

## LISTS OF SPECIES

### **Birds surveyed in the harvested and unharvested areas of a reduced-impact logged forestry concession, located in the lowland subtropical humid forests of the Department of Santa Cruz, Bolivia.**

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#### **Abstract**

As part of a larger study of reduced-impact logging effects on bird community composition, we surveyed birds from December to February during the 2003-2004 wet-season within harvested and unharvested blocks of the La Chonta forestry concession, Department of Santa Cruz, Bolivia. The logged forest was harvested using reduced-impact logging techniques between one and four years previously. During point count surveys, we identified 5062 individual birds, belonging to 155 species, and 33 families. We provide a list of bird species found within the harvested and unharvested blocks of the concession for the benefit of other researchers assessing the responses of Neotropical avifauna to disturbance, and to facilitate increased understanding of the diverse bird assemblages found within the lowland subtropical humid forests of Bolivia.

#### **Introduction**

There are over 1400 species of birds known from Bolivia, with the majority of species found in the sub-tropical and tropical forests of lowland Bolivia (Pacheco 1998). Almost half of forests in lowland Bolivia are now granted to forestry concessions (Mostacedo and Fredericksen 1999). In 1996, a new forestry law was enacted to promote the sustainable harvesting of timber (Mostacedo and Fredericksen 1999). To achieve best-management practices, reduced-impact

logging techniques have gained widespread application in Bolivia and, as of 2005, concessions covering over 2.2 million hectares had obtained certification by the Forest Stewardship Council (Forest Stewardship Council 2005). Here, we provide the results of a wet season bird survey of the harvested and unharvested areas on one of these certified concessions located in the lowland subtropical humid forests of the Department of Santa Cruz, Bolivia.

#### **Material and Methods**

##### *Study site*

Our study area was located in the lowland subtropical humid forest of the Guarayos Forest Reserve, Department of Santa Cruz, Bolivia. Research was conducted in the 100000 ha forestry concession "La Chonta". This is owned and managed by Agroindustria Forestal La Chonta (509000 to 545000 easting, 8275500 to 824900 northing; Figure 1). The forest has an average elevation of 320 m (range 230-390m). The soils consist of oxisols, ultisols, and inceptisols (Park et al. 2005). The mean annual temperature is 25° C with a mean annual precipitation of approximately 1560 mm. The region experiences a distinct dry season from May to October. The entire concession was subjected to legal and illegal selective logging of mahogany (*Swietenia macrophylla*), and Spanish cedar (*Cedrela odorata*) from ~1980 to 1995. The concession was certified by SmartWood in 1998.

##### *Harvesting procedure*

Approximately 2500 ha of forest is harvested annually over three contiguous 850 ha blocks (~4 x 2 km), yielding 50000 m<sup>3</sup> of timber. Eighteen tree species were harvested during the time of this study (2003-2004) including *Ficus boliviana*, *Hura crepitans*, *Terminalia oblonga*, *Cariana ianeirensis*, *C. estrellensis*, and *Pseudolmedia laevis*. Average harvest intensity was approximately 4 trees per ha (Jackson et al. 2002). The forestry company Agroindustria Forestal La Chonta conducts inventories of harvestable trees one year prior to logging. The minimum size for harvest is 50 cm diameter at breast-height (dbh) for all species except *F. boliviensis* and *H. crepitans*, which are harvested above 70 cm dbh. One in five harvestable trees is required by law to be left as a

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seed tree. During pre-harvesting inventory, trees selected for felling are cleared of all vines from their bole. The forestry company uses a 'fishbone' harvesting strategy with a single primary north-south road bisecting each 850 ha block. Skid trails are located 100-150 m apart and run in an east-west direction on either side of the primary road. Chainsaw teams trained in directional felling techniques try to reduce damage to the residual stand during logging. Removal and loading of boles is conducted using rubber-tired skidders to reduce soil compaction. It is intended that blocks be re-cut in 25 to 30 years.

