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The jaguar in South America – status review and strategy

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Prologue: Why care about jaguars?

Humankind has always been fascinated by carnivores, has always felt and emotional response to them, a response of exaltation or fear, delight or loathing (Schaller 1996). The mammal carnivores, order Carnivora, descend from a monophyletic order of placental mammals consisting of the most recent common ancestor of all cat-like and dog-like animals. The jaguar (*Panthera onca*) is the only extant representative of the *Panthera* species in the Western Hemisphere. Its massive head and powerful bite and muscular limbs are unique among felid species and seems to be an evolutionary adaptation for preying on the large and hard-integumented reptiles of the Neotropics (Emmons 1987). Wozencraft recognised nine subspecies of jaguar (Wozencraft 2005), however, morphometric and molecular analysis did not find evidences of morpho-geographical patterns or major phylogeographical structure, respectively (Larson 1997, Eizirik et al. 2001, Ruiz-García et al. 2006, Ruiz-García & Payán 2013). Therefore, the jaguar is considered a monotypic species (Kitchener et al. 2017). Analysis of the whole jaguar's genome revealed that the species have undergone cycles of demographic fluctuations in the last 1–2 million years (Lorenzana et al. 2021). The same study also reinforced the Amazon as having the largest population while highlighting genomic erosion in the Atlantic Forest population.

Carnivora literally means "eaters of flesh". The jaguar's vernacular name comes from the Tupí-Guaraní indigenous name: yaguará, which can be translated as "the one that kills with one jump". Jaguars have been dancing and killing in our collective minds for millennia, have guided us in dreams and questioned our anthropocentrism by being capable (albeit very infrequently) of killing and eating humans. For example, the pictographs in the Colombian table-top mountains of Chiribiquete National Park depict the jaguar as the most common motifs among 6,000 pictographs portrayed in cliff rocks dating back to at least 15,000 years ago. Archeologists argue that being considered prey is the ultimate fear and challenges violently our supreme consciousness as lords of nature (Castaño-Uribe 2013). The jaguar has always been a strong character in the collective imagery of all of the tropical American ethnic groups, a definitory deity for Olmecs, Mayas and Aztecs, for example, and portrayed as hero or devil, the representation of thunder and lightning, or even as a rapist (Reichel-Dolmatoff 1972, 1978, Saunders 1998), or as vital messengers to the gods in the Yanomamö deities (Chagnon 1973). That is why jaguars are preeminent in nearly all ancient society iconographies.

Jaguar symbolism has shifted through time and humanity, from gods to vermin to conservation icons (Payán & Gomez Garcia-Reyes 2017). The values ascribed to jaguars through human history have shifted from objects of admiration to detestation to – recently – conservation. Alan Rabinowitz named this the Jaguar Cultural Corridor, reckoning a connected admiration from pre-Columbian times along all of Latin America (Rabinowitz 2013). As Spanish, Portuguese and other European colonisers came to the Americas jaguars became demonised by the Christian missionaries (Castaño-Uribe 2016), considered as vermin that should be shot for pelts (Payán & Trujillo 2006) or persecuted and killed in retaliation for attacks on their cattle. This sentiment lives on in many rural communities today (Hoogesteijn et al. 2015, Boron & Payán-Garrido 2016). But now, the jaguar is being seen in a new light – as a conservation icon, as the last stand of wildness and wilderness, and as a top representative of healthy and functional ecosystems.

The International Union for the conservation of Nature (IUCN) lists the jaguar as Near Threatened, but, aside from the Amazonian subpopulation, all other subpopulations have been categorised as Endangered or Critically Endangered due to their small size, isolation and poor protection (de La Torre et al. 2018). Jaguars have been decimated over the years, they have currently lost some 60% of their habitat and today large-scale threats such as man/made fires, deforestation, illegal killing and trade, and other invasive human activities keep pushing them into the last forested corners of the Neotropics (Fig. 1; see this issue). Losing jaguars does not just imply an ethical and aesthetic loss, their absence can cause ecological cascades that can reverberate in less dense forest, less water and of lower quality, more erosion, more pests and more wildlife-transmitted diseases. Habitat destruction represents the main threat for the jaguar long term survival (Bernal-Escobar et al. 2015, Olsoy et al. 2016). In the 20th century, the jaguar's habitat has been reduced from 19,000,000 km^2 to 9,000,000 km^2, a trend that remains in the 21st century with an estimated loss of 1,700,000 km^2 by 2015 (Romero-Muñoz et al. 2020).

