



Cultural viability of reintroducing the ecologically extinct Alagoas Curassow (*Pauxi mitu* Linnaeus, 1766) to Northeast Brazil



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ARTICLE INFO

Article history:

Received 6 February 2015

Received in revised form 12 October 2015

Accepted 23 October 2015

Keywords:

Community attitudes

Reintroduction

Human dimensions

Local knowledge

Multimodel inference

ABSTRACT

The Alagoas Curassow (*Pauxi mitu*) became extinct in the wild in the 1980's through a combination of loss/degradation of its Atlantic Forest habitat and over-hunting. Ambitious plans are now underway to reintroduce captive-reared Curassows using a patchwork of protected forest fragments on private lands. Although the planned reintroduction sites are broadly ecologically suitable, it is not clear that the threats from hunting and habitat disturbance have been removed. In other words, the cultural (as opposed to biological) suitability and viability of these sites is unknown. We used a semi-structured social survey of 402 residents who live near three proposed reintroduction sites to evaluate the cultural suitability of the reintroduction. Specifically, we adopted a multimodel inference approach to identify socio-demographic characteristics (e.g., age, gender, education level, duration of residence), knowledge (e.g., of local biodiversity and hunting practices) and behaviors (e.g., bushmeat consumption and firewood collection) that influence support for the reintroduction. Respondents were generally positive to bringing the Curassow back, though our data indicates that hunting is still a major part of the local culture. Support for the reintroduction was most strongly associated with older and, especially, better educated residents. Residents from different reintroduction sites also differed in their professed levels of support. Our results highlight the importance of focused environmental educational programmes to improve the cultural feasibility of this flagship reintroduction for Northeast Brazil.

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1. Introduction

Increasing the effectiveness of conservation interventions in human-modified landscapes is a major challenge for researchers and practitioners. Modern conservation is increasingly recognizing the key influence of humans in shaping ecosystems dynamics through resource use and other interactions (Berkes, 2004). Indeed, human behavior is the main driver for changes in the global environment (Chapin et al., 2000) and, ultimately, conservation goals can only be achieved by modifying how and where humans interact with nature (Schultz, 2011). Thus, identifying and accounting for patterns of human–environment interactions is typically one of the main determinants of the success (or failure) of biodiversity conservation initiatives (Mascia et al., 2003).

Human interactions with the natural environment (e.g., hunting, polluting, etc.) are generally associated with concordant attitudes

and values (Ajzen, 1991; Gifford and Sussman, 2012). Conversely, attitudes can be used to broadly identify and predict behaviors under different scenarios. Such predictions can be further improved though the addition of information on the subject's knowledge and past behavior. A deep understanding of the factors that influence human attitudes and behavior towards the local environment may therefore provide valuable insights for designing effective conservation interventions, especially when they are combined with biological and ecological data, such as species distribution models (Weston, Miller, Lawson, & Ehmke, 2012). Nevertheless, despite the potentially pivotal role of human–environment interactions, the success of many conservation initiatives has often been compromised by insufficient attention to the social dimension (Reading, Clark, & Kellert, 1991).

Reintroduction is a good example of a conservation intervention in which the behavior of the local human population is critical for the long term success of the intervention. This wildlife management tool aims to establish a self-sustaining population in the species former range and, from a biological perspective, is dependent on the existence of suitable habitats and a captive bred or wild

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stock (IUCN, 1998). However, very few reintroductions have so far resulted in self-sustaining populations (Griffith, Scott, Carpenter, & Reed, 1989; IUCN/SSC, 2013; White et al., 2012). Some of these failures are due to the selection of poor habitat conditions (Osborne and Seddon, 2012), but more often reflect the inability of conservationists to remediate the original (often human-associated) reasons for the original extinction. It is possible that the traditional focus of conservation practitioners on biological and ecological issues has led to a corresponding lack of attention to other equally important elements (Reading et al., 1991). One way to address this issue is to perform multidisciplinary (biocultural) assessments of the feasibility of reintroductions, taking into account both biological and social aspects. Indeed, by recognizing that extinction often has socio-economic and political causes (Ladle and Jepson, 2008; Mehta and Kellert, 1998), the feasibility of reintroductions should also consider the current and future propensity of local populations towards habitat degradation and hunting. Thus, biocultural approaches are essential to assess reintroduction feasibility and minimize the risk of failure in these expensive, high profile and inherently uncertain interventions (White et al., 2012).

Here, we use a social survey approach to assess the cultural feasibility of the reintroduction of the ecologically extinct Alagoas Curassow *Pauxi mitu* (Linnaeus, 1766) into three sites located in its original range. Specifically, we assessed local people's knowledge, attitudes and behavior in relation to: the Curassow reintroduction, natural resource exploitation (including hunting) and biodiversity conservation in general. Our main objective was to identify, through a multimodel inference approach, the socio-demographic characteristics (e.g., age, gender, education level, duration of residence), knowledge (e.g., of local biodiversity and hunting practices) and behaviors (e.g. bushmeat consumption and firewood collection) that are most strongly associated with support for the reintroduction. A supplementary objective was to identify any differences in the characteristics of respondents between the three sites with the aim of identifying the most culturally appropriate site for the reintroduction.