### Survey design

A stratified-random sampling design was used. The strata to guide site selection included commercial tree species occurrence, vegetation height, and disturbance type. Five habitat types were surveyed including: 1. 'Tall forest' points (T) with vegetation height over 20 m and possessing one of five commercial tree species (*Ficus boliviensis*, *Hura crepitans*, *Cariniana estrellensis*, *C. ianeirensis*, *Terminalia oblonga*) of harvestable size; 2. 'Medium forest' points (F) from 12-20 m in height and possessing a commercial tree of the afore mentioned five species not yet of harvestable size but above 30 cm dbh; 3. 'Vine thicket' points (N) of less than 12m in height and not possessing commercial trees above 10 cm dbh; 4. 'Gap' points (G) possessing a tree-fall gap caused by the felling of a tree (in the harvested blocks) or a natural tree fall (in the unlogged blocks) of greater than 50 cm dbh; and 5. 'Road' points (R) located on a primary north-south logging road in the logged forest, or along the main north-south access path in the unlogged forest. In total, 360 points was surveyed, equally distributed between the logged and unlogged forest, represented by 72 points of each of the five habitat categories.

### Bird surveys

At each of the 360 survey points, we used an unlimited distance point-count method of surveying bird species abundance. All survey points were located at least 300 m from the nearest point, and at least 500 m from the edge of neighbouring treatment blocks. Surveys were conducted from December to February of the 2003-2004 wet season. Surveys began at first light

(5:45-6:00 am), and continued until approximately 10:45 am. Counts were not undertaken if weather was poor (e.g. rain, high wind). This period overlapped with the daily peak in bird vocal activity. A day's survey consisted of visiting three points of each of the five habitat types (15 points in total). Each point was surveyed for 12 minutes. We included birds flushed from the survey point on approach by the observer, while birds flying over the survey area were not included in the analysis.

Due to the density of forest vegetation, most identifications were made acoustically, rather than visually. In addition to point counts, recordings of birds were made using a Sony TCM 5000 tape-recorder that was attached to a Sennheiser ME66 microphone. These recordings were used as a supplement to in-the-field identification of vocalizing species. For unidentified species, symbolic representations of songs were noted. This was in addition to notes on the recording time, direction, and estimated distance to the call. This enabled the matching of subsequent identifications with abundance and distance information. Unknown recordings were identified using the CD-ROM Birds of Bolivia, 2.0 (Mayer, 2000), or by an expert (B.H). All research was approved by the relevant authorities and this study was conducted within the ethical guidelines of Australia and Bolivia.



**Figure 1.** Map of Bolivia with approximate location of the la Chonta forestry concession indicated within the department of Santa Cruz.

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### Results and discussion

This survey was part of a larger study assessing the effects of reduced-impact logging on bird community composition and abundance. The list should be of benefit to other researchers assessing disturbance associated responses of Neotropical avifauna, and to facilitate increased understanding of the diverse bird assemblages found within the lowland subtropical forests of Bolivia. During point count surveys, we identified approximately 5 050 birds, belonging to 155 species, and 33 families (see Table 1).

Outside of the survey period, several species were noted in addition to those accounted for within the forested areas of the concession. These included the harpy eagle (*Harpia harpyja*), crested eagle (*Morphnus guianensis*), great razor-billed curassow (*Mitu tuberosa*), bare-faced curassow (*Crax fasciolata*), ferruginous pygmy-owl (*Glaucidium brasilianum*), common potoo (*Nyctibius griseus*), pauraque (*Nyctidromus albicollis*) and bare-necked fruitcrow (*Querula purpurata*).

Although avian species richness was nearly identical between the harvested and unharvested areas of the concession (logged 132 spp.; unlogged 133 spp.), this numerical equivalence obscures underlying differences in species composition. Our results suggest that the avian families Ramphastidae, Falconidae and Formicariidae were adversely affected by the logging activities in this forest. At the species level, concern may be warranted regarding the absence of the Barred-forest falcon and the lower abundances of Red-necked Woodpecker, Channel-billed Toucan, Red-billed Toucan, Black-faced Antthrush, Spot-backed Antbird, and Gray-fronted dove within the harvested areas of

the concession. In contrast, the Black-throated Antbird, Yellow-tufted Woodpecker, Buff-throated Saltator, and Moustached Wren, appear to be currently benefiting from logging associated disturbance.

