
An avifaunal survey of the vanishing interior Atlantic forest of San Rafael National Park, Departments Itapúa/Caazapá, Paraguay

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El Bosque Atlántico del sudeste de Brasil, este de Paraguay y noreste de Argentina, se ha considerado como una de las regiones más amenazadas del Neotrópico, con un elevado número de aves endémicas y con problemas de conservación a nivel global. En Paraguay resta menos del 13% de la superficie boscosa original de este tipo de ambiente; la última oportunidad para proteger una masa forestal de tamaño considerable, depende de los pasos que se den en el futuro inmediato para consolidar de forma efectiva el polémico Parque Nacional San Rafael (65,000 ha), un parque “sobre el papel” cuya tenencia de tierra permanece en manos privadas. Esta situación ha provocado una alarmante deforestación, con una pérdida de aproximadamente un 17% de las 78,000 ha que inicialmente se habían decretado como área de reserva para parque en 1992.

Se presentan los resultados de un estudio ornitológico llevado a cabo durante la primera quincena de Noviembre de 1996 en el extremo noreste del parque (2,000 ha de bosque en muy buen estado de conservación). Nuestros resultados, en combinación con el trabajo anterior de Lowen *et al.*¹⁹, proporcionan evidencia de que San Rafael debiera considerarse como la principal prioridad de conservación nacional por ser el lugar más importante desde el punto de vista de la conservación de las aves del Bosque Atlántico y no gozar de la protección necesaria. Hasta la fecha, se conocen en San Rafael 272 especies de aves de las cuales 16 tienen problemas de conservación a nivel global (14 de las mismas son endémicas del Bosque Atlántico). Se estima que en San Rafael se dan cita la mayoría de los 76 endemismos del Bosque Atlántico registrados hasta la fecha en Paraguay.

La consolidación definitiva del Parque Nacional San Rafael requiere de urgentes medidas de conservación por parte de los organismos gubernamentales y ONGs conservacionistas. El reto más importante en la actualidad, radica en diseñar una estrategia de conservación para que San Rafael se pueda considerar un área protegida con una categoría de manejo que satisfaga la situación particular del parque. Se ha propuesto la compra de tierras (por parte del gobierno, o en su defecto, por la Fundación Cordillera de San Rafael) de una zona núcleo de unas 15,000–20,000 ha. Rodeando a esta se podría lograr un área de usos manejados, donde los propietarios (incluyendo asentamientos indígenas) puedan entrar en un régimen especial de uso sustentable que garantice el bienestar de los recursos naturales del parque a largo plazo. Se deben tomar medidas urgentes para detener la deforestación y extracción ilegal de madera. Finalmente, la protección del parque requerirá de una infraestructura mínima y de programas de apoyo a las comunidades vecinas (indígenas, campesinos y propietarios afectados).

Introduction

The Atlantic forest of south-east Brazil, east Paraguay, and north-east Argentina has been identified as one of the most endangered habitats in the Neotropics^{6,27}, and is one of the most threatened habitats of the world¹⁴. Almost a decade ago Wilson²⁸ estimated that 94% of this forest had been destroyed and that 5% what remained was already degraded. Given the amount of deforestation in the region since those grim estimates, the forest area remaining now will be even lower.

The subtropical forests of east Paraguay are the westward extension of the coastal Atlantic forest of south-east Brazil and are generally referred to as the Brazilian Interior Atlantic forest⁵, Southern Atlantic forest²⁷, Paraná forest¹⁶ or Interior Atlantic forest^{11,22}. These forests form part of one of the richest regions of avian endemism in the Neotropics^{14,27}: 76 of the 199 species considered endemic to the Atlantic forest region²⁷ have been recorded in Paraguay^{2,3,12,18,19}. A total of 13 threatened and 20 near-threatened forest-dependent species, of which 10 and 16 respectively are endemic to the Atlantic forest, have been recorded in the country^{5,19}. Stotz *et al.*²⁷ subdivided the Atlantic forest into four subregions, of which the “Southern Atlantic forest” contains more endemic bird species (101) than any other region (divided or otherwise) in the Neotropics. Forty six of these 101 endemics have been documented in Paraguay^{2,12,18,19}, of which seven are classified as threatened and nine as near-threatened⁵.

