars should remain in their proper place.*" However, "*if there are conditions for jaguars to survive*" in modified landscapes that is "*good*". Jaguar conservation does not benefit the rich while the poor pay the price. Jaguar conservation is no serious obstacle to rural or economic development in Brazil and no one really suffers substantial economic loss because of jaguars. Actually, "*the jaguar does not represent anything; a cattle breeder can kill as many jaguars as he would like*". However, jaguar hunting is no act of bravery or skill, and retaliatory killings should be forbidden.

River conservation and the conservation of native vegetation for river conservation is for a "*fact*" important (significantly more important, **P<.01**). Forest fires are a "*major problem*" and a "*threat to both animals and humans*". It is important to establish protected areas in Brazil "*because we have nature, but we also have indigenous peoples and our wild animals in general*". Therefore, "*it is important to demarcate, to make it clear where*" the protected areas are and "*privately protected areas ought to be considered reserves as well*". Moreover, nature conservation should be based on scientific knowledge, "*together with traditional knowledge*".

Jaguar conservation in Brazil does not bring unwanted involvement from foreign organisations. In contrast, foreign organisations are "*important, primarily because of their knowledge*". Although, "*international institutes*" can be "*far from reality*" and "*pressure a lot, in a bad way, without really understanding the situation*", "*all that come to increase knowledge, principally through studies, are most welcome, including foreign institutions*" (significantly more positive to foreign organisations, **P<.05**).

It is not necessary to increase pasture areas in Brazil to feed people, but possibly cultivated areas should be increased (significantly more indecisive than the other narratives, **P<.05**). New technology might aid increase production, additionally "*the infrastructure must be improved*". However, in essence it is a matter of "*improving what we already have*" since "*there are plenty of agricultural areas and people have other needs too.*"

Brazilian laws are generally not respected. Notably (P < .01) conservation (environmental) laws are not respected and implementation needs improvement. "*Much could change if the laws were followed*" and "*more [resources] must be invested in the laws*". The Brazilian state does not spend too many resources on nature conservation. On the contrary, "*the government does not spend any resources*". "*They do not give money to restore the forest. There are many corrupt people who divert the money and do nothing.*" In addition, sometimes "*people end up disobeying laws because of ignorance*". Therefore, laws should "*not only [be] better implemented but also better communicated*". "*More and more effective vigilance*", is needed by "*the institutions [that are responsible for the laws and] which the people almost don't know*" since "*many times their presence is missing*". Moreover, environmental laws must become locally "*applicable*" "*e.g. adapted to the Cerrado savannah, etc.*"

3.7. Narrative 5

Narrative 5 comprised the views of one small-scale farmer, one jaguar hunter, and one cattle breeder, from Roraima, explaining 9% of the total variance:

Hunting "*should be forbidden*" otherwise "*there will be an imbalance in nature*" (significantly more positive to the hunting ban, **P<.01**). Jaguars do not threaten human safety, and generally, they are not a major threat to the economic viability of cattle ranching. However, there must "*be conditions to produce food*". Therefore, "*jaguars should be in their own place*" or else they will "*cause problems for people*" (significantly more negative toward allowing jaguars throughout Brazil, including in human modified environments, **P<.01**). Thus, "*it is sometimes unavoidable to kill jaguars*" because "*if no one does anything to resolve the problems [experienced by local cattle breeders] then we have to kill jaguars or else the jaguars will cause damage.*"

Moreover, it is necessary to expand agriculture because "*The food is very expensive and the people will suffer even more unless we increase the productive areas.*" However, forests are important and "*deforestation is not right*". Instead, farmers need more "*general supportive projects from the federal level*".

Brazil's rich nature, fauna and flora are important for attracting tourists. Nature conservation "*laws exist but they are not always followed.*" Thus, environmental laws need better implementation. "*If it [the regulatory management system] had been taken care of at the local level then it would have been possible to be more vigilant*". Hence "*it would [have been] much easier to regulate and to resolve a situation, and it would [have given] the people of that place greater opportunities to influence the situations*" (significantly more positive toward local level decision-making about nature conservation, **P<.01**). Today, foreign agencies have too much influence over environmental policies in Brazil and jaguar conservation brings unwanted involvement from foreign organisations (significantly more negative toward foreign involvement, **P<.05**). "*They say that the foreigners invest money here but there are many corrupt people that secure the money for themselves, so I don't know if we have any obligation [to ensure jaguar survival].*" Brazil can "*survive without outside help.*" However, "*Corruption is a burden*" and major threat to environmental conservation in Brazil. For example, in Brazil, "*there are resources for everything, but they are diverted.*" "*The small person is not favoured*" and "*almost all institutions have much corruption.*" "*They [the politicians] say that the government spends money but we [the people] never see that anything is being done*".