Due to temporal and seasonal variation in bird species vocalization and presence, results should be interpreted acknowledging the season of the survey and the time of day during which the surveys were carried out. It should also be acknowledged that the mere presence of a species in an area does not necessarily mean that the area possessed suitable habitat for that species' long-term persistence (O'Brien et al., 2003). At the time of the survey, the first logging rotation for the concession was not as yet completed, and disturbance processes associated with selective logging activity occurred from only one to four years previously. This temporal period of disturbance is well short of that by which most localized avian extinctions are predicted to occur following anthropogenic disturbance processes (Robinson 1999; Mason and Thiollay 2001).

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**Table 1.** Bird species encountered during bird surveys conducted from December 2003 to February 2004 within 360 sampling points equally distributed between the harvested (Log) and unharvested (Unl) blocks of the reduced-impact logged La Chonta concession, Department of Santa Cruz, Bolivia. Bird abundance is grouped according to the number of total contacts made during the survey within the harvested and unharvested areas. Birds are labeled either as abundant (ab; >99), common (com; >29), uncommon (unc; 9>n<30), rare (rar; 2>n<10), present (pre; 1, 2), or not observed (-; 0).

Scientific name	Common name	Unl	Log
<b>Tinamidae</b>			
<i>Crypturellus soui</i>	Little Tinamou	unc	unc
<i>Crypturellus cinereous</i>	Cinereous Tinamou	unc	unc
<i>Crypturellus strigulosus</i>	Brazilian Tinamou	rar	unc
<i>Crypturellus tataupa</i>	Tatapua Tinamou	rar	pre
<i>Crypturellus undulatus</i>	Undulated Tinamou	com	com
<i>Tinamous tao</i>	Gray Tinamou	pre	pre
<b>Cathartidae</b>			
<i>Sarcoramphus papa</i>	King Vulture	-	pre
<b>Accipitridae</b>			
<i>Spizaetus ornatus</i>	Ornate Hawk-eagle	pre	pre
<i>Spizaetus tyrannus</i>	Black Hawk-eagle	pre	-
<b>Falconidae</b>			
<i>Micrastur ruficollis</i>	Barred Forest-falcon	rar	-
<i>Falco rufigularis</i>	Bat Falcon	pre	-
<i>Micrastur gilvicollis</i>	Lined Forest-falcon	pre	-
<i>Micrastur semitorquatus</i>	Collared Forest-falcon	pre	-
<b>Cracidae</b>			
<i>Penelope jaquacu</i>	Spix's Guan	rar	rar
<i>Pipile pipile</i>	Blue-Throated Piping-guan	pre	pre
<b>Columbidae</b>			
<i>Columba speciosa</i>	Scaled Pigeon	unc	com
<i>Columba plumbea</i>	Plumbeous Pigeon	unc	unc
<i>Columbia subvinacea</i>	Ruddy Pigeon	com	com
<i>Claravis pretiosa</i>	Blue Ground-dove	com	com
<i>Geotrygon montana</i>	Ruddy Quail-dove	rar	pre
<i>Leptotila rufaxilla</i>	Gray-fronted dove	com	unc

