BIRDS OF A CENTRAL SÃO PAULO WOODLOT: 1. CENSUSES 1982-2000

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ABSTRACT

Some 263 birds were recorded near and in a 230-ha patch of semideciduous forest in cane fields of central São Paulo, Brazil. Subtracting 67 open-area species, 22 of marshes or creeks, 10 vagrants and 12 recorded later, 152 forest and border species were recorded in 1982-86, much like what was observed in a similar woodlot near Campinas. Both woodlots lost species gradually over the years. Some birds avoided hard cane-field edges, preferring soft bushy edges. Of open-area species, 22 seemed to have disappeared by 1997 due to earlier high El Niño rains or rare permanently open habitats in the sugar cane; 17 new species were mostly nocturnal ones not noted earlier, or occasional visitors. Forest and borders lost 31 species, gaining five of dry regions and one winter visitor. Several migrants from the south appeared only in wet years before recent greenhouse effects, some resident birds were hunted, and canopy hummingbirds were perhaps still present. Dry-forest travel-prone or "metapopulational" species moved their centers of distribution, partly concealing loss of moist-forest diversity.

Key words: birds, conservation, greenhouse effect, metapopulations, semideciduous forest, sugar cane.

RESUMO

Aves de uma mata na região central de São Paulo: 1. Censos 1982-2000

Foram listadas 263 aves próximo e dentro de uma mata semidecídua de 230 ha em meio a plantações de cana-de-açúcar, na região central do Estado de São Paulo, Brasil. Subtraindo-se 67 espécies de áreas abertas, 22 de riachos, 10 vagantes e 12 observadas mais tarde, cerca de 152 espécies de mata e de borda foram observadas entre 1982-86, semelhantemente às observadas em uma mata próxima a Campinas. Ambas as matas perderam espécies gradualmente. Algumas aves evitaram as margens "duras" dos canaviais, preferindo as margens "macias" arbustivas. Das espécies de área aberta, parece que 22 desapareceram até 1997, em razão das abundantes chuvas anteriores causadas por El Niño, ou pela raridade de habitats permanentemente abertos nos canaviais; 17 espécies "novas" eram principalmente noturnas que não haviam sido checadas anteriormente, ou visitantes ocasionais. A mata e as bordas perderam 37 espécies, ganhando 5 de regiões secas e 1 visitante de inverno. Vários migrantes do sul apareceram somente em anos chuvosos antes do recente efeito estufa; algumas aves residentes foram caçadas, e os beija-flores das copas talvez estivessem presentes ainda. As espécies de zonas secas, prones à movimentação ou "metapopulacionais", movem os centros de distribuição, camuflando parcialmente a perda de diversidade da mata úmida.

Palavras-chave: aves, conservação, efeito estufa, metapopulações, mata semidecídua, cana-de-açúcar.

INTRODUCTION

In central São Paulo State, there was once a belt of semideciduous forest between the evergreen coastal and montane forests, and the interior deciduous woods and savannas (cerrados). Only small patches of the belt persist today, as the region was deforested for agriculture and cities. In 1982, we started studies of birds in a remanescent patch of semideciduous forest, a 230-ha tract (Pagano & Leitão, 1987; Pagano *et al*., 1987) on watershed between the basins of the Mogi-Guaçu and Tietê Rivers, at the south edge of the Fazenda São José, border of Rio Claro and Araras townships (22°21'S, 47°29'W and 675 m elevation).

Studies of birds of other remnant semideciduous forests include ones done near Campinas and Anhembi (Willis, 1979; Aleixo & Vielliard, 1995) and northward, near Jardinópolis (Chiarello, 2000). Transitional vegetation approaching the cerrado near São Carlos, just northwest (Marini *et al.*, 1997), has received some study. Two master's theses (Cândido-Júnior, 1991, published 2000; Gondim, 1995) studied edge effects and fruit-eating birds in Fazenda São José.

Here we report our bird censuses in and near the Fazenda São José woodlot. Later parts of the study will analyze bird body masses, measurements, molt cycles, ectoparasites, and include detailed observations for understory species captured and banded.

STUDY AREAS AND METHODS

An originally large forest area was cut into three fragments about 60 years ago (Pagano & Leitão, 1987). Sugar cane and other agriculture now surround this tract, the southernmost of the fragments. Grassy swales, with ponds in rainy years, cut through the cane fields. A small permanent farm pond near the main road to Araras occupies part of one grassy swale (22°23'S, 47°27'W, at 650 m). Secondary scrub and woods along the Ribeirão Claro, at 600 m and 22°20'S, 47°30'W on the west edge of the woodlot, partially connect the woodlots. A small side creek, arising in the north edge of the woodlot, provides some wooded swamps on its way west. Just southeast in the forest, an east-west belt of open-understory woods borders another belt of bamboo-crowded understory across the north-south divide of the Mogi-Guaçu and Tietê (border of Rio Claro and Araras townships). Flowering and death of this large bamboo in 1994 left little, except for a small species forming thickets in the central understory. Dense spiny *Celtis* vines took over in the southern understory, moving in from the wind-damaged south edge of the woodlot. Tall jequitibá (*Cariniana estrellensis* Kuntz) trees project over the canopy near the divide. Eastward, a cleared swath along an electric power line and a cat-tail marsh cut off two narrow end stretches of the woodlot. The marsh drains southeast toward the Mogi-Guaçu, not southwest to the Tietê as does the Ribeirão Claro.

Several north-south cleared trails, cleared for Pagano's and later studies, cross the woodlot and were used for censuses, as were the road along the west edge near the Ribeirão Claro and one on the south edge along sugar cane fields of Fazenda São João. In the cane field, a dip collected rain water in the strong El Niño years of 1982-83, and we recorded water birds at that time.

