



## Review

## Ecotourism contributions to conservation of African big cats

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## ABSTRACT

Ecotourism has been advocated and adopted widely to provide financial, political and local community support for conservation. We analyse its application for conservation of African big cats, through systematic analysis of 66 published studies over three decades, and on-site audit of 48 current conservation tourism enterprises. Conservation measures include: expanding and restoring habitat and reducing net habitat loss; anti-poaching patrols and programs; measures to combat illegal wildlife trade; improved livestock husbandry such as better fences and guard dogs; well-designed livestock compensation and predator conservation incentive programs; and live-capture, veterinary services, captive breeding, and translocation and reintroduction programmes. Some tourism enterprises do contribute to conservation of African big cats, but others have negligible or negative net outcomes. Conservation outcomes depend critically on the detailed design of conservation programmes, community involvement, and tourism marketing.

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## 1. Introduction &amp; methods

Tourism has become an increasingly significant tool in conservation of threatened species worldwide, providing political and economic support across all land tenures (Balmford et al., 2015; Buckley, 2009, 2014; Gubbi & Poornesha, 2013; Lindsey, Alexander, du Toit, & Mills, 2005; Meena, Macdonald, & Montgomery, 2014). This applies particularly in developing nations, where conservation areas are under continuing threats from encroachment and poaching, and have limited funds for operational management (Balmford

et al., 2015; Buckley, 2010a,b, 2014; Buckley & de Pegas, 2014, 2015; Dickman, Macdonald, & Macdonald, 2011; Lindsey, Balme et al., 2013; Nelson, 2009; Packer et al., 2013). Tourism may also produce negative ecological impacts on the same threatened species, through a variety of direct and indirect mechanisms (Buckley, 2011; Leung et al., 2015; Monz, Pickering, & Hadwen, 2013). Tourism yields negative net overall environmental effects at global scale (Buckley, 2011; Gössling & Peeters, 2015) but positive contributions to conservation for some sites at local scale (Buckley, 2010a,b; Buckley & Pabla, 2012; Funston, Groom, & Lindsey, 2013; Sims-Castley, Kerley, Geach, & Langholz, 2005; Snyman, 2012) and for some species at global scale (Buckley, Castley, de Pegas, Mossaz, & Steven, 2012). Some of these species themselves act as tourism attractions, whereas others benefit indirectly.

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Here we analyse the mechanisms by which tourism contributes to conservation of lion (*Panthera leo*), leopard (*Panthera pardus*) and cheetah (*Acinonyx jubatus*), a small group of species which act as iconic tourism attractions at continental scale (Bond et al., 2004; Castley, Bennett, & Pickering, 2013; Cousins, Sadler, & Evans, 2008; Dickman et al., 2011; Lindsey et al., 2006, 2012; Macdonald & Loveridge, 2010; Nelson, 2009; Okello, 2005; Okello, Manka, & D'Amour, 2008; Ripple et al., 2014). Public and private wildlife reserves routinely reintroduce big cats, to attract tourists as well as to conserve cats (Buk & Marnewick, 2010; Castley, Boshoff, & Kerley, 2001; Hayward et al., 2007; Hunter et al., 2007; Sims-Castley et al., 2005; Trinkel et al., 2008). African big cats have also been the focus of a number of large-scale international conservation efforts (Balme, Slotow, & Hunter, 2009; Balme, Slotow, & Hunter, 2010; Dickman et al., 2011; Hazzah, Mulder, & Frank, 2009; Hazzah et al., 2014). Because of the high profile of the African big cats in both tourism and conservation, these species provide a good opportunity to test the use of tourism as a conservation tool.

The conservation status of African big cats is severe (IUCN, 2015). Populations of lion have fallen from a pre-European estimate of 400,000 (Joubert & Joubert, 2011), to around 20–30,000 (Bauer & Van Der Merwe, 2004; Riggio et al., 2013). There are only ten remaining genetically diverse subpopulations with over 1000 lions each (Riggio et al., 2013), largely in protected areas (Dolrenry, Stenglein, Hazzah, Lutz, & Frank, 2014; Dubach, Briggs, White, Ament, & Patterson, 2013; Henschel et al., 2014; Hunter et al., 2007). The remaining range of leopard has shrunk by up to 40%, and nearly 90% of remaining habitat is on private rangeland (Balme et al., 2009, 2010; Hayward et al., 2006; Swanepoel, 2008). Cheetah have lost over 75% of their historical range, and the total remaining population is below 10,000, mostly outside protected areas, with the largest subpopulation of ~2500 in Namibia (Buk & Marnewick, 2010; Marker & Dickman, 2004; Marker, Mills, & Macdonald, 2003; Marker, Dickman, Mills, Jeo, & Macdonald, 2008). The population effects of range reduction are exacerbated by low genetic diversity in remaining populations (Buk & Marnewick, 2010; O'Brien & Evermann, 1988).