Only 13% of the Paraguayan Atlantic forest remained in 1994, most of the deforestation having occurred within the last two decades^{1,7}. On paper, the largest block of Atlantic forest remaining in

Paraguay is San Rafael National Park in the Cordillera de San Rafael on the border of Departments (Depts.) Itapúa and Caazapá, south-east Paraguay. In 1992, 78,000 ha were reserved for the national park^{8,9}, but most of the park has been heavily impacted during the ensuing four years, with some sections converted to agriculture¹⁹ (judged from March–April 1994 aerial photographs, pers. obs.). Delimitation of San Rafael was completed in March 1997 with an estimated 65,000 ha as the final size of the park. All of the land, however, remains in private ownership^{8,19}. In this paper we present results of an avifaunal survey in the last remaining block of pristine forest in San Rafael and discuss the conservation efforts required to ensure that this immensely valuable site is not further degraded or destroyed.

Study area and methods

San Rafael National Park lies in the Cordillera de San Rafael in the upper Río Tebicuary drainage, immediately south of the Cordillera de Caaguazú. The majority of the park lies within the Río Paraguay watershed, although the east side of the park either has or adjoins streams that flow into the Río Paraná watershed. The relief of the park is most pronounced in the east, where there are a series of steep-sided valleys, with maximum elevations of 400–500 m. These valleys are predominantly aligned east–west, and other small rivers follow this same orientation through relatively hilly and undulating lowlands (mostly 150–300 m) until they reach the Río Tebicuary. Soils vary from relatively sandy in the west to more fertile clays in the east. Bedrock of volcanic origin is exposed in areas of more pronounced relief. San Rafael lies between the Alto Paraná and Selva Central ecoregions as defined by CDC⁴ and on the border between the Alto Paraná and Central Paraguay geographic regions of Hayes¹².

Our study site comprised 2,000 ha of forest centered on 26°20'S 55°32'W within the “Parabel” part of Estancia Parex (see map), an area of steep-sided forested valleys. Base camp was at the estancia's headquarters on the forest edge at 26°21'S 55°31'W. The flora of this same block was studied by Keel *et al.*¹⁵. They found the five most common species at Parabel (in a 0.1 ha plot) to be: *Actinostemon concolor*, *Holocalyx balansae*, *Sorocea bonplandii*, *Patagonula americana* and *Pilocarpus pennatifolius*. Myrtaceae are noticeably scarce at Parabel compared to the Mbaracayú Natural Forest Reserve, Dept. Canindeyú^{15, pers.obs.}, the only extensive tract of effectively protected Interior Atlantic forest in Paraguay. Forest height on more level areas at Parabel is typically medium to tall, with a notably high density of *Jacaranda* sp. and *Ficus* sp. compared to other sites in Paraguay. Both favour red clay soils¹⁷ and are very rare (especially the former) at Mbaracayú^{pers. obs.}. Other large trees in the study area included: *Enterolobium* sp., *Peltophorum dubium*, *Parapiptadenia* sp., *Balfourodendron riedelianum*, *Tabebuia* sp. and *Cedrela* sp. Common trees in the midstorey included *Syagrus romanzoffiana*, *Myrcarpus frondosus* and *Lonchocarpus* sp. The understorey varied from open to patches of thick bamboo (*Chusquea* sp.). Small shrubs, such as *Sorocea bonplandii*, were common and fruiting during our survey. A more complete vegetation description of Parabel can be found in Keel *et al.*¹⁵.

Fieldwork was conducted from 3–16 November 1996 (with one additional half-day on 8 December 1996 by AMN and RPC). A total of c.250 diurnal field hours and c.9,500 diurnal metre net hours were accrued. Tape recordings were made of 92 species: these will be deposited with the Library of Natural Sounds, Cornell, USA. Seasonality and annual rainfall in San Rafael are similar to Caaguazú National Park, Dept. Caazapá¹³. October 1996 was unusually wet in eastern Paraguay²³, but the weather during November 1996 was more typical.