In the Brazilian Amazon, the largest jaguar's stronghold, deforestation in recent years (2016–2019) has displaced nearly 1,422 individuals (Menezes et al. 2021). The worldwide increases in soy and beef production, trade and consumption are likely to boost deforestation in Latin America considering that these commodities are the base for the economy of most of the South America countries. Agriculture expansion increases access

Fig. 1. Fire destroying jaguar habitat (Photo: E. Payán/WCS).

Fig. 2. Jaguar tourism (Photo: E. Payán/WCS).

to formerly remote areas (Romero-Muñoz et al. 2020) facilitating the action of hunters and poachers. In addition, close contact between jaguars and livestock may result in a conflict, in which case jaguars are persecuted and killed (Carvalho et al. 2015). For instance, in Brazil just one poacher has killed 200 jaguars in the last four years in a small region of the Acre State. In Bolivia and other countries, the increasing illegal trade of jaguar body parts seems to be a byproduct of retaliatory killing (Romero-Muñoz et al. 2020). Although the creation of protected areas, more efficient law enforcement and human-jaguar coexistence are useful instruments for the species conservation, they are not enough. Conservationists must find new creative ways to protect jaguar populations and promote co-existence actions, mainly through economic incentives and conservation financing for those living in contact with the jaguar (Romero-Muñoz et al. 2020, Menezes et al. 2021).

However, the jaguar may be more valuable alive than dead. Resource economics provides a means of calculating the potential value of a species (Schaller 1996). Jaguar-viewing ecotourism represents a gross annual income of nearly seven million dollars annually in land-use revenue across a representative portion of the northern Brazilian Pantanal, the world's largest wetland (Fig. 2; Tortato et al. 2017). These economic gains compared to projected losses in the same area from depredation (less than 2 percent of losses compared to tourism gross income), reinforce the importance of jaguar tourism as a conservation tool in boosting tolerance of jaguars in private ranches, which is on the increase in the Brazilian Pantanal and in the Colombian Llanos (Hoogesteijn et al. 2015).

The vast distribution of jaguars (but high abundance/density variation) poses challenges and opportunities for jaguar protection and valuation. The great aspect of jaguar conservation is that we have so much occupied range to deal with, with a low percentage of officially and effectively protected areas and large areas under private property and used for cattle-ranching (with high levels of jaguar/cattle conflict). This implies a variety of threats in intensity and scale, and a multitude of stakeholders with varying attitudes and opinions on jaguar conservation. Bringing stakeholders together to promote and ensure jaguar preservation is one of the great challenges for conservationists. Our ability to truly monitor the species is another daunting challenge since it requires significant funding and is dependent on habitat-specific monitoring. For example, the total estimated number of jaguars is in the range of 175,000 individuals (Jędrzejewski et al., 2018), which seems large, but the need for density studies in impacted ecosystems was very apparent and mostly lacking. For example, there are fewer than three density estimates for the Amazon Basin, its stronghold (Payán et al. 2013, Tobler et al. 2013, Mendonça et al. 2023). Most jaguar research has not taken place in high-slope landscapes such as coastal southern Brazil, or the northwest coast of Honduras; and researchers tend to choose areas that are less impacted by human influence. Furthermore, we lack range-wide surveys, and there is significant discrepancy of different "mapping exercises" since there are still some information voids in geographic distribution and potential connectivity. Furthermore, as we further map these uncharted populations, the total number of jaguars estimated on paper increase and affect Red Listing exercises. Another major challenge is jaguar conflict resolution across larger areas of the species' distribution, especially around protected areas and corridors (Castaño-Uribe et al. 2016).

Many of the big cats, like lions, tigers and leopards, have range-wide population survey results, but not jaguars. This volume probably contains the most up to date body of knowledge on the species.

Why care? We present this chapter, and this volume, to make the case for the jaguar as an ideal species for conservation focus for South America, and for the Americas. As a large carnivore, the jaguar is the quintessential focal species and thus the ultimate conservation target for many conservation programs (Rabinowitz & Zeller 2010). Focusing on jaguar conservation will enable large scale conservation given their landscape species needs (Coppolillo et al. 2004) and umbrella effects (Thornton et al. 2016). Part of the stability of ecosystems is due to the presence of large carnivores such as jaguars that contribute to the stability of ecosystems because they maintain healthy prey species populations and they impose a landscape of fear. This landscape is the primordial, healthy forest, where rich tropical biodiversity has flourished for hundreds of thousands of years. Given the jaguar's focal species position, areas with conserved populations will also protect entire wildlife communities. This, coincidentally, is biodiversity conservation's ultimate purpose! Thus, to conserve the jaguar epitomises an important goal for humanity: Saving this species has become one of the most difficult tests we face in the race against extinction.

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