We set up trails in a 300 × 200 m forest area (six 100-m squares) on the divide, by the south edge and sugar cane, in 1983-88; the spiny vines took over later. All banding studies were in the 100-m squares and on a botany trail through the squares. We had hoped to locate bird territories and do behavioral studies, but the wind damage and dense spiny vines complicated our and our students' work. The road along the west edge was closed in 1995; elephant grass grew there, so 13 of 22 later visits were made to the botany trail through the banding area and to the east marsh, rather than to the west road and the botany trail as earlier.

Willis recorded birds at any distance on transect counts, ordinarily from just before dawn to just after midday. He usually walked the west road and back, then the botany trail and back, during about 6 hours from dawn to midday. After the west road was closed, an hour or so at dawn was spent in the east marsh and nearby edges; earlier, these were visited only briefly at dawn and midday for around a half hour. In 1982-1984, when other cross trails were open, he occasionally checked them rather than the main botany trail. Here, as in Willis (1979), we record the number of birds per 100 hours of study, to avoid using space-waste

decimals. To determine total numbers of birds actually seen, one only need multiply by the number of hours of study divided by 100.

Banding studies involved 8 mist nets (12 m long, of 36 mm mesh) for about 10 hours daily, along one edge of 100-m squares. We banded on 24 days from 6 Aug. 1983 to 17 June 1984, then 36 days from 12 March 1987 to 16 Aug. 1988. In 3 morning visits in 1985-86 and 12 such visits 1989-2000, 3-5 nets were placed along trails near the road, for ornithology classes. B. S. Ataguile, a student, helped with many captures in 1987-1988; other students also helped. Some 4 hours per visit were of transects along the edge to the east marsh, to the depression in the nearby sugar cane, or on the woodland trails. Half-day visits added 2 hours or so of censuses per visit. Oniki measured the captured birds and checked for ectoparasites, molt, brood patches, and defects.

RESULTS AND DISCUSSION

Species

Willis recorded 263 species (Table 1) in the 601.4 hours of censuses (155 visits) 1982-2000. *Xiphorhynchus guttatus*, listed by Cândido-Jr. (2000), is not a São Paulo species and may have been a *Dendrocolaptes platyrostris*. Of these, 67 were birds of surrounding open areas (including distant ponds or marshy zones in the open), 22 of marshes or creeks next to the woods, and 63 edge birds.

Five birds of edges and 5 of the 111 woodland species were vagrants. Subtracting these vagrants and 67 open-area birds, 186 species were birds of the woodlot itself. Of these, 22 were of marsh and water areas, not present in woods studied by Willis (1979). Of the remaining 164 edge and forest species, 12 were not recorded in 1982-86 (152 early species present), 22 not in 1987-92 (144 species present), 32 not 1992-97 (132 species), and 31 not in 1997-2000 (133 species). Four of the species in 1987-92 were not recorded before or since, two in 1992-97, and six in 1997-2000. Some 62 species (considered in a later part of this report) were captured and banded. Canopy species, vagrants, marsh and water birds, and open-area birds were not captured, so that the banding project captured 38% of the 164 woodlot and border species.

TABLE 1

Birds recorded per 100 hours.
1 = 1982-83 plus 2 visits 1986, 2 = 1987-92, 3 = 1992-95, 4 = 1997-2000, a = banding 1983-86, b = 1987-88, c = end 1988-91, d = 1993-97. A = open areas, B = border, C = creek or marsh, n = migrant from north, N = winter from north, s = migrant from south, S = winter from south, T = summer breeder, V = vagrant.

Species	1	a	b	2	c	3	d	4
Crypturellus obsoletus	22	24	29	27	24	28	50	28
Crypturellus parvirostris – A	7	10	16	20	12	32	20	16
Crypturellus tataupa	9	19	21	25	42	38		28
Rhynchotus rufescens – A			2	1	6	6	10	3
Nothura maculosa – A	4	3	1			1		7
Penelope superciliaris	6			1		1		
Dendrocygna viduata – A	22	11	8			1		
Cairina moschata – C	21	10	4	3	12	7	10	2
Amazonetta brasiliensis – C	25	16	67	10	6	17		20
Nomonyx dominicus – A	2	4						
Tringa solitaria – An	1	1						
Bartramia longicauda – An		10						
Gallinago paraguayae – A	2							
Gallinago undulata – A						8	10	2

TABLE 1 (*Continued*)

Species	**1**	**a**	**b**	**2**	**c**	**3**	**d**	**4**
Jacana jacana – A	8		3	3	6	1	10	3
Vanellus chilensis – A	19	31	11	16	36	88	300	107
Rallus nigricans – C	2	4	6	1		3		13
Aramides cajanea – C	1	1	3	1		8		8
Aramides saracura – C	22	3		7		9		13
Porzana albicollis – A	9	9	13	1	12	5	10	7
Laterallus melanophaius – C	9	7	6	9		5	10	16
Porphyriops melanops – AS		1						
Gallinula chloropus – A	7	6	4	4	6	21	20	16
Cariama cristata – A	5	4	5	26	6	29	60	43
Tachybaptus dominicus – A	5	8						
Ardea alba – A				3		1		7
Bubulcus ibis – A				1				
Egretta thula – A				1				
Butorides striatus – C	2		1	1		3		
Syrigma sibilatrix – A	3	3	2		6	14	50	44
Pilherodius pileatus – C				1				
Mesembrinibis cayennensis – C				4		6		
Coragyps atratus – B	101	109	42	121	72	59	110	104
Cathartes aura	6	1						
Elanus leucurus – A			1					2
Leptodon cayanensis	4			3		5		
Accipiter striatus – B								1
Buteo albicaudatus – A			2					
Buteo magnirostris – B	19	9	14	23	12	16	10	35
Buteo brachyurus – B	3		3	3		1		
Buteogallus meridionalis – A	1	3	5		6	1		2
Micrastur ruficollis		2	3					
Micrastur semitorquatus								1
Caracara plancus – B	25	48	21	20	12	37	20	35
Milvago chimachima – A	8		5	4	6	7	10	10
Herpetotheres cachinnans – B	5	8	5	4		7		
Falco sparverius – A	1	3	2	3	6	1	10	5
Falco femoralis – A	1		2		6	2		3
Otus choliba – B		7	2			7		1
Glaucidium brasilianum	1	7	15	4		7		
Athene cunicularia – A	5	2	5			8		
Caprimulgus rufus								1
Caprimulgus parvulus – AT						1	10	
Nyctidromus albicollis – B	3	5	5	2	30	24	10	13
Hydropsalis torquata – A		8	16	6		47	30	10
Podager nacunda – A								3
Chordeiles minor – AN			4			3		