3.8. Consensus statements

Consensus statements are statements that do not significantly distinguish between any pair of factors, i.e. statements that are non-significant at p > .01 (cf. Table 1). There were 5 consensus statements; three related to wildlife and jaguar management, and two related to land management. There are no consensus statements concerning governance, laws and implementation. Considering consensus statements, it appears that all interviewed stakeholders agree that jaguars have the right to exist in Brazil, even though their importance for tourism is relative, and their potential to reduce crop depredation by other wild animals is contested. Stakeholders also share a positive view about establishing protected areas in Brazil, notably considering that Brazil's rich nature, fauna and flora has the potential to attract tourists.

4. Discussion

We explored local people's views regarding jaguars and their conservation in a Brazilian environmental justice context. Interestingly we did not find evidence to suggest that these stakeholders view jaguar conservation as unjust in principle. Considering the often heated, polarised and politicised conflicts that have emerged around large carnivore conservation in parts of Europe and North America (Moore, 1994; Brox, 2000; Nie, 2003; Skogen and Krange, 2003; Bredin et al., 2015a) this result is surprising and clearly differs from a similar study conducted in Norway, also using Q methodology (Jacobsen and Linnell, 2016).

In contrast to the Norwegian study by Jacobsen and Linnell (2016), we found no evidence of clear "pro" and "anti" jaguar conservation groups, and the respondents did not fall into predictable stakeholder clusters, except that all stakeholders in narrative 1 are from Goiás whereas all stakeholders in narrative 5 are from Roraima. However, the main differences in perspectives on jaguar conservation were not between primary resource users from different communities, biomes or livelihood activities. Hence, differences in the narratives regarding jaguars and conservation could not be linked to differences in land uses, or the historical or social contexts across the regions. Similar unpredictable clustering has been observed concerning wolf reintroduction in Yellowstone (Robbins, 2006) and stakeholder acceptance capacity for cougars in Montana (Riley and Decker, 2000). The result is especially interesting because we did not find any direct articulation of distributional injustice despite jaguar depredation on cattle (Zimmermann et al., 2005; Palmeira et al., 2008) and fatal jaguar attacks on people, albeit rare (Neto et al., 2011). Rather, the divisive issues among stakeholders were their views on hunting, where jaguars should be allowed to survive, the need for more agricultural lands, constraints of conservation on (private) land use, and their views on corruption and law enforcement. This indicates that the greatest problems were expressed with respect to procedural issues and participatory injustice.

4.1. Wildlife and jaguar management

Although some respondents expressed fear toward jaguars, there was no evidence of any strong resistance to jaguars among the stakeholders, indicating that they recognised the rights of jaguars to exist. Nevertheless, some respondents doubted that jaguars and human activities could coexist in shared multi-use landscapes throughout Brazil. Whereas it is difficult to assess the degree to which the respondents from narratives 1, 2, and 4 considered that jaguars were unable to survive in human modified environments, or simply opposed jaguar presence there, they held no strong opinions on the matter. Only narrative 3 was decidedly positive toward the coexistence between jaguars and human activities in shared landscapes whereas narrative 5 argued that people and jaguars must have their separate spaces.

Noteworthy is also the lack of consensus among respondents regarding hunting in general, and jaguar hunting in particular, as well as the absence of self-proclaimed jaguar hunters in our study sites in central Brazil (despite evidence of jaguar killings also occurring in this region). Possibly the "missing jaguar hunters" reflects a potentially higher degree of law enforcement in central Brazil compared to the more remote communities of Roraima, and the relative trust that our respondents put in our respective local contacts and us. Nonetheless, the act of hunting was clearly controversial. Brazil is one of the countries with the most restrictive policies on hunting in the world.