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Scientific name (cont.)	Common name	Unl	Log
<b>Psittacidae</b>			
<i>Brotogeris cyanopectera</i>	Cobalt-winged Parakeet	unc	com
<i>Pyrrhura molinae</i>	Green-cheeked Parakeet	unc	unc
<i>Pionus menstruus</i>	Blue-headed Parrot	unc	unc
<i>Ara severa</i>	Chestnut-fronted Macaw	rar	unc
<i>Ara chloroptera</i>	Red and Green Macaw	rar	unc
<i>Ara arauna</i>	Blue and Yellow Macaw	rar	rar
<i>Aratinga leucophthalmus</i>	White-eyed Parakeet	-	pre
<i>Amazona farinosa</i>	Mealy Parrot	com	com
<b>Cuculidae</b>			
<i>Piaya cayana</i>	Squirrel Cuckoo	unc	unc
<i>Tapera naevia</i>	Striped Cuckoo	pre	-
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	-	pre
<b>Strigidae</b>			
<i>Otus watsonii</i>	Tawny-bellied Screech-owl	pre	rar
<i>Ciccaba huhula</i>	Black-banded owl	pre	-
<b>Carpimulgidae</b>			
<i>Nyctiphrynus ocellatus</i>	Ocellated Poorwill	rar	unc
<b>Trochilidae</b>			
<i>Phaethornis ruber</i>	Reddish Hermit	unc	unc
<i>Thalurania furcata</i>	Fork-tailed Woodnymph	rar	pre
<i>Phaethornis hispidus</i>	White-bearded Hermit	rar	-
<i>Heliothryx barroti</i>	Purple-crowned Fairy	pre	pre
<i>Glaucis hirsuta</i>	Rufous-breasted Hermit	pre	-
<i>Hylocharis cyanus</i>	White-chinned Sapphire	com	rar
<b>Trogonidae</b>			
<i>Trogon curucui</i>	Blue-crowned Trogon	unc	unc
<i>Trogon collaris</i>	Collared Trogon	com	com
<i>Trogon melanurus</i>	Black-tailed Trogon	com	com
<b>Motmotidae</b>			
<i>Motmotus motmota</i>	Blue-crowned Motmot	unc	com
<b>Bucconidae</b>			
<i>Monasa morphoeus</i>	White-fronted Nunbird	unc	unc
<i>Monasa nigrifrons</i>	Black-fronted Nunbird	com	com
<i>Nonnula ruficapilla</i>	Gray-cheeked Nunlet	rar	rar
<i>Nystalus striolatus</i>	Striolated Puffbird	rar	rar
<i>Notharcus macrohynchus</i>	White-necked Puffbird	-	rar
<b>Galbulidae</b>			
<i>Galbula ruficauda</i>	Rufous-tailed Jacamar	pre	pre
<i>Brachygalba lugubris</i>	Brown Jacamar	-	pre
<b>Ramphastidae</b>			
<i>Pteroglossus castanotis</i>	Chestnut-eared Aracari	rar	rar
<i>Ramphastos tucanus</i>	Red-billed Toucan	com	unc
<i>Ramphastos vitellinus</i>	Channel-billed Toucan	com	unc
<b>Picidae</b>			
<i>Melanerpes cruentatus</i>	Yellow-tufted Woodpecker	unc	com
<i>Campephilus rubricollis</i>	Red-necked Woodpecker	unc	rar
<i>Piculus leucolaemus</i>	White-throated Woodpecker	rar	pre
<i>Celeus torquatus</i>	Ringed Woodpecker	pre	rar
<i>Picumnus aurifrons</i>	Bar-breasted Piculet	pre	-