TABLE 1 (*Continued*)

Species	**1**	**a**	**b**	**2**	**c**	**3**	**d**	**4**
Lurocalis semitorquata – T		2	2			9		
Chaetura meridionalis – AT	1	1						
Phaethornis pretrei	18	15	22	11	12	13	20	28
Eupetomena macroura – B	2		3			1		
Florisuga fusca	10	1	2	3		5	10	3
Colibri serrirostris – B	14	8	16	1	6			5
Anthracothorax nigricollis – T							10	
Chlorostilbon aureoventris – B	8		2	1		10	20	5
Thalurania glaucopis	11	7	5	14		13		3
Amazilia lactea	34	10	5	7		21	30	13
Amazilia versicolor	21	8	9	20	6	9		3
Aphantochroa cirrochloris	1			1				
Leucochloris albicollis – S			1					
Heliomaster squamosus	1			1		2		
Calliphlox amethystina	2							
Aratinga leucophthalmus – S	15		30		48	36		15
Aratinga auricapilla – V			1					
Brotogeris chiriri – V			3					
Pyrrhura frontalis	17	14	30		12			
Forpus xanthopterygius – B	89	15	58	50	84	38	100	77
Pionopsitta pileata – V			1					
Pionus maximiliani	109	62	82	50	102	75	80	69
Amazona aestiva – V				1				
Coccyzus melacoryphus – BT	4		1	1				
Coccyzus euleri – T	1							2
Coccyzus americanus – N				1				
Piaya cayana	65	52	45	50	48	75		25
Crotophaga ani – B	64	22	43	20	102	34	60	56
Guira guira – A	8			4	42	8	50	5
Tapera naevia – B	18	6	6	11	6	13	20	10
Dromococcyx pavoninus – T	1	2	1			1		3
Columba cayennensis – B	67	16	33	85	96	102	70	69
Columba picazuro – A	4	5	5	11	6	19		43
Zenaida auriculata – A	134	49	50	27	30	47		5
Columbina talpacoti – B	200	50	36	56	48	47	20	64
Claravis pretiosa – T	13		7	7		1		
Leptotila verreauxi	159	67	82	174	120	145	100	115
Leptotila rufaxilla		3	1	11		5		2
Geotrygon violacea	2			1		5		2
Trogon surrucura	31	34	33	21	18	23		25
Ceryle torquata – C	1			1				
Chloroceryle amazona – C	1					3		
Chloroceryle americana – C	1			3				

TABLE 1 (*Continued*)

Species	**1**	**a**	**b**	**2**	**c**	**3**	**d**	**4**
Bucco chacuru – A	1							
Ramphastos toco						3		2
Picumnus albosquamatus	52	36	46	47	36	31	30	30
Melanerpes candidus – B	5	72	14		30	1		2
Colaptes melanochloros – B	16	11	8	16		10	10	10
Colaptes campestris – A	19	8	19	27	12	35	30	40
Veniliornis passerinus	33	17	31	24		41	30	30
Dryicopus lineatus	22	15	11	26	12	27	10	23
Campephilus robustus	14	5	9	11	12	8		8
Sittasomus griseicapillus	35	29	27	24	24	36	70	43
Dendrocolaptes platyrostris	3	15	4	3	6	8		8
Lepidocolaptes fuscus	10	14	14			1		
Furnarius rufus – A			7	7		15	10	30
Phacellodomus ferrugineigula – C	24	5	2	17	12	16	30	41
Automolus leucophthalmus	51	45	23	28	18	40	10	15
Lochmias nematura	1	1		1		2		7
Sclerurus scansor	4	1	1			1		
Xenops rutilans	4	5	3	3		12	20	7
Certhiaxis cinnamomea – C	2		5	1	6	2		3
Certhiaxis vulpina – C				3		6		
Synallaxis spixi – B	39	5	3	51		56	10	35
Synallaxis albescens – A	1		5					
Synallaxis frontalis – B	17	43	44	34	36	40	70	28
Synallaxis ruficapilla	116	146	128	118	78	100	110	86
Psiloramphus guttatus	40	51	34	57	30	36	10	18
Conopophaga lineata	103	147	86	161	66	66	100	48
Hypoedaleus guttatus – V				1			10	
Mackenziaena severa	83	95	73	67	60	73	80	68
Taraba major – B		1						5
Thamnophilus caerulescens	98	80	63	103	54	87	70	63
Thamnophilus ruficapillus – A			1			2		
Thamnophilus doliatus – B	26	6	12	57		46	20	35
Dysithamnus mentalis	71	105	91	74	24	98	70	92
Herpsilochmus rufimarginatus	128	115	87	121	102	125	50	104
Pyriglena leucoptera	112	210	159	151	132	113	120	112
Drymophila ochropyga	38	66	50	61	72	73	80	72
Drymophila ferruginea	161	135	102	134	144	138	120	91
Phyllomyias fasciatus – BV	1							
Capsiempis flaveola	100	81	82	103	54	131	100	77
Myiornis auricularis		4	6	4	24	9		5
Hemitriccus diops	14	32	20	10	18	36	10	30
Hemitriccus nidipendulus – B	1					1		5