All the African big cat species face similar threats (Winterbach, Winterbach, Somers, & Hayward, 2013). Habitat loss is widespread, principally through conversion to rangeland, farmland or residential areas (Inskip & Zimmermann, 2009; Nowell & Jackson, 1996; Ripple et al., 2014). Livestock owners, whether private or communal, industrial or subsistence, regularly kill predators (Balme et al., 2009, 2010; Frank, Hemson, Kushnir, & Packer, 2006; Kissui, 2008; Lichtenfeld, Trout, & Kisimir, 2014; Maclellan, Groom, Macdonald, & Frank, 2009; Packer et al., 2013). Livestock grazing also reduces the abundance and availability of those native species that constitute the big cats' usual prey (Hayward & Kerley, 2005; Hayward et al., 2006). Organised poaching for international criminal trade in animal body parts is widespread (Macdonald & Loveridge, 2010). Poaching may also occur at smaller scale to supply animal parts for traditional medical rituals (Simelane & Kerley, 1998). Some species, notably lions in the Maasai lands of southern Kenya and northern Tanzania, were hunted traditionally for cultural reasons. Individual animals are killed by commercial hunters, sometimes beyond local population capacities (Buckley et al., 2012; Buckley & Mossaz, 2015; Lindsey, Alexander, Frank, Mathieson, & Románach, 2006; Lindsey, Balme, Booth, & Midlane, 2012).

Similar conservation threats, efforts and measures also apply for felines in other continents. These include: tiger (*Panthera tigris*), Gir lion, leopard and snow leopard (*P. uncia*) in Asia; jaguar and puma (*P. onca*, *P. concolor*) in the Americas, and Iberian lynx (*Lynx pardinus*) in Europe (Breitenmoser, 1998; Buckley & Pabla, 2012; Gubbi & Poornesha, 2013; Inskip & Zimmermann, 2009; Karanth & Chellam, 2009; Li, Yin, Wang, Jiagong, & Lu, 2013; Meena et al., 2014; Nowell & Jackson, 1996; Sharma, Wright, Joseph, & Desai,

2014; Weber & Rabinowitz, 1996; Wolfe et al., 2015; Zimmermann, Walpole, & Leader-Williams, 2005).

For the African big cat species, the interactions between conservation threats, conservation efforts, and conservation tourism (Buckley, 2010a,b) are thus increasingly critical to their continuing survival. Here we examine how tourism contributes to conservation in the face of threats. We identify and classify the various mechanisms involved, by reviewing published studies and conducting on-site field audits. The former indicate the range of conservation mechanisms involved and their historical development. The latter demonstrate patterns in current adoption and practice. We combine these two data sources to generate a menu of mechanisms for the effective use of tourism as a tool in conservation of these and other threatened species. We use the term ecotourism to refer to nature-based tourism which includes education, minimal-impact management, and some contribution to conservation (Buckley, 1994), and conservation tourism to mean tourism which aims to generate a net gain for conservation, over and above negative impacts (Buckley 2010a,b).

To analyse published studies, we conducted a systematic search of past publications on tourism, conservation and African big cats, using Google Scholar<sup>®</sup> and Web of Science<sup>®</sup> for articles in English from 1981 to 2014, and forward and backward citation tracking. We coded these publications into research themes, adding and revising themes until saturation was reached, and analysed patterns amongst themes and publications using principal components analysis (Primer<sup>®</sup> Ver. 6.1.11). To analyse practices in the field, we conducted brief on-site audits following the approach reported by Buckley (2003, 2010a,b). We also interviewed staff and stakeholders in person, by phone or by email, and searched for more detailed and updated information using project websites, blogs, marketing materials, and mass and social media.

## 2. Results

We identified 66 publications that focussed on conservation management of African big cats and included the role of tourism. Coding yielded 12 themes, reflecting the scale of analysis, ecological outcomes, social aspects, tourist attitudes, and policy and management measures. The 66 publications, and the 12 coded research themes, are listed in Supplementary Table 1. Eighteen of these 66 studies, summarised in Table 1, present detailed information on conservation measures and mechanisms. Of the 66 published studies, 75% considered lion, 48% leopard and 42% cheetah. One third were from South Africa; 85% were published since 2006; 45% used timeframes  $\leq 2$  years; 55% used social-science methods; 29% reported experimental ecological studies. Those addressing social aspects considered a wider range of issues than those investigating biological aspects (chi-square = 56.03,  $P < 0.01$ ). Human-felid conflicts (44%) and livestock compensation schemes (12%) were heavily studied. Only one publication mentioned the negative ecological impacts of tourism.

Ecotourism (38%) and trophy hunting (32%) were equally favoured as tools for conservation. Of those recommending ecotourism, 24% (6/25) noted the importance of big cats in attracting international visitors, and 36% (9/25) argued that ecotourism raised awareness of big cat conservation amongst international tourists. Principal component analysis of the 12 coded research themes yielded similar results. The first component distinguished studies addressing direct ecological gains (loading  $-0.61$ ) from those assessing indirect measures, through management of human-wildlife conflict ( $+0.63$ ). The second axis distinguished studies assessing socioeconomic gains through ecotourism ( $-0.65$ ), from those considering more indirect mechanisms ( $+0.41$ ). Ecotourism is also associated with changes in tourist attitudes ( $-0.42$ ).

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