Biological Conservation 143 (2010) 992–998

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Avian conservation priorities in a top-ranked biodiversity hotspot

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ARTICLE INFO

Article history:
Received 29 September 2009
Received in revised form 29 December 2009
Accepted 11 January 2010
Available online 6 February 2010

Keywords:
Atlantic Forest
Birds
Biodiversity hotspot
Endangered species
Rio de Janeiro
Priority setting

ABSTRACT

Rio de Janeiro state in Brazil has one of the most diverse and most endangered avifaunas in the continental Americas. Many of these endangered birds are endemic to the Atlantic Forest biodiversity hotspot, and some even endemic to Rio de Janeiro itself. As with all other forested hotspots, little original forest remains. Much of that is outside formal protected areas and faces the risk of deforestation. These factors create special circumstances for setting conservation priorities — ones common to hotspots in general — but typically not to many conservation priority setting exercises.

We mapped the distribution of the remaining habitat for the 189 birds in Rio de Janeiro state that are officially endangered and/or endemic to the Atlantic Forest. Using those habitat maps, we calculated the amount of habitat currently within protected areas for each species. We then prioritized all non-protected parts of the state for their avian conservation value and their potential contribution to a comprehensive protected area system. This analysis identified 10% of the remaining unprotected part of the state as the highest priority for avian conservation. We further highlight specific locations where conservation actions could create a more comprehensive protected area system for the avifauna of Rio de Janeiro state.

1. Introduction

The state of Rio de Janeiro, Brazil, is at the geographic center of one of the world's most threatened biodiversity hotspots, the Atlantic Forest (Myers et al., 2000). The avian diversity of Rio de Janeiro is exceptional, with more than 730 species in the state (Gagliardi, 2009) in an area of only 43,700 km^2, corresponding to ~40% of the 1825 species in Brazil (CBRO, 2009). That diversity is highly threatened, with the state having the highest concentration of endangered bird species in all of the continental Americas (Manne et al., 1999; Harris et al., 2005; Jenkins and Pimm, 2006).

The state and federal governments have made significant conservation efforts, with approximately 14.4% of the state under formal protection (Figs. 1 and 2). About 5.9% of the state has Integral protection, a formal designation that bans the use or harvest of natural resources for commercial purposes. The remaining protected areas allow sustainable use in various forms. As with many protected areas in the world though, those in Rio de Janeiro state are not necessarily in the most effective places for conserving biodiversity. Many are in mountains, where steep slopes often protect the land as much as the legal protections (Fig. 2). Others protect important places for biodiversity, but are isolated from other forest. Perhaps they will protect their species long enough so that the isolated forest fragments can be reconnected in the future. To avoid extinctions though, every species must have sufficient habitat for its long-term survival. Protecting a large area will not be enough if that area does not include habitat for each species.

For few species in the world do we actually know how much of their habitat remains or how much of it has protection. Without that information though, we will not know if existing protected areas are adequate to prevent their extinction. Here, we produce such information for the birds of Rio de Janeiro, demonstrating a clear and simple process to define conservation priorities in a data-limited environment. Using these data, we assessed how well the existing protected area system includes habitat for the state's highly endangered avifauna. We then prioritized the remaining unprotected area of the state by its potential value for bird conservation, identifying particular places that would best complement the existing protected areas.

The state government plans to double the area of Integral conservation units by 2010. This includes expansion of already protected areas (Reserva Biológica de Araras, Parque Estadual Serra da Concórdia, Parque Estadual do Desengano, Parque Estadual da Ilha Grande and Reserva Ecológica de Juatinga) and creation of new ones (Parque Estadual da Costa do Sol and Parque Estadual Restinga de Grussaí) (Eduardo Lardosa, personal communication).

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doi:10.1016/j.biocon.2010.01.014