TABLE 1 (*Continued*)

Species	**1**	**a**	**b**	**2**	**c**	**3**	**d**	**4**
Todirostrum plumbeiceps	1			7		3		3
Todirostrum poliocephalum	37	34	56	53	42	45	50	49
Todirostrum cinereum – B	2	8	8	9	12	9		21
Serpophaga subcristata – B	16	2	2	4		7		3
Myiopagis caniceps	46	43	42	19	36	25		13
Myiopagis viridicata – T	10	16	20	17	12	17	20	5
Elaenia chiriquensis – BV	1							
Elaenia flavogaster – B	28	3	9	14		21	20	40
Elaenia spectabilis – CT	8			6				
Elaenia obscura – B	4			4	6			
Elaenia mesoleuca – s	2	1				2		
Elaenia parvirostris – s	1							3
Phaeomyias murina – BV	1							
Cnemotriccus bimaculatus – B	4	4	3			17	80	20
Lathrotriccus euleri	71	70	49	63	36	47	110	30
Myiophobus fasciatus – B	40	23	18	31	30	42	60	36
Platyrhynchus mystaceus		1	1	6		5		5
Tolmomyias sulphurescens	66	54	29	67	24	58		48
Contopus cinereus – s	11	9	4			2		2
Camptostoma obsoletum	20	9	11	27	6	32	30	18
Corythopis delalandi	1							
Knipolegus cyanirostris – Bs	2	2	1			1		3
Colonia colonus	60	69	56	26	24	22	40	26
Fluvicola leucocephala – C	13	1	11	6	24	12		23
Pyrocephalus rubinus – AS								3
Xolmis velata – A	2					1		3
Xolmis cinerea – A		1	6		12	2	30	8
Satrapa icterophrys – Bs	12					1	10	8
Gubernetes yetapa – A	5					3	30	8
Machetornis rixosus – A	1					2		
Tyrannus melancholicus – BT	26	31	44	50	18	36	60	21
Tyrannus savana – As	1		2	7		3		8
Empidonomus varius – BT	10	4	10	23		22	30	7
Myiodynastes maculatus – BT	14	28	17	17		20	30	13
Pitangus sulphuratus – B	40	17	14	33	6	39	10	48
Myiozetetes similis – C	13	3	11	7		18	10	23
Megarynchus pitangua – BT	11	10	13	20		18		
Myiarchus swainsoni – T	13	38	19	9		6	30	5
Myiarchus ferox – B	26	14	17	36	6	30	40	18
Leptopogon amaurocephalus	26	29	15	24		21	20	20
Schiffornis virescens	7	3						
Pachyramphus polychopterus – BT	14		5	24		13		2

TABLE 1 (*Continued*)

Species	**1**	**a**	**b**	**2**	**c**	**3**	**d**	**4**
Pachyramphus viridis – Bs	2							
Pachyramphus validus – B	5	2	3	11		12	10	8
Tityra inquisitor – s			2					
Tityra cayana – T	1	7	3			2		2
Phibalura flavirostris – Bs	5	1						
Antilophia galeata – C	4			3				2
Chiroxiphia caudata	81	44	11	54	24	85	40	51
Manacus manacus	8	3	2	7	12	14		16
Tachycineta leucorrhoa – A	23	92	91	3	66	4		26
Progne tapera – AT	40	11	14	7		19	10	2
Progne subis – AN	17	4	13	19				
Progne chalybea – As	2		2			1		
Notiochelidon cyanoleuca – A	27	380	194	23		119	80	21
Alopochelidon fucata – As	2	1		2		24		21
Stelgidopteryx ruficollis – B	48	138	107	14	72	73	90	69
Hirundo rustica – AN	4	151	53			1		
Petrochelidon pyrrhonota – An			30	3				
Cyanocorax cristatellus – B						1		3
Troglodytes aedon – B	16	2	11	3	6	17	10	31
Donacobius atricapillus – C	11	5	5	7	6	8		31
Mimus saturninus – A	10	6	13	6		12	20	16
Turdus nigriceps – s	1	3	2	3		3	10	
Turdus amaurochalinus – B	35	1	5	20	6	28		3
Turdus leucomelas – B	2	1	11	11		28		38
Turdus rufiventris – B	4	3	5	30		25		12
Turdus albicollis	10	2				1		
Anthus lutescens – A	7	6	2	3	6	1		
Cyclarhis gujanensis	78	58	77	83	54	80	80	51
Vireo olivaceus – T	53	83	42	47	42	40	120	26
Hylophilus amaurocephalus – B	14			1				2
Passer domesticus – A	3							
Estrilda astrild – A	29		13		12	14		16
Zonotrichia capensis – B	123	98	74	60	66	80	180	41
Myospiza humeralis – A	5	2	9			8	10	21
Emberizoides herbicola – A	2	3	6		6	2		10
Arremon flavirostris	2	4		1	6			10
Arremon semitorquatus		1		1				
Donacospiza albifrons – As	1							
Coryphospingus cucullatus – B	2		2					2
Haplospiza unicolor – S						2		
Tiaris fuliginosa	10	6	3	6		4		2
Volatinia jacarina – B	69	12	30	36	24	6		74
Sporophila leucoptera – A			2			1		

TABLE 1 (*Continued*)

