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Analysis

The value of endangered forest elephants to local communities in a transboundary conservation landscape

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ABSTRACT

This paper seeks to determine and characterize social and cultural preferences for the conservation of endangered forest elephants (EFEs) in the Congo Basins Tridom Landscape. Using unique data from a stratified, random, face-to-face survey with 1,035 households in 108 villages in 2014, we combine double-bounded dichotomous choice with open-ended elicitation formats to assess the willingness-to-pay (WTP) for EFE conservation. We find that local households are willing to pay CFA 1,139.4 (€1.74) per month to prevent EFE extinction. This totals CFA 753.9 million (€1.15 million) per year for all inhabitants. Indigenousness positively influences the WTP for EFE conservation. Spatial data suggest that local communities prefer that elephants remain far from their crops. The existence of human-elephant conflicts has a neutral effect on preferences for EFE conservation. Therefore, our study suggests that local communities would engage in biodiversity preservation when the public benefits of conservation are accompanied by private benefits, such as human-elephant conflict avoidance.

1. Introduction

Forest elephant (*Loxodonta africana cyclotis*)[1] poaching in tropical Africa is a major threat to the dynamics of this iconic species. In 2011, the Congo Basins forest elephant population was less than 10% of its potential size and occupied less than 25% of its potential range (Blake et al., 2007; Maisels et al., 2013; Martin and Stiles, 2000). The Tri-national Dja-Odzala-Minkebe (Tridom) cross-border landscape, spanning Cameroon, Congo (R), and Gabon, is considered to have ecological and biodiversity uniqueness, and hosts the most important population of forest elephants in the world, with the highest density in the Minkb National Park (MNP). The MNP lost more than 11,000 individuals between 2004 and 2012, representing more than 50% of the 2004 elephant population (Maisels et al., 2013). Despite the ivory trade ban by CITES[2] to protect the African elephant (Van Kooten, 2005), the current growing demand for ivory for jewellery, leisure and Asian medicine as well as the increasing deforestation and land pressure are the main drivers of the elephant population's devastating decline. It is evident that the elephant is much appreciated for these material and provisioning services. However, elephants also contribute to the maintenance of ecological equilibrium and to the provision of social and cultural services.

The forest elephant can be considered a flagship species, as its protection implies the protection of other species in the same ecosystem. Indeed, the elephant disseminates the seeds of important tropical fleshy fruit trees over long distances and contributes to the regeneration of these tree species throughout the Congo Basin (Beaune et al., 2013; Blake et al., 2009; Wang, 2008). For instance, *Baillonella toxisperma* (moabi), a traditional multi-use species among

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[1] There are two elephant subspecies, the forest elephant and the savannah elephant. This paper focuses on the forest elephant.

[2] CITES stands for Convention on International Trade in Endangered Species of Wild Fauna and Flora Signed in Washington, D.C., on 3 March 1973.

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Bantu and Baka villagers in the Tridom region is now an endangered species because of its high commercial value in the wood market. Moabi contributes significantly to balanced diets among forest people. Indeed, its fruits and nuts are eaten raw and its oil is used in cooking, disease treatment and cosmetics. By disseminating its seeds, the elephant contributes to the restoration of the forest; therefore, it indirectly contributes to carbon storage. Hence, elephant conservation is consistent with the REDD+ mechanism[3] , which has emerged as an important framework for forest conservation. Forest elephants help improve the forest habitat and thus restore the ecological services provided by the forest (i.e., they regulate the ecosystem).

Moreover, forest elephant populations are crucial to the cultural identity of the indigenous Baka ethnic group. Their main rituals occur after an elephant hunt, and the most important are the *"yeli"* and the *"jengi"* ceremonies. *"Yeli"* is the female ritual, and *"Jengi"* is the male ritual (Kent, 1996). The traditional elephant hunt is also the most important spiritual and religious event for this population. The hunt brings together dispersed groups, all of which have specific responsibilities (e.g., the vital contribution of women to the mystical preparations for a safe hunt). Only the oldest Baka are permitted to kill elephants, and they undergo rigourous preparation, in which they learn from experienced hunters over many years before obtaining permission to kill elephants. Once killed, the elephant is celebrated for many days and nights in a complex series of ritual feasts and celebrations until all the meat has been consumed (Lewis, 2002). Therefore, elephants participate in maintaining the spiritual enrichment, cultural identity and knowledge of the Baka community. This cultural service implies that elephant extinction entails an opportunity cost in terms of the loss of cultural values (Garrod and Willis, 1999). Fig. 1 provides a synoptic description of the ecosystem services and the total economic value of the elephant in the Tridom landscape. Considering the importance of forest elephants to ecological, cultural and socio-economic equilibria, possible crop damage (human-elephant conflicts) notwithstanding, endangered forest elephant (EFE) extinction would severely and directly affect local and indigenous welfare. Considering the interdependence of the elephant, *B. toxisperma* and rural communities as described above, nature too would seem to lose (Tisdell, 1990, pp. 83). This irreplaceable loss to Tridom society makes the EFE a priority in biodiversity conservation decisions. In addition, the social value of biodiversity is unknown, and thus, the potential impact of this loss in biodiversity on social wellbeing is uncertain (Turpie, 2003). An assessment of the economic value of the ecosystem services that the elephants provide for local communities will yield important information for policy makers and conservation managers. The findings may also increase awareness of the importance of biodiversity conservation. Therefore, the key question addressed in this paper is the following: ***What are local households willing to pay to prevent the elephants extinction***?