Results

A total of 211 bird species were recorded at Parabel, including two threatened and eight near-threatened species (see Appendix 1). Our results, combined with findings by Lowen *et al.*¹⁹, document a total of 272 species for the park as a whole. These include four threatened and a minimum of 12 near-threatened species: all of the former and 10 of the latter are endemic to the Atlantic forest region (Appendix 1). One threatened species – Russet-winged Spadebill *Platyrrinchus leucoryphus* – and two near-threatened species – Solitary Tinamou *Tinamus solitarius* and Saffron Toucanet *Bailloni bailloni* – had not been recorded in the park prior to our fieldwork at Parabel, although all had been predicted to occur¹⁹. Blue-winged Macaw *Ara maracana* is also probably present: two groups of four birds were recorded flying along the ‘biological corridor’ formed by the Arroyo Tayay, between Caaguazú and San Rafael National Parks, in December 1996 (E.Z. Esquivel verbally 1997; see map).

A sizeable population of *Platyrrinchus leucoryphus* was an important discovery. At least seven birds were recorded along c.1.5 km of forest trail, with an eighth c.1.5 km distant. A minimum of three individuals were caught (one male and two females) with both females showing signs of brood patches. A nest was also found under construction, with two eggs laid by the end of our fieldwork. In contrast to fieldwork at Caaguazú National Park in 1995²³, *P. leucoryphus* was heard singing on very few

occasions. It seems likely that the Parabel population is considerably higher than we recorded. This difference in vocal activity between November 1995 and 1996 may be related to the different weather conditions during the two periods (see Study area and methods).

Of the 76 Atlantic forest endemics known from Paraguay, 62 (82%) have been recorded at San Rafael (Appendix 1), and we predict that additional fieldwork will reveal virtually all 76 endemics to be present. Parker *et al.*²⁵ provide a list of “indicator species” for each region, and habitat within that region, in the Neotropics. The presence of a near-complete suite of the expected indicator species at a site signifies that the site is a high quality example of a particular habitat type. Of the 78 indicator species documented for Atlantic forest in Paraguay, 57 (79%) have already been recorded at San Rafael, indicating its high quality forest (particularly at Parabel). This figure will also undoubtedly increase with additional fieldwork.

The 1995 fieldwork at San Rafael produced records of several species known from Paraguay on very few occasions, such as Rusty-barred Owl *Strix hylophila*, Black-billed Scythebill *Campylo-rhampus falcularius*, Bertoni’s Antbird *Drymophila rubricollis*, Large-tailed Antshrike *Mackenziana leachii*, Speckle-breasted Antpitta *Hylopezus nattereri*, Green-chinned Euphonia *Euphonia chalybea* and Diademed Tanager *Stephanophorus diadematus*^{19,21}. We recorded two of these species at Parabel. *Mackenziana leachii* was found regularly in forest-edge scrub – these and records in 1995 are the first in Paraguay since 1936¹⁸. In contrast to 1995 fieldwork, there was only one record of *Hylopezus nattereri*, in a bamboo (*Chusquea* sp.) stand along a river at a lower elevation than most of the study site. The 1995 and 1996 records of this species are the first in Paraguay since c.1903¹⁸. In addition, a tape-recorded *Pulsatrix* sp. is likely, based on range, to be Tawny-browed Owl *P. koeniswaldiana*, a species known from Paraguay from just a lost old specimen and a handful of records from two sites^{3,12,19}.

Several species recorded from San Rafael have very limited distributions in Paraguay, being known only from the extreme south-east/east, and not found, for example, at Mbaracayú²². Such species include Lesser Woodcreeper *Lepidocolaptes squamatus*, Black-billed Scythebill, Olive Spinetail *Cranioleuca obsoleta*, White-browed Foliage-gleaner *Anabacerthia amaurotis*, Large-tailed Antshrike, Bertoni’s Antbird and Diademed Tanager (of which all but the latter are endemic to the Atlantic forest). In addition, other Atlantic forest endemics e.g. *Platyrinchus leucoryphus* and Chestnut-headed Tanager *Pyrhocomma ruficeps* are more numerous at San Rafael than at forested sites further north and west (such as at Mbaracayú; AMN).