2. Methods

2.1. Study organism

The Alagoas Curassow is endemic to the Pernambuco Centre of Endemism (PCE) (Silveira, Olmos, & Long, 2004), a biogeographical sub-region of the Atlantic Forest of the north-east of Brazil (Brown, 1982; Prance, 1982). The species is categorized as Extinct in the Wild by the IUCN Red List (BirdLife International, 2013): the main causes for extinction being the loss/degradation of habitat and hunting (Collar et al., 1992). The Curassow was never widespread, being only recorded at five localities within its presumed historical distribution (Silveira et al., 2004). In 1979 a captive breeder collected five birds in Alagoas, of which only three reproduced. The remaining birds were hybridised with the Amazonian Razor-billed Curassow *Pauxi tuberosa* (Spix, 1825) in order to increase the genetic variability of the captive population (Grau, Pereira, Silveira, & Wajntal, 2003; Nardelli, 1993). Continuous increases in the captive population since the 1980s have prompted conservationists to consider the reintroduction of the Curassow into its historical range (Grau et al., 2003). The most recent published estimate for the breeding population is 145 individuals (De Avelar Azeredo and Simpson, 2014).

The species' original habitat is now a highly fragmented landscape (Ribeiro, Metzger, Martensen, Ponzoni, & Hirota, 2009): the PCE has suffered an intense habitat degradation for sugarcane plantations (Tabarelli, Aguiar, Ribeiro, Metzger, & Peres, 2010) and less than 5% of its original habitat still remains (Ribeiro et al., 2009).

Moreover, the potential release sites are within a heavily hunted landscape with people from various social levels engaging in this illegal activity (Silveira et al., 2004)—although hunting of wildlife in Brazil is technically illegal, this activity is very widespread and culturally accepted in many areas, especially northeast Brazil (Flesher and Laufer, 2013; Silveira et al., 2004).

In 2007, Brazil's Government developed an Action Plan for the reintroduction of captive-bred Curassows into suitable habitat within their former historical range. Management strategies are currently being developed with the captive population (De Avelar Azeredo and Simpson, 2014; Sant'Ana Sousa et al., 2012). Simultaneously, Private Protected Areas (PPAs) under the designation of Private Natural Heritage Reserves (Portuguese acronym RPPN [*Reserva Particular do Patrimônio Natural*]) have been identified as ecologically suitable for the reintroduction (Silveira et al., 2004).

2.2. Study area

Our study area consists of a 5 km area surrounding the three potential release sites for the proposed reintroduction of the Alagoas Curassow, Mata do Matão (hereafter identified as MM) (lat: 9°46'12.00"S; long: 36°14'23.00"W, 160 m—662 ha), located in the municipality of Campo Alegre; Mata do Pinto (hereafter MP) (lat: 8°58'41.06"S; long: 36°6'17.70"W, 500 m—two fragments of 218 ha and 309 ha each, separated by a local road), located in São José da Lage, and Mata do Cedro (hereafter MC) (lat: 9°31'56.3"S; long: 35°54'51.5"W, 116 m—1286 ha) located in Rio Largo (Fig. 1). The size of the remnants were based on Atlantic Forest vegetation map produced by SOSMataAtlântica/INPE (2013). These areas are located in the Atlantic Forest of the State of Alagoas, in the north-east of Brazil, also inside the PCE, and were selected based on the demands of working group of the Alagoas Curassow Species Action Plan (BirdLife International, 2013; Roda and Santos, 2005; Silveira et al., 2004). The fragments fulfill the minimum criteria defined by the group: they are at least 500 ha and should be legally protected. Mata do Matão and Mata do Cedro are already designated as RPPNs, and Mata do Pinto is in the process of becoming an RPPN—all three sites are within the boundaries of large sugar cane plantations. However, while Mata do Matão and Mata do Cedro are within the species known historical range, Mata do Pinto is in a region with higher altitude than the species' confirmed range. Nevertheless, due to the quality and size of the remnant, and the high levels of deforestation and habitat fragmentation in other areas (Ribeiro et al., 2009; Tabarelli, Pinto, Silva, Hirota, & Bedê, 2005), this site was also considered as a potential area (Silveira et al., 2004).

Alagoas State has the second lowest human development index of Brazil and the economy is supported by agricultural activities, mostly sugarcane plantations, and cattle grazing.

2.3. Data collection

A semi-structured survey was administered to 402 households (respondents aged 18 or older) of rural communities, within 5 km of each potential release site from May 2014 to September 2014 (Fig. 1). We used a proportional random sampling design to ensure a robust and representative sample and to estimate the required number of interviews (Ferreira and Freire, 2009; Newmark, Leonard, Sariko, & Gamassa, 1993). Most of the communities within the study area were visited, and only one adult per household was interviewed. Considering the total number of municipal rural inhabitants, a sample size of 402 respondents would give a 95% confidence interval of below 5% ($\pm 4.8\%$).

The questionnaire was composed by 14 closed-choice questions (Table 1), seven attitude statements, and eight general socio-economic attributes. It was organized in four sections as follows: (i) biodiversity and conservation; (ii) natural resource exploitation

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