A large body of research has contributed to enriching the literature on the economics of endangered species conservation (Barbier et al., 2013; Bishop, 1978; Bulte and Kooten, 2002; Kremer and Morcom, 2000; Tisdell et al., 2002). However, only a few studies have assessed the indirect use value, bequest value and existence value of the elephant (Bandara and Tisdell, 2003a, 2005, 2003b), even though this iconic species plays important roles in socio-cultural and ecological integrity (Blake et al., 2009; Lewis, 2002).

Bandara and Tisdell (2001) used data from a face-to-face contingent valuation (CV) study of a sample of 300 urban residents in Colombo (Sri Lanka) to assess their willingness to pay (WTP) for elephant conservation. Their assessment differentiated between the values reported by users and non-users for the Asian elephant. Respondents who had used elephant facilities at least once were willing to pay Rs. 137.38 (€2.05), while non-users were willing to pay Rs. 82.96 (€1.24) for elephant conservation, yielding an average of Rs. 110.17 (€1.65) per month. The results reveal that urban residents are willing to pay for elephant conservation because they want to secure the existence of the elephant (non-use value) and because the presence of elephants has a use value, i.e., importance for recreation and tourism. The results also indicated that the probability of a positive WTP is significantly and positively influenced by pro-conservation attitudes and higher incomes (Bandara and Tisdell, 2004). The study found that the total WTP is sufficient to compensate for the value of annual crop damage.

While a small number of studies have investigated farmers' valuations of the use value (Smith and Sullivan, 2014), as well as the option value and non-use value, of Asian savannah elephants (Bandara and Tisdell, 2003a, 2004, 2003b; Vredin, 1997), no research has addressed the value of EFEs to local and indigenous communities. Our first contribution is thus to measure the value of EFEs to local and indigenous communities in Central Africa to contribute to the growing literature on CV implementation in developing countries. Additionally, this paper considers the relations between landscape factors, such as the distance between the household and the nearest concentration of elephants (i.e., protected areas), the elephant population density in the protected area and the households land ownership, and the WTP. Furthermore, our methodological contribution involves combining closed-ended and open-ended (OE) elicitation formats to target robust WTP value. This analysis is facilitated by the collection of a novel, unexploited dataset obtained through face-to-face interviews with 1035 households geo-localized by GPS.

The purpose of this study is to calculate local and indigenous households' WTP for EFE conservation and to analyse the factors that influence its value. We test four hypotheses. First, the extinction of the forest elephant may lead to a significant net loss in household welfare. Second, WTP for elephant conservation varies with the distance between the household and the nearest protected area. The effect of this distance may be positive or negative. Indeed, following the distance decay hypothesis, WTP declines as the distance between the respondent location and the site providing environmental services increases (Bateman et al., 2006; Loomis et al., 2000; Schaafsma et al., 2013). However, the distance to the protected area may also be an indicator of elephant scarcity. Therefore, if we assume decreasing marginal utility of forest elephant presence, household heads living close to a protected area with higher elephant density would be likely to express lower marginal WTP for elephant conservation. Third, WTP is significantly influenced by the indigenous status of households, as cultural services such as traditions and religious practices depend on the elephant's existence. Knowledge of spatial and ethnic differences in WTP may be used to design spatially explicit and culturally adapted conservation policies. Fourth, the presence of human-elephant conflicts is expected to reduce WTP for elephant conservation. The following sections present the case study of the Congo Basin Tridom landscape's EFEs (Section 2), the methodology (Section 3), the results (Section 4) and the discussion and conclusion (Section 5).

2. Case Study: The Tridom Landscape's EFEs in the Congo Basin

The Tridom is a cross-border conservation landscape covering a geographical area of 191,541 km^2, representing 7.5% of the total area of tropical forests in the Congo Basin of Central Africa. The

[3] This emerging policy aims to Reduce Emissions from Deforestation and Forest Degradation (REDD+). It aims to create financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. REDD+ goes beyond deforestation and forest degradation and includes the role of conservation, the sustainable management of forests and improvement of forest carbon stocks.