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Bird use of logging gaps in a subtropical mountain forest: The influence of habitat structure and resource abundance in the Yungas of Argentina

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ABSTRACT

Selective logging is one of the main economical activities in tropical and subtropical forests. While most of the effects of this activity on bird communities have been studied by comparing exploited vs. non-exploited areas; the use of human-created treefall gaps by birds is relatively unknown. We studied habitat structure, resource abundance (fruits, flowers and arthropods) and bird activity in logging gaps of different age (1-year-old and 10- to 20-year-old) in a mountain forest (Yungas) of northwest Argentina in both dry and wet seasons. In less than a year after creation, short herbs colonize logging gaps increasing the abundance of arthropods in the ground and the activity of understory insectivores. During dry seasons recently created gaps become an important source of resources for understory frugivores-insectivores. Later on in succession logging gaps are invaded by exotic graminoid vegetation and tall herbs (dispersed through extraction tracks) which can impede the colonization and development of pioneer trees and natural regeneration. Probably as a consequence of a high abundance of fruits and flowers in the understory and a very low abundance of these resources in the canopy, old gaps were mainly used by understory frugivores-insectivores while arboreal frugivores were rare. Because arboreal frugivores disperse most tree seeds in tropical and subtropical forests, the low activity of this guild in logging gaps contribute to the low observed regeneration. Sustainable timber harvest in tropical and subtropical forests should include gap and logging track management to minimize the invasion by exotic graminoid vegetation and facilitate natural succession.

1. Introduction

The creation of forest gaps by treefalls in temperate and tropical ecosystems enhances species coexistence by increasing spatial heterogeneity and decreasing competitive exclusion (Schemske and Brokaw, 1981; Schnitzer and Carson, 2001; Faccio, 2003). Canopy openness increases light incidence and modify microclimatic conditions allowing the establishment and development of vegetation in the understory and pioneer trees which produce fleshy fruits and flowers consumed by birds (Blake and Hoppes, 1986; Levey, 1988; Feisinger et al., 1998; Wunderle et al., 2005). Also, as a consequence of changes in vegetation structure and composition, arthropods abundance tends to be high in gaps compared to forest interior (Blake and Hoppes, 1986; Linhart et al., 1987). Natural gaps represent an important habitat patch exploited by birds in both tropical and temperate forest (Schemske and Brokaw, 1981; Blake and Hoppes, 1986; Levey, 1988; Feisinger et al., 1998; Fuller, 2000; Wunderle et al., 2005).

Selective logging is one of the principal human disturbances in tropical and subtropical forests. Despite its economical importance, governmental and private controls and regulations are, almost, non-existent (Putz, 2000; Fredericksen and Putz, 2003). Studies evaluating the effects of selective logging on bird communities and populations in tropical and subtropical forests showed heterogeneous responses; while some species disappear or decrease in abundance (particularly understory insectivores), others increase in abundance (Thiollay, 1992; Mason, 1996; Marsden, 1998; Robinson and Robinson, 1999; Aleixo, 1999; Fredericksen and Putz, 2003; Woltmann, 2003). Only a few studies evaluated bird use of logging gaps at a small scale (Fredericksen et al., 1999).

The Yungas of Argentina represents the southern limit of the tropical Andes ecosystem, one the world hotspot of biodiversity (Myers et al., 2000), which extends from 400 to 2500 m a.s.l

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(Cabrera and Willink, 1980). Lowland premontane forest is the most disturbed sector in the Yungas and currently less than 20% of this forest is protected in Argentina (Grau and Brown, 2000). Selective logging is one of the main economical activities in the Yungas of Argentina; however, no study has evaluated the effects of this activity on bird communities. In this context, our objective was to study the use of logging gaps by birds in a premontane forest in relation to the structure of vegetation and resource abundance.

2. Materials and methods

2.1. Study area

The study was conducted in a premontane forest of northwestern Argentina (23° 47′S; 64° 47′W; Fig. 1). Total precipitation is 1400 mm and is highly seasonal, with 80% concentrated between November and April (Cabrera and Willink, 1980). Because bird community composition changes with altitude (Blake and Rougès, 1997), we focused in the premontane forests between 490 and 560 m a.s.l. Native forest in the study area is exploited in cycles of 10–20 years between harvests; the most recent harvest was in 2000. Logging treefall gaps (mainly old gaps) were dominated by isolated individuals of pioneer tree species including *Croton* spp., *Urera baccifera* and *Anadenanthera colubrine*. The most abundant species of interior forest in the study area included several species of the Myrtaceae family and *Trichilia hieronymi*.