Whereas narratives 2, 3, and 4 favoured some hunting, narratives 1 and 5 both supported the existing hunting ban. At the same time however, most respondents felt that it would have been appropriate to permit limited killing of jaguars in response to livestock depredation (narratives 2, 3, 4, & 5). This reflects a desire for a degree of empowerment, and the fact that jaguars are presently subject to regular illegal killing throughout Brazil (Sollmann et al., 2008; Silveira et al., 2010; Desbiez and De Paula, 2012). Although most respondents did not view jaguar hunting as an act of bravery and skill, some respondents openly engaged in illegal jaguar hunts. Yet respondents did not perceive the retaliatory killing of jaguars by ranchers as a major threat to jaguar survival.

These diverse elements show that the current practice of strict and unconditional jaguar protection is contested. Killing a jaguar is a crime in Brazil (Lei de Crimes Ambientais - 9.605/98), but article 37 of this law allows exceptions − with an authorisation from the competent administration body − for protecting livestock from predators. However, this authorisation has apparently never been used. Although the capture and release of the incriminated animal is more likely to be authorized, all narratives were rather neutral concerning this solution.

In a study about key factors driving attitudes towards large mammals in conflict with humans, Kansky and Knight (2014) found evidence that intangible costs are more important determinants of stakeholder attitudes than tangible costs. Thus, they

conclude that the use of financial incentives (e.g. payment schemes for livestock loss) would be relatively ineffective for improving stakeholder tolerance. In our study, we also found that tangible costs were relatively unimportant. Only a few of the respondents (narratives 3 and 2) felt that financial compensation payments for livestock losses incurred by wild animals would be appropriate. Moreover, there was almost no articulation of distributional injustice issues. Thus, economic compensation would probably not improve stakeholder tolerance toward jaguars, in Brazil. This is interesting considering that existing literature generally focus on economic aspects of livestock production whereas our results show that this is relatively unimportant. Correspondingly, although a recent study suggests that jaguar conservation in the Pantanal could benefit from "a stable compensatory partnership from tourist operators to livestock ranchers" the authors highlight that such schemes may only work if considered "a reward to ranchers for, first and foremost, protecting jaguars within their properties" rather than simple payment schemes for livestock loss (Tortato et al., 2017).

4.2. Land management

Creating corridors for jaguar conservation would require establishing some form of protected areas or at least place some restrictions on land use practices. Therefore, it was important to assess whether there could be opposition from local stakeholders and the way that they perceived and managed land. Generally, the respondents appreciated Brazilian nature and showed widespread awareness of the negative impacts of forest fires and erosion. Hence, the respondents agreed that it was important to conserve native vegetation, which they considered important for river conservation and the prevention of soil erosion, and to establish protected areas. For jaguars this is good news since protected area establishment secure jaguar habitat, especially in the light of deforestation and cattle breeding, which appear highly important for jaguar persistence (Jędrzejewski et al., 2017). However, many respondents disagreed with the way in which protected areas have been established in Brazil and emphasised the importance of careful planning in protected area establishment to secure both the connectivity between protected areas, and to minimize conflicts with other interests. Although the respondents agreed with land protection in general, they also considered it important to increase Brazilian food production to feed people. While all the respondents agreed that pasture areas and agricultural lands in Brazil had to be better utilized, they also expressed awareness about the need for conservation and good environmental laws. Only the respondents behind narrative 5 saw a need to expand the cultivated areas by clearing forests to produce enough food, with the other narratives indicating that increased production should be achieved by better management of existing land. Thus, local stakeholder views generally coincide with institutional stakeholder views regarding protected area establishment and the need to improve food production within existing agricultural land (Bredin et al., 2015b).

4.3. Governance, laws and implementation

Although the stakeholders had few issues with Brazilian laws in general, or jaguar conservation specifically, they perceived the environmental laws as being maladapted and too general to be practical on the local level. Moreover, the way in which laws were being implemented in practice was viewed as unjust. Widespread corruption was believed to make it easier for some people to avoid respecting the laws than for others, and the laws were viewed as being neither uniformly nor predictably enforced. Hence, the stakeholders experienced environmental management (including jaguar/species conservation) as unpredictable and even wanton or opportunistic at times. Thus, there was widespread discontent with corruption and the way in which environmental laws in general were (not) enforced. This implies that procedural justice issues are important, especially considering that trust in institutions is essential for effective management (Kansky and Knight, 2014). Additionally, there was consensus among the narratives that the Brazilian state did not spend too many resources on nature conservation.