Species	**1**	**a**	**b**	**2**	**c**	**3**	**d**	**4**
Sporophila lineola – BV	1							
Sporophila caerulescens – B	110	65	29	46		20	20	165
Passerina brissoni – BV				1				
Passerina glaucocaerulea – BS	1	4		1	6			
Pitylus fuliginosus	24	7	3	13		2	10	15
Saltator similis	34	8	5	21		21	10	13
Schistochlamys ruficapillus – A	5							
Hemithraupis ruficapilla	42	57	24	34	6	50	70	33
Nemosia pileata	12	18	8	9		10	20	
Thlypopsis sordida	58	38	32	43	24	47	20	33
Pyrrhocoma ruficeps – S	2							
Trichothraupis melanops	98	104	67	70	54	77	110	71
Tachyphonus coronatus	67	31	24	78	36	63	70	46
Habia rubica	84	89	52	60	30	89		71
Ramphocelus carbo – B	44	4	11	58		54	60	18
Thraupis sayaca – B	59	14	28	60		48	40	28
Tangara cayana – B	42	14	5	48		29	20	3
Pipraeidea melanonota – S	10	3				2		
Euphonia chlorotica	14	1	9	6	6	3		8
Euphonia violacea – S	1		1			1		
Euphonia musica – S								2
Dacnis cayana	13		6	6	12	10	20	3
Coereba flaveola – B	53	17	8	19		25	60	18
Conirostrum speciosum	53	38	17	37		51	50	12
Parula pitiayumi	16	5	1					
Geothlypis aequinoctialis – C	35	13	17	47	18	64	30	61
Basileuterus flaveolus	48	56	62	78	96	77	110	66
Basileuterus leucoblepharus	76	8		41		55		36
Basileuterus hypoleucus	207	252	148	155	126	150	210	143
Basileuterus culicivorus – S		3		1		2		
Pseudoleistes guirahuro – A	2			7				30
Agelaius cyanopus – C	4		3	3	18	1		3
Agelaius ruficapillus – A			15			8		66
Molothrus bonariensis – A	34			10		2		2
Cacicus haemorrhous	8			9				
Days	34	25*	33*	15	5*	20	3*	12
Hours	166.8	100	132	70.2	16.6	106	10	60.7
Night Hours	0	+	+	+	+	8.3	+	2.0

* Other days, birds not recorded. Hours of banding not counted.

Comparison with Campinas woodlot

In size and forest type, the São José woodlot is rather like the Fazenda Santa Genebra semideciduous woodlot of Campinas, studied in the 1970s by Willis (1979) and in the 1990s by A. Aleixo (Aleixo & Vielliard, 1995). Considering only the nonvagrant forest and border species, there were 152 species in São José in 1982-86, 144 in 1987-91, 132 in 1992-97, and 133 in 1997-2000. In Santa Genebra, there were 145 such species in the 1970s (147 counting two swifts that fly over) and 117 in the 1990s. Both woodlots lost species gradually.

Other than substitution of *Picumnus* and *Veniliornis* for coastal species in Campinas, there were few differences between the woodlots. The kite *Ictinia plumbea*, antshrike *Hypoedaleus*, and mixed-flock canopy flycatcher *Sirystes sibilator* persist in Campinas, while in the 1970's there had been a summering hawk (*Harpagus diodon*); two owls (*Tyto alba, Otus atricapillus*); two swifts (*Streptoprocne zonaris, Cypseloides fuliginosus*); two rare woodcreepers (*Dendrocincla turdina, Campylorhamphus falcularius*); two flycatchers (open-understory *Hemitriccus orbitatus* and migrant *Elaenia albiceps*); and rare, possibly vagrant *Dendroica striata* (migrant from North America) and *Icterus cayanensis* (an edge species spreading eastward). In the 1990s, Aleixo added the woodpecker *Celeus flavescens* plus a possibly vagrant flycatcher (*Mionectes rufiventris*) and tanager (*Tersina viridis*), not yet recorded in São José. Campinas gained, much like São José, a few dry-forest fruit-eating *Aratinga, Amazona*, and *Ramphastos*. Probably present but not seen in the 1970s, *Colaptes melanochloros* and *Turdus rufiventris* were also new in Campinas.

By the 1990s, Campinas seemed to have lost *Cryturellus obsoletus, Glaucidium*, summer *Anthracothorax*, winter *Leucochloris, Coccyzus euleri, Dromococcyx, Sittasomus, Dendrocolaptes, Lepidocolaptes, Automolus, Lochmias, Synallaxis ruficapilla, Mackenziaena, Dysithamnus, Herpsilochmus, Drymophila ferruginea, Capsiempis, Hemitriccus diops, Todirostrum poliocephalum, Myiopagis caniceps*, migrant *Elaenia mesoleuca, Platyrhynchus, Corythopis, Schiffornis, Hemithraupis*, plus winter *Euphonia violacea* and *Basileuterus culicivorus*. Several of these were also lost in São José, or no longer reached there in migration.

The Campinas woods lacked several bamboo-forest upland species throughout, notably *Drymophila ochropyga, Psiloramphus, Todirostrum plumbeiceps*, and *Myiornis*. *Arremon, Pyriglena, Trogon*, and *Pyrrhura* were also absent, as well as *Sclerurus* (both the latter disappeared in São José). Several hummingbirds (*Aphantochroa, Heliomaster, Calliphlox*) although unrecorded in Santa Genebra, were in suburbs there; censusing canopy nectarivores is difficult in Rio Claro and Campinas. Other birds absent in Campinas were *Cathartes, Leptodon, Micrastur* spp., *Herpetotheres* (the first two now gone in São José also), and many of the dry-forest species that invaded São José from the northwest (*Cyanocorax* reached Campinas, as did *Ramphastos* later).