Of the 63 species collected (two additional species were preserved as fluid specimens; no gonads examined) 31 had enlarged gonads indicating reproduction (Appendix 1). Based on vocal activity, breeding was suspected in a number of other species. Although no specimens were collected, there was a general lack of breeding evident during the July 1995 survey (RPC), as might be expected in the austral winter.

There appeared to be little hunting pressure at Parabel, as substantial populations of frequently hunted species such as *Tinamus solitarius* and Rusty-margined Guan *Penelope superciliaris* were encountered. The remains of two eggs of *T. solitarius* were found in different areas, birds were calling frequently, and on two occasions presumed parent–chick contact calls were tape-recorded. The best indicator of how little hunting occurs at Parabel was the presence of a relatively large (up to three troops/day) and approachable population of Brown Capuchin monkeys *Cebus apella*. Another indication of the high capuchin density at this site is our record of a large eagle (plus one recorded in 1995, but omitted by Lowen *et al.*²⁶), which refers to either Harpy Eagle *Harpia harpyja* or Crested Eagle *Morphnus guianensis*. Given the low historical diversity of arboreal mammals in Paraguay’s Atlantic forest (lacking, e.g. squirrels *Sciurus* sp., sloths *Bradypus* sp. and Kinkajou *Potus flavus*^{10,26} on which, for example, *Harpia* depends elsewhere in its range) this eagle must rely heavily on monkeys as its primary food source.

Discussion

Our results and those of Lowen *et al.*¹⁹ document that San Rafael National Park is the most important site in Paraguay for the conservation of Atlantic forest avifauna. San Rafael has the most complete suite of Atlantic forest indicator species (as identified by Stotz *et al.*²⁷) of any site in the country. Only one other locality, the smaller and more comprehensively surveyed Caaguazú National Park^{19,23} holds more Atlantic forest endemic birds (63 compared to 62 species). In terms of taxa of global conservation concern, only three sites in Paraguay are known to have more threatened and near-threatened species¹⁹. All three sites (Itabó Private Nature Reserve, Dept. Canindeyú, Mbaracayú and Caaguazú National Park) have been much more thoroughly surveyed than San Rafael^{19,20,22,23}.

Adding our findings to the evaluation by Lowen *et al.*¹⁹ of sites based not only on the presence/absence of species but additionally using indices of global status and abundance (see¹⁹), we

reveal San Rafael National Park to be Paraguay's second most important site for the conservation of the Atlantic forest avifauna. Only Itabó Private Nature Reserve appears to be more important, but that site's 3,000 ha of protected forest must contain much smaller and (less viable) populations of endemic and threatened species than the c. 65,000 ha of forest at San Rafael. The size and configuration of San Rafael's remaining forest block means that the park is likely to harbour Paraguay's largest absolute populations of a number of Atlantic forest species. The preservation of San Rafael National Park should be the highest conservation priority in Paraguay, and because of the overall global threat to this habitat, its preservation should become an international priority.

Current conservation initiatives and threats to San Rafael National Park

The future of San Rafael is a subject of great controversy in Paraguay. From November 1996 to March 1997, the national press published several articles on the fate of the park, discussing issues such as illegal logging within its boundaries and incursions into the indigenous Mbyá lands by Paraguayan and immigrant Brazilian campesinos (farmers). The park delimitation – now complete – shows that deforestation has reduced the park's protected surface area from 78,000 ha (its estimated area in 1992⁸, hence the map in OTRO²⁴) to c.65,000 ha (see map). The revised boundaries (c.70% of the new perimeter was delineated by early December 1996) will require the final approval of the government.

The consolidation and effective protection of San Rafael National Park largely depends on the success of a five-year project financed by the World Bank and managed by the "Dirección Nacional de Coordinación y Administración de Proyectos" (DINCAP) within the "Ministerio de Agricultura y Ganadería" (MAG). This project is attempting to improve social and environmental conditions in Dept. Alto Paraná and northern Dept. Itapúa, with that part relating to the park managed by the "Centro Regional Ambiental del Este" (CRAE).

However, the World Bank credit does not allow for direct land acquisition. This fundamental obstacle was the central theme of a two-day workshop organised by DINCAP/CRAE in December 1996 with representatives from regional governments, landowners and two conservation NGOs, Fundación Cordillera San Rafael and Fundación Moisés Bertoni (FMB).

