

# Occurrence of Hyacinth Macaw nesting sites in *Sterculia apetala* in the Pantanal Wetland, Brazil

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## Abstract

Manduvi tree, *Sterculia apetala*, provides critical habitat, hosting 94% of the threatened hyacinth macaw (*Anodorhynchus hyacinthinus*) nesting sites. We examined the probability of occurrence of nesting sites in *Sterculia* trees and the population structure of this tree species at three sites in the Pantanal due to the increasing conversion of forest to pasture where *S. apetala* occurs, its populations may be under threat as well as the availability of nesting sites to the hyacinth macaw. A logistic model of the relationship between presence of macaw nests and tree diameter at breast height (DBH) showed that nests did not occur in trees smaller than 50 cm DBH and that most nests occurred in trees with DBH greater than 100 cm. The population structure indicates low recruitment in classes of DBH larger than 5 cm and a strong reduction in the occurrence of individuals greater than 50 cm DBH. Conservation priorities for the *S. apetala* and hyacinth macaw are presented.

**Key words:** bird conservation, *Anodorhynchus hyacinthinus*, population structure, deforestation

## Resumo

OCORRÊNCIA DE SÍTOS DE NIDIFICAÇÃO PARA A ARARA-AZUL EM *STERCULIA APETALA* NO PANTANAL, BRASIL. O manduvi, *Sterculia apetala*, oferece um habitat crítico, abrigando 94% dos ninhos da ameaçada arara-azul, (*Anodorhynchus hyacinthinus*). Nós avaliamos a probabilidade de ocorrência de sítos de nidificação em árvores de *Sterculia* e a estrutura populacional desta árvore em três sub-regiões no Pantanal devido à intensa conversão de manchas florestas para pastagens onde *S. apetala* ocorre, estas populações podem estar sob ameaça bem como a disponibilidade de sítos de nidificação para a arara-azul. Um modelo logístico para a relação entre a presença de ninho de arara e o diâmetro da árvore na altura do peito (DAP) mostrou que os ninhos não ocorrem em árvores menores que 50 cm de DAP e que a maioria dos ninhos ocorre em árvores com DAP maior que 100 cm. A estrutura populacional indica pequeno recrutamento nas classes de DAP maiores que 5 cm e uma forte redução na ocorrência de indivíduos maiores que 50 cm DAP. Propostas para conservação para *S. apetala* e da arara-azul são discutidas.

**Palavras-chave:** conservação de aves, *Anodorhynchus hyacinthinus*, estrutura populacional, desmatamento

## Introduction

The Pantanal is a large floodplain (140,000 km<sup>2</sup>) consisting of a mosaic of rivers, oxbows, draining channels, permanent and temporary ponds, as well as inundable grasslands. The vegetation is composed by a matrix of vast extensions of seasonally flooded grasslands, interspersed with slightly higher areas not subjected to inundation, which are covered with cerrado or seasonal forest (Ratter et al., 1988). The diversity of fauna and flora is high and

the floodable and non-floodable habitats offer a wide range of refuges for native species as well as introduced species (Mourão et al., 2002). Forest cover represents approximately 26% of the vegetation (Silva et al., 2000) and has been preferentially transformed into pasture for raising cattle (Padovani et al., 2004; Johnson et al., 1997). Unfortunately, many of the threatened native species of the Pantanal are dependent on forests, with special reference to the hyacinth macaw, *Anodorhynchus hyacinthinus* (Tubelis & Tomas 1999). This species is threatened due to its capture for the illegal

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pet trade, and the destruction of its habitat through burning or deforestation (Nunes et al., 2006; Guedes, 2002).

The hyacinth macaw is one of the species that use forest trees for reproduction in the Pantanal wetland, excavating cavities preferentially in the trunks of manduvi trees, *Sterculia apetala* (Sick, 1997). Approximately 94 % of the nests of this macaw are found in this tree species, making it a key resource for the conservation of the hyacinth macaw in the Pantanal (Pinho & Nogueira, 2003; Guedes, 1993). Cavities in trees are a limiting resource for birds that use them for nesting, and a reduction in the availability of this resource due to human factors, such as deforestation and burning, may threaten the persistence of many bird species as a result of lower recruitment and a gradual reduction in population size (Santos Jr. et al., 2006). Thus, the decreased availability of nesting sites might severely impact *A. hyacinthinus* in the Pantanal wetland, which shelters the largest population of this species. The objective of this study was to describe the occurrence of hyacinth macaw nesting sites in manduvi trees and discuss the conservation of both species in the Pantanal.

## Methods

We examined the presence-absence data of nests in trunks of *S. apetala* obtained from the data bank of the Hyacinth Macaw Project/UNIDERP, and applied a logistic regression to model the probability of occurrence of nests in relation to trunk diameter at breast height (DBH). Additionally, we collected data on the population structure of *S. apetala* from the following localities: (1) Fazenda Santa Emília (19°30'24"S – 55°36'00"W), sub-region of Aquidauana; (2) Estância Caiman (19°56'23"S – 56°14'26"W), sub-region of Miranda; (3) Fazenda Nhumirim (19°00'52"S – 56°38'38"W), sub-region of Nhecolândia (Silva & Abdon, 1998). In each sub-region, all individuals of *S. apetala* taller than 1.5 m found in forested areas were measured for height and DBH. The logistic function derived from the previously collected data (Databank Hyacinth Macaw Project/UNIDERP) was used to estimate the probability of occurrence of *A. hyacinthinus* nesting sites.