Lost and new species

Of 67 open-area species near São José, 22 seemed to disappear in 1997-2000, but open areas were not censused intensively and will very likely still occur with the 45 species recently recorded. Four "lost" species (*Thamnophilus ruficapillus, Machetornis, Passer* and *Schistochlamys*) definitely still occur in open areas closer to or in Rio Claro. Cane fields are not suitable for the species of this group, and grassy or bushy swales provide little habitat locally. *Progne subis*, a northern open-area wintering bird (here present in summer), once roosted in large flocks in city parks in Rio Claro, but has disappeared from the city and region; it was last noted in 1993. A probable southern open-area wintering bird (here present in winter), *Donacospiza albifrons*, was only noted 8 April 1983 (2 birds together) in marsh scrub near the farm pond, in an El Niño rainy year.

In 1983, a flooded pond inside the cane field attracted several water birds not seen since (*Tachybaptus, Nomonyx*, northern migrant *Tringa, Gallinago paraguayae*, southern winter *Porphyriops*). The first three still occur at times on a large permanent pond in a sizeable eucalyptus grove or "Horto", closer to Rio Claro. The northern migrant *Bartramia* was spotted in wet cutover cane fields later in 1983, and has not been recorded since. Migrant swallows have been over cane mostly in wet years (*Hirundo, Petrochelidon*). *Dendrocygna* was recorded at that time, but later was occasionally seen on the roadside farm pond; hunters probably hunt it there, discouraging recent visits, except at night when we did not visit. During the day, it is

still common on the Horto pond and a city lake, both protected. Hunters probably rarely check the El Niño pond, hidden in the cane and empty except in wet years.

The four other species that seem to have disappeared recently have always been uncommon in cane areas near Rio Claro, commoner in savannas to the northwest: *Buteo albicaudatus* (with cane fires), *Bucco chacuru, Synallaxis albescens*, and *Sporophila leucoptera*.

Seventeen "new species" of the 67 in open areas probably were not among the 50 species recorded in 1982-86 either because Willis has been checking before dawn mostly in recent years (*Rhynchotus, Gallinago undulata, Caprimulgus parvulus, Podager, Chordeiles, Thamnophilus ruficapillus*) or because they are rare visitors at the farm pond or just flying over (*Ardea* spp., *Bubulcus, Egretta, Elanus, Buteo albicaudatus*, northern migrant *Petrochelidon*, southern migrant *Pyrocephalus, Sporophila leucoptera*). The *Sporophila, Petrochelidon, Thamnophilus*, and *Buteo* are also unrecorded in recent years (above), as are *Bubulcus, Egretta*, and *Chordeiles*.

Two of the 17 new open-area species were perhaps absent 1982-86. *Furnarius* definitely moved into the farm pond after 1984, perhaps after the muddy roads dried up, allowing it to walk there. Cane areas provide little forage for the species, though houses with lawns are not far south. *Agelaius ruficapillus* moved to the farm pond marsh, as it is increasing statewide; but cane fields here are rarely suitable for its open-field foraging.

Columba picazuro of dry regions has also invaded São Paulo in recent years (Willis & Oniki, 1987) and has increased even near Fazenda São José, where it finds food in a few open fields but rarely nests in the few scattered trees, hence not being as common as border nesting *C. cayennensis. Zenaida* of open fields and *Columbina* of edges seem less usual than during the 1983 El Niño, but both continue common in the city during the last 15 years. As they drink water on open roads in wet years but not in dry, the problem recently may be heat and lack of water at midday in the São José cane fields. Weed seeds may also be less available in dry years. *Progne tapera* has also become generally less common in recent years and, like other *Progne*, was perhaps more successful during the wet 1982-84 period; it had roosted in town with *P. subis* earlier.

Creek and marsh birds were usually present both at the start and end of the studies, though *Cairina* has become less common in recent dry years. It is still frequent on the protected Horto Pond, as are *Butorides* and *Ceryle* (both rare in 1982-84). *Aramides saracura* appeared on roads more in 1982-84. *Elaenia spectabilis* seemed to disappear after 1989 and *Certhiaxis vulpina* after 1995, while *Pilherodius* was only recorded in 1990, but censuses were not frequent on the bushy and hard-to-approach creek; these species may have been overlooked as they had never been recorded at the east marsh.

By 1997-2000, some 31 species had disappeared from the woodlot, including 6 border species. Eleven were birds from the south that migrate or winter in the Rio Claro region. Five southern species (*Phibalura, Pyrrhocoma, Pipraeidea, Passerina glaucocaerulea*, and *Basileuterus culicivorus*) were registered in the wet El Niño years of 1982-84, with a few winter records later only for *Phibalura* and *glaucocaerulea*. *Pyrrhocoma, Pipraeidea*, and *Basileuterus* were recorded in the dense understory or canopy of the Rio Claro Horto also mainly during 1982-84. *Euphonia violacea* was noted infrequently in 1982-92, *Leucochloris* only in Aug. 1988, *Haplospiza* only May 1994. They are rare as southern winter visitors in the region. Migrant *Pachyramphus viridis, Turdus nigriceps*, and *Elaenia mesoleuca* are also not common locally.

Three summer visitors (*Claravis, Coccyzus melacoryphus, Tityra inquisitor*) and a northern winter bird (*Coccyzus americanus*) are also unrecorded recently. *Tityra* and *C. americanus* are rare in the region, but the other two may have decreased due to recent dry years.

Some other forest and border species that have disappeared since 1982-84 may have been affected by low rainfall in the last 15 years. *Arremon semitorquatus* of the humid east of the state seems to have been replaced by *A. flavirostris* of the dry interior. Treetop *Parula* has dropped in numbers both in São José and in eucalyptuses near Rio Claro, though it seems a dry forest bird and should not have disappeared with droughts. Other treetop birds that join mixed flocks, such as *Myiopagis caniceps, Hemitriccus, Conirostrum*, and *Nemosia* also seem less frequent recently. *Megarynchus* continues in the Horto near Rio Claro, however, and in São José may have little edge habitat except for the hard edges along the cane fields (see below).