2.2. Sampling design and bird surveys

Bird activity, vegetation structure and composition and resource abundance (arthropods, fruits and flowers) were sampled during both wet (January–February) and dry (July–August) seasons in 2001. We randomly selected ten logging gaps (five 10- to 20-year-old and five recent gaps less than 1-year-old) and 10 interior forest sites. Selected sampling sites were at least 200 m apart to ensure independence. Logging gaps were identified, in most cases, by the remaining stumps and the presence of extraction tracks. Average size of gaps was 211 m^2 (113–412 m^2) for recent gaps and 308 m^2 (212–530 m^2) for old gaps. Because five old gaps and five interior forest sampling sites were destroyed by extraction tracks created between wet and dry seasons, we sampled only five recent gaps and five interior sites in dry season.

We used the point count method with fixed radius (20-m) to estimate bird species abundance in gaps and interior forest (Bibby et al., 1998). We recorded all heard individuals during a 10-min period between sunrise and 3 h later (7:30–10:30 h in wet season and 8:00–11:00 h in dry season). To increase the reliability of samples, all point counts were sampled 6 days but visit order was systematically changed (Bibby et al., 1998). We only considered aural records because of differences in visual detectability between gaps and forest interior. All point counts were performed by the same observer. However, to validate aural species identification, the principal observer and another trained observer simultaneously sampled the same bird point counts for 3 days in wet

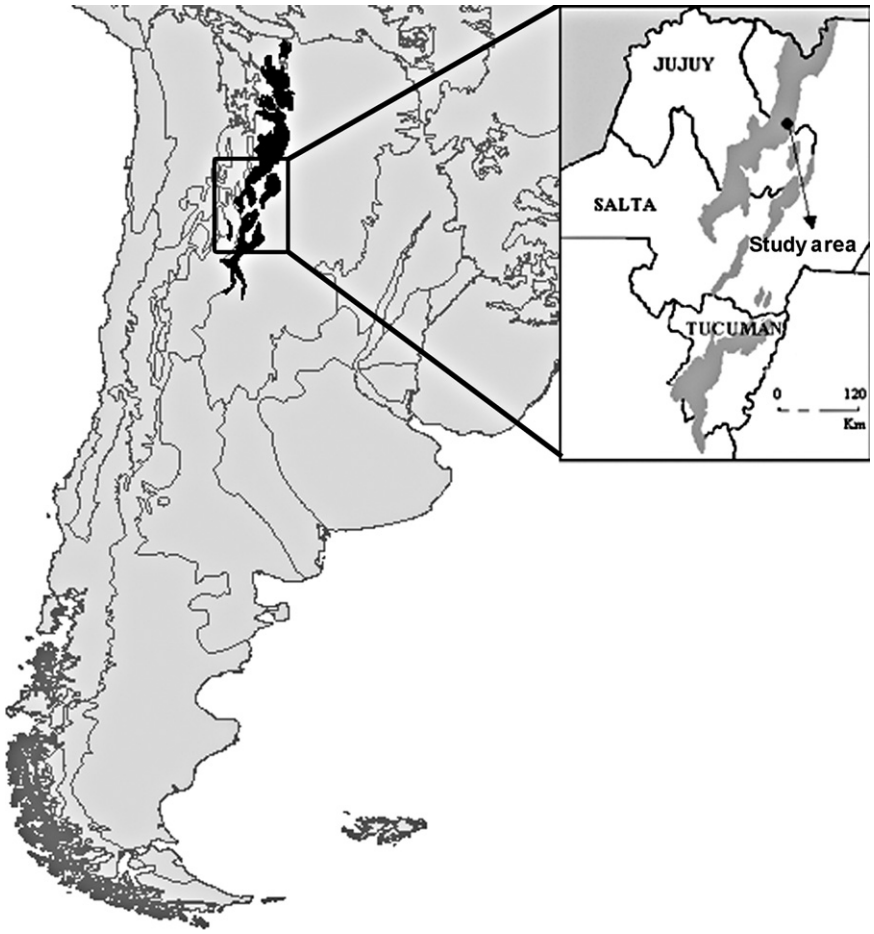

Fig. 1. Regional distribution of the Southern Andean Yungas in South America and detailed study area in the Yungas of Argentina.