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Scientific name (cont.)	Common name	Unl	Log
<b>Dendrocolaptidae</b>			
<i>Dendrexetastes certhia</i>	Cinnamon-throated Woodcreeper	unc	unc
<i>Lepidocolaptes albolineatus</i>	Lineated Woodcreeper	rar	rar
<i>Sittasomus griseicapillus</i>	Olivaceous Woodcreeper	rar	rar
<i>Dendrocolaptes certhia</i>	Barred Woodcreeper	rar	pre
<i>Dendrocolaptes piccumnus</i>	Black-banded Woodcreeper	pre	pre
<i>Nasica longirostris</i>	Long-billed Woodcreeper	pre	pre
<i>Dendrocincla fuliginosa</i>	Plain-brown Woodcreeper	pre	-
<i>Xiphorhynchus guttatus</i>	Buff-throated Woodcreeper	com	com
<b>Formicariidae</b>			
<i>Hyllopezus berlepschi</i>	Amazonian Antpitta	-	pre
<i>Formicarius analis</i>	Black-faced Antthrush	com	unc
<i>Myrmeciza atrothorax</i>	Black-throated Antbird	unc	com
<i>Thamnophilus amazonicus</i>	Amazonian Antshrike	unc	unc
<i>Hylophylax naevius</i>	Spot-backed Antbird	unc	rar
<i>Myrmotherula axillaris</i>	White-flanked Antwren	rar	rar
<i>Thamnophilus sticturus</i>	Bolivian-slaty Antshrike	rar	rar
<i>Hylophylax poecilonota</i>	Scale-backed Antbird	rar	rar
<i>Pyriglena leuconota</i>	White-backed Fire-eye	pre	rar
<i>Phlegopsis nigromaculata</i>	Black-spotted Bare-eye	pre	pre
<i>Hypocnemoides maculicauda</i>	Band-tailed Antbird	pre	-
<i>Myrmeciza hemimelaena</i>	Chestnut-tailed Antbird	com	com
<i>Thamnophilus palliatus</i>	Chestnut-backed Antshrike	com	com
<i>Dysithamnus mentalis</i>	Plain Antvireo	com	com
<i>Herpsilochmus rufimarginatus</i>	Rufous-winged Antwren	ab	ab
<i>Thamnophilus schistaceus</i>	Plain-winged Antshrike	ab	ab
<i>Cercomacra cinerascens</i>	Gray Antbird	ab	ab
<i>Hypocnemis cantator</i>	Warbling Antbird	ab	com
<b>Tyrannidae</b>			
<i>Myiarchus tuberculifer</i>	Dusky-capped Flycatcher	unc	com
<i>Tolmomyias assimilis</i>	Yellow-margined Flycatcher	unc	unc
<i>Hemitriccus flammulatus</i>	Flammulated Bamboo-Tyrant	unc	unc
<i>Attila spadiceus</i>	Bright-rumped Attila	unc	unc
<i>Rhytipterna simplex</i>	Grayish Mourner	unc	unc
<i>Myiornis ecaudatus</i>	Short-tailed Pygmy-Tyrant	rar	unc
<i>Legatus leucophaeus</i>	Piratic Flycatcher	rar	rar
<i>Tolmomyias sulphurescens</i>	Yellow-olive Flycatcher	rar	rar
<i>Hemitriccus minor</i>	Snethlage's Tody-tyrant	rar	pre
<i>Ramphotrigon ruficauda</i>	Rufous-tailed Flatbill	rar	-
<i>Onychorhynchus coronatus</i>	Amazonian Royal Flycatcher	pre	rar
<i>Lathrotriccus euleri</i>	Euler's Flycatcher	pre	pre
<i>Casiornis rufa</i>	Rufous Casiornis	pre	-
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	pre	-
<i>Tityra cayana</i>	Black-tailed Tityra	pre	-
<i>Attila bolivianus</i>	White-eyed Attila	-	pre
<i>Leptopogon amaurocephalus</i>	Sepia-capped Flycatcher	-	pre
<i>Pachyramphus marginatus</i>	Black-capped Becard	-	pre
<i>Pachyramphus minor</i>	Pink-throated Becard	-	pre
<i>Pachyramphus polychopterus</i>	White-winged Becard	-	pre
<i>Tyrannus melancholicus</i>	Tropical Kingbird	-	pre
<i>Myiopagis gaimardi</i>	Forest Elaenia	com	com
<i>Corythopsis torquata</i>	Ringed Antpipit	com	unc