Accordingly, the stakeholders perceived a need for devolving more authority to the state level to respond to diverse local situations and to establish a sense of local ownership, which could result in better enforcement and compliance with the laws. At the same time as respondents agreed that decisions about nature conservation should be taken at the local level, respondents generally agreed that nature conservation should be primarily based on scientific knowledge. To some extent, it thus appeared that respondents expected local level decisions to be informed by scientific knowledge. There was no strong agreement on Brazil having an international obligation to conserve its nature or to ensure jaguar survival, although the respondents agreed that nature and jaguar conservation were important. Despite some scepticism toward international involvement (within narrative 5), the general view was that there was neither too much international influence in Brazilian environmental policies nor unwanted involvement from foreign organization.

4.4. Method limitations and implications for results

A Q study involves several steps of which the two most critical steps are the selection of Q statements (typically through a concourse) and the inclusion of respondents. Because possible outcomes of a Q analysis are constrained by the inclusion of Q statements, the set of Q statements must be broad in scope to ensure that all the different aspects are covered. We based the Q statements on *a priori* interviews with local people in central Brazil and the results of a previous study (Bredin et al., 2015b), which should have given us a good insight into the "universe" of statements on the topic. However, we could not include Q statements based on *a-priori* interviews with local primary resource users in Roraima. Hence, we may have missed out on regional nuances and valuable insights through our study design. However, the open discussions following the Q sorts should,

at least to some extent, have compensated for this limitation as respondents were encouraged to raise and comment on any additional concerns they might have had throughout the interview process. It should also be noted that we set out with a specific goal to investigate environmental justice issues, so we deliberately selected statements that were relevant to the different forms of injustice. Because the number of respondents in a Q study is a function of the number of Q statements (Brown, 1980), our set of respondents was necessarily small. Furthermore, for a Q study to generate reliable results, the respondents must be carefully chosen to ensure that they understand and are likely to have formed opinions about the issues presented to them (Brown, 1980; Van Exel and de Graaf, 2005). The respondents are therefore not representative of the population at large. It is, however, important to be inclusive of different kinds of stakeholders to ensure that the whole spectrum of existing views is covered among the respondents. Thus, we tried to reach as diverse a set of people as possible, within the subset of society that is prone to interact with jaguars and jaguar habitat through their activities. Subsequently, we feel confident that we obtained a reasonably balanced and inclusive sets of Q statements and respondents and hence, reliable results. It will however be noted that these results — just like the results of any other Q study — do not allow for generalisations about the representativeness of these views within the Brazilian population at large (commonly a goal in questionnaire-based surveys).

5. Conclusions

Combining the insights from local level stakeholders with the insights previously reported from a study of institutional representatives in Brazil (Bredin et al., 2015b) a relatively consistent picture emerges of broad support for/low resistance toward jaguar conservation. Therefore, jaguar conservation apparently doesn't generate injustice in terms of equity or in terms of recognition. Although there are still comparatively few social science studies on jaguar-human relationships, similar observations have previously been explained with the jaguar's cultural symbolic values (e.g. De Angelo et al., 2011). Moreover, the combination of this study, and our early study (Bredin et al., 2015b), show little evidence of the highly political, polarized and institutionalised conflicts between stakeholders and large carnivores that have emerged in some parts of Europe, such as Norway (Bredin et al., 2015a; Skogen et al., 2017) or of the significant focus on recognition justice that was identified in a comparable study in Norway (Jacobsen and Linnell, 2016).

There was however, a significant undercurrent concerning a desire for more local empowerment, expressed both in terms of a desire to loosen the strict ban on killing jaguars and for more state level (as opposed to federal) management. Thus, the stakeholders wished for more pragmatic management and systematic implementation of (environmental) laws. Although these conflicts are not directly linked to jaguars, they are linked to jaguar habitat, which is a precondition for jaguar survival (Jędrzejewski et al., 2017). Anyway, this desire for more local empowerment shows that our informants felt that they were underrepresented and that there was injustice in terms of participation in decisions about local environment management. We therefore propose the following five recommendations for improved practice in Brazilian jaguar conservation: (1) Uniformly implement more locally-adapted environmental laws; (2) Frequently and systematically enforce these laws; (3) Provide more government support for farmers (e.g. through technical support and infrastructure, but not through compensation for livestock losses); (4) Grant greater flexibility for local people to respond to local conditions and depredation by jaguars; and (5) Consolidate the existing protected area network through inclusive and local adapted processes.

Acknowledgements

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