Glaucidium, *Pyrrhura*, and five other midlevel to understory moist-forest species seem to have disappeared due to loss of the few individuals present earlier: *Lepidocolaptes*, *Sclerurus*, *Corythopis*, *Schiffornis*, and *Turdus albicollis*. *Cacicus* was a river-edge forest species that definitely disappeared from near the east marsh after 1987; it did not survive on Fazenda Barreiro Rico, about 100 km west, after river woods were cut (Willis, 1979; Magalhães, 1999).

Hummingbirds were common mainly in *Inga* and *Tabebuia* flowers along the Ribeirão Claro, hence several upper-level species have seldom been recorded of late. *Anthracothorax* was rare in migratory periods, and *Eupetomena* and *Heliomaster* are just rare (more common in the eucalyptus grove off to the south). Study of flower cycles probably would have provided better records. Understory and midlevel *Phaethornis*, *Thalurania*, *Amazilia lactea*, and *versicolor* were more successfully sampled.

Micrastur ruficollis appeared in 1986-87 and then disappeared. Hunters would not affect these species, although extreme droughts like the La Niña from March to winter of 2000 may have.

Cathartes has disappeared from the Rio Claro region, though still present on rather dry escarpments with better updrafts off to the north (where *Sarcorhamphus* still occurs). *Coragyps* declined briefly in 1987, partly due to hunters killing large numbers around a few carcasses. They also may have killed the few *Cathartes* near Rio Claro. *Penelope* almost certainly was exterminated by hunters or wandering dogs, first near the roadside banding sites and later in the woods. Various hawks that have disappeared (*Leptodon*, *Buteo brachyurus*) may have been shot by occasional hunters, or affected by dry years and low populations. *Passerina brissoni* is a vagrant in the region due to capture for caging (as *Oryzoborus angolensis*, *Gnorimopsar chopi*, *Sicalis flaveola)*, the fate of many macaws and parrots formerly found the Rio Claro region.

Five new forest and border species (*Accipiter*, *Micrastur semitorquatus*, *Caprimulgus rufus*, *Ramphastos*, *Cyanocorax*) are still rather rare in the Rio Claro region, and like *Taraba major* have apparently moved in from dryer and more open regions to the north and west. None have yet been as successful as *Columba picazuro*, which feeds in open fields. *Micrastur* do seem to move in and out of local woodlots, as for instance *M. ruficollis* (above). *Euphonia musica*, a rare winter visitor at forest edges, was recorded only 1997 but was probably present earlier

Some new species may yet disappear and lost species reappear, especially if droughts (possibly linked to greenhouse effects) stop. Many species are able to recolonize (travel-prone species of Willis 1979, metapopulations in more recent works). However, nonmetapopulational forest species like *Lepidocolaptes* or *Schiffornis* may be unable to reach the woodlot again. Thus, though border and other species seem to appear and take the place of lost species, the regional diversity will probably decrease with loss of forest species partly concealed by local spread of outside species already present. Entry of new dry-forest species merely moves the centers of distribution of these birds, concealing loss of diversity eastward in moist forest. As houses and intensive agriculture invade the region and water supplies get scarce, even the open-area, border, and water birds will vanish.

Intervening censuses

In the case of Fazenda São José, we checked birds in intervening years, notably 1987-92 (columns b, 2 and c in Table 1). This allowed one to see if birds absent in the intermediate period had reappeared in the final study periods, rather than being "lost" forever. Eight forest species, seemingly lost in 1987-92, reappeared later: *Calliphlox* (rare spring), *Coccyzus euleri* (rare summer), *Taraba* (invading region), *Hemitriccus nidipendulus* (rare), *Elaenia parvirostris* (rare migrant), *Satrapa icterophrys* (uncommon migrant), *Turdus albicollis* (rare), and *Pipraeidea* (rare winter). All but *Coccyzus* and *Turdus* are more frequently found at soft or bushy edges, censused less (2 of Table 1) than earlier. Probably all these species were present in 1987-92, but not recorded; or they were travel-prone metapopulations and reinvaded.

This indicates the kind of error one can make in such censuses – 8 of 16 species (50%) seemingly lost in 1987-92 either moved in again or were actually present throughout. Some 4 species, new in 1987-92 (*Micrastur ruficollis*, winter *Leucochloris*, northern winter *Coccyzus americanus*, summer or migrant *Tityra inquisitor*), were not sighted later. Some 20 species present both in 1982-86 and 1987-92 subsequently disappeared.

In open areas in 1987-92, three uncommon species (*Chaetura, Xolmis velata, Gubernetes*) of 15 seemingly lost ones (or 20%) reappeared from 1997 on. Nine rare species previously unrecorded turned up, and four (*Bubulcus, Egretta, Buteo albicaudatus,* and *Petrochelidon*) were not seen thereafter, while five (*Ardea alba, Chordeiles, Thamnophilus ruficapillus, Agelaius ruficapillus, Sporophila leucoptera*) were resighted in later years. Only 2 swallows, present in 1982-86 and 1987-92, vanished later; 12 of 67 open-area species had already been lost soon after the 1982-84 El Niño rains. Open-area species, notably aquatic ones, seemed more directly affected by drought than were forest species.

Of creek and marsh species, only *Chloroceryle amazona* seemed gone in 1987-92 (reappearing later), while two other species were not reported from 1992 on (*Ceryle, Elaenia spectabilis*). *Pilherodius* in 1987-92 was not recorded later, while *Mesembrinibis* and *Certhiaxis vulpina* were. As noted above, it was difficult to check these creekside species. Records of these birds seemed mostly unrelated to drought, as creek and marsh water did not dry up as much as did the cane swales or forest.