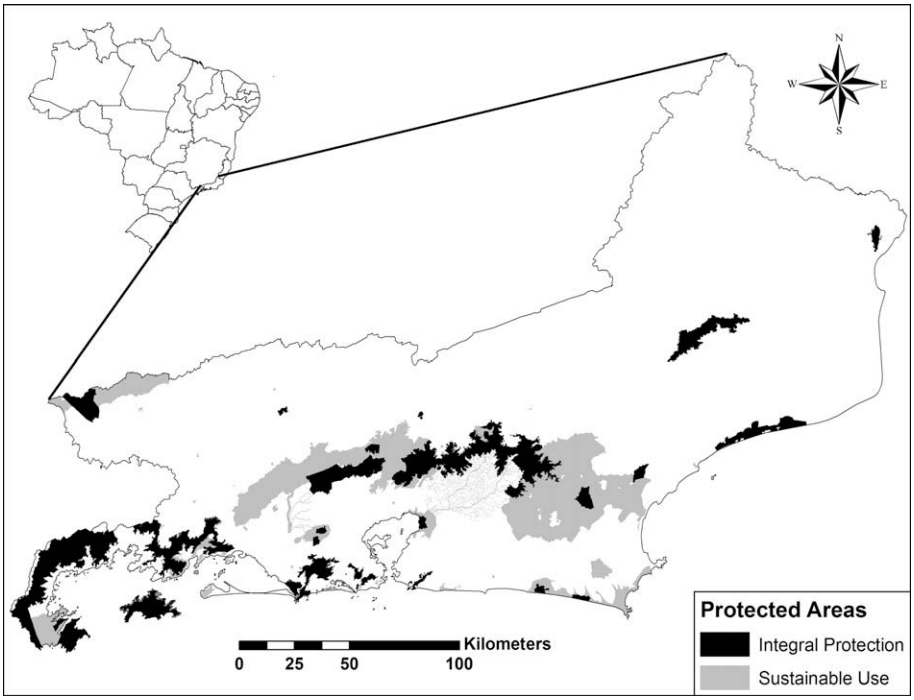

Fig. 1. Study area of Rio de Janeiro state with public protected areas.

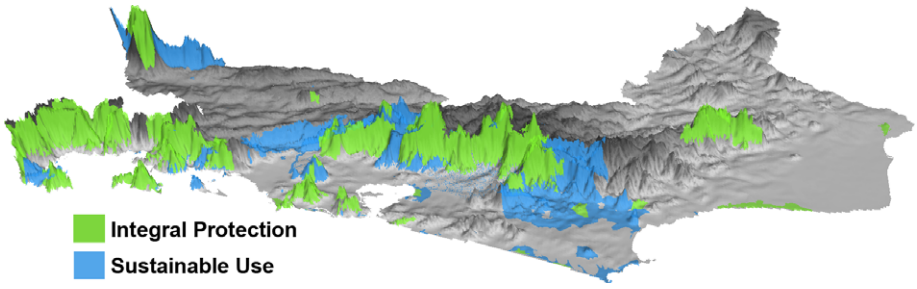

Fig. 2. Topography of Rio de Janeiro with overlay of public protected areas.

Our analysis provides quantitative data for use in such conservation planning, and provides a guide for a more comprehensive protected area system for the avian diversity of Rio de Janeiro. This approach should also be replicable for other taxa in the state, and in other data-limited regions planning to expand their protected area system.

2. Methods

For the analyses, we included all terrestrial bird species occurring in Rio de Janeiro state that are listed as threatened (vulnerable, in peril/endangered, critically in peril/critically endangered) on global (IUCN, 2007), national (Machado et al., 2005), or state (Alves et al., 2000) red lists, or that are Atlantic Forest endemics according to Bencke et al. (2006). We excluded species thought to be extinct in the state (Alves et al., 2000). The final list included 189 species, 67 of which were vulnerable or higher on one or more red lists (Appendix A).

For each species, we modeled their potential distribution using elevation and land cover to identify remaining suitable habitat within the species' range. Original geographic ranges were from NatureServe (Ridgely et al., 2005) and were converted to an ArcGIS raster geodatabase at a 5 km resolution using ArcGIS 9.3 (ESRI, Redlands, California). These maps were then buffered by 15 km to insure that all coastal areas were included as the range maps did not always extend to the shoreline when it was obvious that they should.

Habitat variables included the suitable land cover types and elevation range for a species, found in Parker et al. (1996). For species listed only as "lowland" in Parker et al. (1996), we used an elevation range of 0–300 m, which is the lowest numerical elevation listed in the database. Parker et al. (1996) does not always reflect the latest taxonomy and ecological research for every species, although it is the most recent treatment that includes consistent categories of habitat preference for all of the state's species. To supplement Parker et al. (1996), we updated species entries using the Handbook of the Birds of the World series (del Hoyo et al., 1992) and the BirdLife Data Zone (http://www.birdlife.org/datazone/index.html). When more localized information was available for a species (e.g., specific to Rio de Janeiro or adjacent states), we modified the species requirements accordingly. Elevation data were from the Shuttle Radar Topography Mission (Rabus et al., 2003).

Land cover data were from the Fundação CIDE IQM-Verde II database (Fundação CIDE, 2003). The state government of Rio de Janeiro produced these data by interpreting Landsat 7 satellite imag-