Aerial photos taken during March and April 1994 demonstrate that most of the forest within the San Rafael block had already been selectively logged (see map). At the southern end, where Lowen *et al.*¹⁹ worked in July 1995, the forest had been selectively logged for some time, with additional recent removal within a few weeks of their fieldwork. Even within the relatively intact block of forest at Parabel, some illicit logging had occurred. For example, c.20 *Tabebuia* sp. trees of high commercial value were cut before the owners discovered what was happening and stopped removal of the timber. That pristine forest remains in Parabel is testimony to the landowners' willingness to protect the forest. During our fieldwork, chainsaws were heard daily from adjacent areas theoretically protected within the national park. Even the steep undulating topography provides little protection for the remaining forest, with tracks opened up and trees removed using tractors.

The single largest threat to the park is the conversion by landowners of forest to agricultural uses in an attempt to avoid expropriation of their land to form the national park. The clearing of land by owners is also a common practice to preclude campesinos from settling on their property. This practice is now occurring at an increasingly rapid rate within the supposed park boundaries (various landowners and local people verbally 1996). An added incentive to cut the forest is that the park boundaries are only delimited on forested land: by clear-cutting, landowners can claim ignorance of the boundaries. For instance, at Estancia Toro Blanco (a large square-shaped clearing to the north; see map), heavy machinery has already been hired for 4,000 hours of land clearance. Further intentions to deforest within the park boundaries were obvious from the 1994 photographs, with a minimum of three 4-km long rectangular openings cut.

The forest is still used by local people (Guaraní Indians and Paraguayan campesinos), and there are two areas legally set aside for indigenous communities within the park. We found several small paths used by indigenous Guaraní for subsistence hunting and gathering, but such relatively small scale hunting is unlikely to be a serious threat to the integrity of the area. Because the remaining forest is surrounded by agricultural land there is a large impact on water quality in the drainage basin. Many of the streams in the upper reaches of the watersheds are in farmland, and heavy rains cause severe erosion (pers. obs.). The abundant use of fertilisers and pesticides on the surrounding cropland undoubtedly has an insidious effect on the forest ecosystem.

Recommendations

- It will take the coordination of all governmental authorities involved and close cooperation with conservation NGOs to ensure that San Rafael National Park does not suffer further deterioration.

In line with the results of the above mentioned workshop, we highly recommend adoption of the following measures to guarantee the integrity of the remaining habitat:

- The immediate acquisition of a core area of 15,000–20,000 ha, ideally by the Paraguayan government (funds for a small land purchase are apparently now available: W. Sosa verbally 1997). If immediate governmental action is not feasible, then a private initiative (e.g. by the Fundación Cordillera San Rafael with international support) should take the lead.
- A surrounding protected area of 45,000–50,000 ha should be added around the core purchased area (but within the existing park boundaries), with landowners entering a private nature reserve scheme, whereby they are allowed to make sustainable use of certain areas of their forested land.
- Delimitation of the park is now complete and the current wooden marker posts should be replaced with more permanent markers such as concrete posts. The catastro, a map delimiting boundaries of private properties, should be procured as a prerequisite to identifying important landowners.
- Indigenous lands within the park should be clearly demarcated to deter further land invasions by Paraguayan campesinos. These lands are of vital importance in maintaining the biological integrity of the park, especially since the indigenous area in the north forms a forest corridor between the core area and the pristine forest at Parabel (see map).
- Use of the land by the indigenous people should be included within the park management plan, being defined and discussed in close cooperation with them.
- A corps of park guards consisting of local people knowledgeable about the forest should be employed as soon as possible to ensure the effective protection of the newly demarcated area.
- An environmental education programme should be initiated in the settlements neighbouring the park such as Arroyo Claro.
- The regional governments (Depts. Itapúa and Caazapá) should be actively involved in reinforcement of the laws pertaining to the park.
- The Fundación Cordillera San Rafael should seek help with institutional development and fund-raising such that it can play an active role in the protection of San Rafael.
- Categorisation of San Rafael needs to be carefully considered; current plans for sustainable use of resources outside of a central core area do not meet the criteria for national park status (see⁹).

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