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<b>Furnariidae</b>			
<i>Automolus ochrolaemus</i>	Buff-throated Foliage-Gleaner	unc	unc
<i>Xenops rutilans</i>	Streaked Xenops	rar	pre
<b>Cotingidae</b>			
<i>Laniocera hypopyrra</i>	Cinereous Mourner	rar	rar
<i>Cephalopterus ornatus</i>	Amazonian Umbrellabird	-	pre
<i>Lipaugus vociferans</i>	Screaming Piha	ab	ab
<b>Pipridae</b>			
<i>Machaeropterus pyrocephalus</i>	Fiery-capped Manakin	unc	unc
<i>Neopelma sulphureiventer</i>	Sulphur-bellied Tyrant-Manakin	unc	unc
<i>Piprites chloris</i>	Wing-barred Piprites	rar	pre
<i>Pipra fasciicauda</i>	Band-tailed Manakin	pre	pre
<i>Pipra rubrocapilla</i>	Red-headed Manakin	pre	-
<b>Troglodytidae</b>			
<i>Thryothorus genibarbis</i>	Moustached Wren	unc	unc
<i>Thryothorus guarayanus</i>	Fawn-breasted Wren	rar	rar
<i>Campylorhynchus turdinus</i>	Thrush-like Wren	-	pre
<i>Microcerculus marginatus</i>	Scaly-breasted Wren	-	pre
<b>Sylviinae</b>			
<i>Ramphocaenus melanurus</i>	Long-billed gnatwren	com	unc
<b>Turdinae</b>			
<i>Turdus albicollis</i>	White-necked Thrush	unc	unc
<i>Turdus amaurochalinus</i>	Creamy-bellied Thrush	pre	pre
<i>Turdus hauxwelli</i>	Hauxwell's Thrush	-	pre
<b>Vireonidae</b>			
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	rar	unc
<i>Hylophilus pectoralis</i>	Ashy-headed Greenlet	pre	pre
<i>Hylophilus muscicapinus</i>	Buff-cheeked Greenlet	com	com
<b>Emberizinae</b>			
<i>Arremon taciturnus</i>	Pectoral Sparrow	rar	rar
<b>Cardinalinae</b>			
<i>Cyanocompsa cyanoides</i>	Blue-black Grosbeak	unc	unc
<i>Saltator maximus</i>	Buff-throated Saltator	-	rar
<b>Thraupinae</b>			
<i>Tangara chilensis</i>	Paradise Tanager	unc	unc
<i>Hemithraupis guira</i>	Guira Tanager	rar	pre
<i>Euphonia rufiventris</i>	Rufous-bellied Euphonia	pre	rar
<i>Euphonia cyanocephala</i>	Golden-rumped Euphonia	pre	pre
<i>Euphonia chrysopasta</i>	White-lored Euphonia	pre	-
<i>Tachyphonus luctuosus</i>	White-shouldered Tanager	pre	-
<i>Euphonia laniirostris</i>	Thick-billed Euphonia	pre	-
<i>Euphonia xanthogaster</i>	Orange-bellied Euphonia	pre	-
<i>Tachyphonus cristatus</i>	Flame-crested Tanager	pre	-
<i>Ramphocelus carbo</i>	Silver-beaked Tanager	-	rar
<i>Dacnis cayana</i>	Blue Dacnis	-	pre
<i>Eucometis penicillata</i>	Gray-headed Tanager	-	pre
<i>Thraupis sayaca</i>	Sayaca Tanager	-	pre
<i>Thraupis palmarum</i>	Palm Tanager	-	pre
<i>Habia rubica</i>	Red-crowned Ant-tanager	com	com
<i>Coereba flaveola</i>	Bananaquit	rar	rar

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Scientific name (cont.)	Common name	Unl	Log
<b>Parulidae</b>			
<i>Basileuterus culicivorus</i>	Golden-crowned Warbler	unc	com
<i>Parula pitiayumi</i>	Tropical Parula	rar	rar
<b>Icteridae</b>			
<i>Psarocolius decumanus</i>	Crested Oropendola	rar	pre
<i>Psarocolius bifasciatus</i>	Olive Oropendola	rar	-
<i>Cacicus cela</i>	Yellow-rumped Cacique	-	pre

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