## Results and discussion

The logistic model indicated that the minimum size for having a nest cavity for *A. hyacinthinus* was 50 cm DBH, confirming the suggestion of Santos Jr. et al. (2006) and Guedes (1993). All individuals larger than 100 cm DBH have nest cavities (Fig. 1).

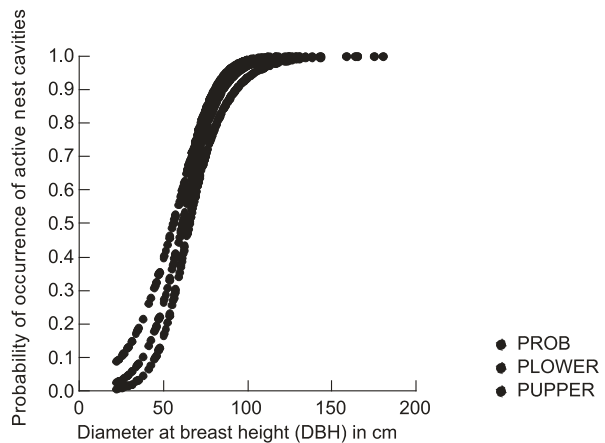


Figure 1. Logistic regression relating the probability of occurrence of active nest cavities of the hyacinth macaw in trunks of *Sterculia apetala* as a function of diameter at breast height (DBH) (LOGIT Analysis; N=259; df = 1; P=0.0001;  $(w^*) = \exp(-5.599 + (0.092) * N - \text{tot}) / 1 + [\exp(-5.599 + (0.092) * N - \text{tot})]$ ), in the Pantanal wetland.

The data collected on population structure of *S. apetala*, independent of the collection area, indicates low recruitment in classes of DBH larger than 5 cm and a strong reduction in the occurrence of individuals greater than 50 cm DBH and very few individuals with diameter greater than 110 DBH (Fig. 2). These results indicate that potential nesting sites are rare and will become increasingly rarer in the future. Data on deforestation in the Pantanal wetland showed an annual rate of 0.46% in the period from 1999 to 2000 (Padovani et al., 2004). However, more recent data indicate an annual rate of 2.3 % in the period from 2000 to 2004 and at this rate the forested areas will disappear within 45 years (Harris et al. 2006), thus critically reducing, in the next decades, the occurrence of Hyacinth Macaw nesting sites in the Pantanal Wetland. The following steps should be taken as conservation priorities: 1) the reduction of deforestation to reduce the risk of elimination of large individuals of *S. apetala*; 2) the development of public policies to prevent deforestation in the region; 3) the initiation of management strategies aiming the regeneration of *S. apetala*, as a best practice in ranches inside the Pantanal. The third priority is needed as the effects of cattle trampling and foraging, plus the uncontrolled burning of forest habitats, may be drastically reducing the recruitment and survivorship in the *S. apetala* population (Johnson et al., 1997), with long term effect in the viability of the Hyacinth macaw population. This is likely to lead this macaw species to extinction due to lowered reproductive success. The development of habitat management strategies for cattle ranching in the Pantanal wetland, as well as large protected areas, are urgent to achieve a long term conservation of the largest wild *Anodorhynchus hyacinthinus* population.

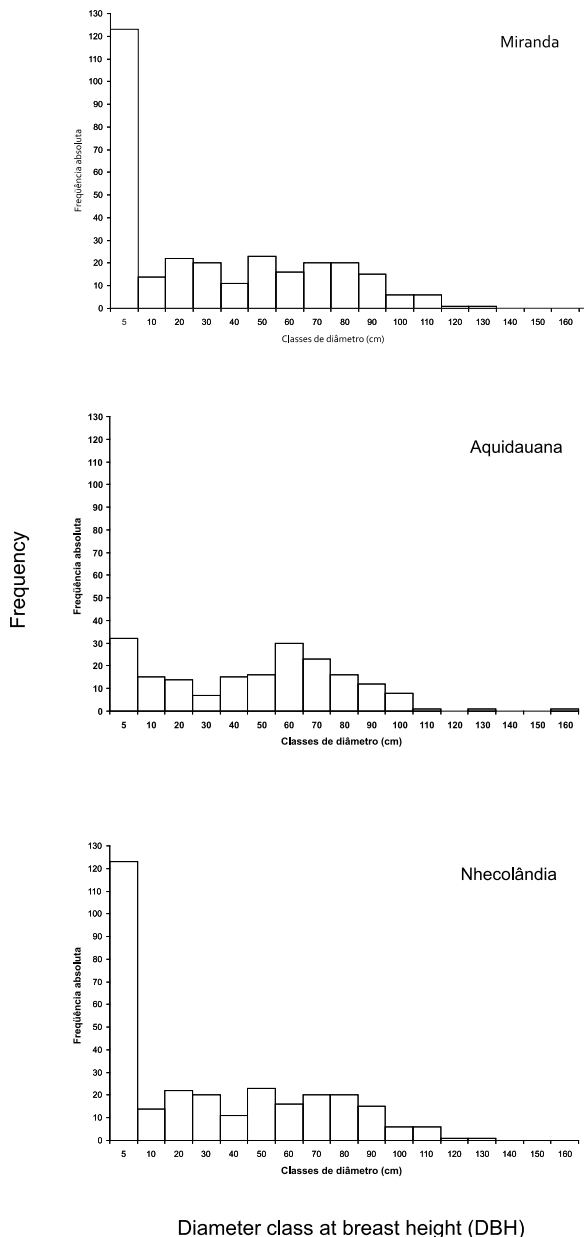


Figure 2. Population structures of *Sterculia apetala* larger than 1.5 m in height in three sub-regions of the Pantanal wetland in the state of Mato Grosso do Sul.

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