For the intervening years of 1992-97 (columns 3 and d in Table 1), 8 forest or border species seemingly lost reappeared later: C*olibri, Aphantochroa, Calliphlox, Coccyzus euleri, Taraba, Elaenia* spp., *Antilophia, Hylophilus, Arremon flavirostris,* and *Coryphospingus*. Thus, 12 of 19 (63%) of the birds lost from the preceding period (or earlier) reappeared later. Some 15 other species present up to 1992-97 disappeared later (of these, *Turdus albicollis* and *Pipraeidea* were also absent just before). Two species (*Anthracothorax* and *Haplospiza*) were only recorded in 1992-97, and *Ramphastos* and *Cyanocorax* were new species that also appeared later.

In open areas in 1992-97, only 2 species that had disappeared (*Elanus* and *Pseudoleistes*) were noted later, out of 8 species (25%) seemingly lost after the preceding 5 years. The only new species were *Gallinago undulata* and *Caprimulgus parvulus,* noted due to pre-dawn work. Seven species were not seen from 1998 on.

After 1992-97, *Butorides* and *Certhiaxis vulpina* seemed to disappear from creeks and marshes. Three species (above) had disappeared by 1992.

Hard vs. soft edges

The south forest edge was hard, the forest (though much damaged by wind blowdowns and *Celtis* vines) abruptly ending at the road and cane field of the neighboring ranch. The west and east edges were either soft or gradual, with scrub and grass, plus additional weeds along the eastern power line swath and cat-tails along the nearby creek. Some species showed a clear difference in censuses because of this, for instance *Synallaxis spixi* of bushes and tall grass: it was rarely recorded on netting days (abcd in Table 1) along the hard south edge, and regularly on census days (1234 in Table 1) when soft east or west edges were checked. *S. frontalis* inside shady borders and *S. ruficapilla* in the woods did not show this pattern.

Other birds that showed a preference for soft edges were *Aramides saracura* and a few other water species or flowering-tree hummingbirds near Ribeirão Claro: *Buteo magnirostris; Amazilia; Heliomaster; Tapera; Columbina; Leptotila* spp.; *Dryocopus; Campephilus; Thamnophilus doliatus; Serpophaga; Elaenia flavogaster* and *E. obscura; Myiophobus; Camptostoma; Satrapa; Empidonomus; Pitangus; Myiarchus ferox; Pachyramphus* (3 spp.); *Troglodytes; Turdus amaurochalinus* and *T. rufiventris; Hylophilus*; *Volatinia; Sporophila caerulescens; Pitylus* (?)*; Saltator; Thlypopsis; Tachyphonus; Ramphocelus; Thraupis; Tangara; Coereba,* and *Parula.*

Some birds were commoner on regular census days with soft edges, but for other reasons. Several species were found more in swampy uncluttered woods near creeks (not visited on banding days) along the north or west edge: *Geotrygon, Lochmias, Sclerurus*, 3 manakins, and *Basileuterus leucoblepharus*. Only the manakins used bushes beyond the forest border. *Penelope* was absent along the hard cane-field edge due to hunters; it regularly uses similar edges where not hunted.

Birds that seemed somewhat more common (Table 1) along the hard edge were *Buteo brachyurus* (soars and dives at high edges), *Nyctidromus* (road by the wood at night), *Melanerpes* (using roost hole), *Synallaxis frontalis* (?), *Drymophila ochropyga* (mainly due to bamboo there), *Myiarchus swainsoni* (avoids *M. ferox*?), and *Basileuterus flaveolus* (avoids *B. leucoblepharus*?). Birds of

open areas were often more common there, notably swallows that fly over cane fields.

Some forest birds did enter the cane fields, notably *B. flaveolus* and *S. frontalis* (see Cândido-Jr., 2000). Cane cutters reported a banded *Pyriglena* deep into the cane, near the highway. Willis saw a banded *Basileuterus hypoleucus* 100 m out in the cane, near the El Niño pond. Other birds entered the cane fields near the road in the early morning. We recorded such species as *Crypturellus parvirostris, Thamnophilus caerulescens, Pyriglena, Conopophaga, Capsiempis, Geothlypis*, and *Zonotrichia* on several occasions. When cane is burned, several hawks, falcons, and caracaras often are present. Bare fields in spring provide a habitat for *Vanellus, Syrigma, Xolmis* spp., *Anthus*, and other open-area birds. However, these birds have to leave as the cane grows, and only the *Crypturellus* regularly move in except for aerial swallows.

Note added in proof

In 16 more visits (28/7/2000 to 12/2/2002) in and near the São José woodlot, we recorded one or a few *Dendrocygna, Bartramia, Bubulcus, Mesembrinibis, Tachybaptus, Cathartes, Leptodon, Buteo brachyurus, Herpetotheres, Glaucidium, Athene, Lurocalis, Caprimulgus parvulus, Chaetura, Eupetomena, Aphantochroa, Calliphlox, Coccyzus melacoryphus, Claravis, Ceryle, Chloroceryle* (2 spp.), *Thamnophilus ruficapillus, Elaenia obscura* and *chiriquensis, Megarynchus, Progne chalybea, Turdus nigriceps, Anthus, Passerina glaucocaerulea, Schistochlamys* and *Sporophila leucoptera* and *lineola*. Thus, instead of 38 species (including 9 border birds) that disappeared from the woodlot in 1997-2000, there were 23 (2) lost in 1997-2002, or 141 species still present. Four new nonforest species (*Ardea cocoi* flying past, *Porphyrula martinica* on the cane pond, *Myiarchus tyrannulus* down Ribeirão Claro, and *Sturnella superciliaris* near the farm pond) and one hybrid (*Sporophila "ardesiaca"*) were added, for an area total of 266.

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