Status of Birds at the U. P. Laguna Land Grant, Luzon, Philippines

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Abstract The avifauna of the U. P. Laguna Land Grant in Southern Luzon consists of 101 species belonging to 41 families. Collectively, a total of 78 bird species were recorded along four transects selected for their different habitats: mature secondary forest (44 species), heavily disturbed forest (35), grassland with scattered remnant forest trees (38) and second growth forest with mixed cultivated areas (35). Species richness and abundance were determined for each transect and the feeding guild, residency and conservation status for each bird species were discussed. Significant reduction in diversity and endemism are attributed mainly to habitat degradation caused by extensive logging activities, both local and commercial. Non-endemic birds colonized the overlogged areas while only a few strictly forest birds tolerate non-native vegetation. The inclusion of the lowland forests of Luzon such as the Paete-Pakil-Kalayaan zone as one of the most critical Endemic Bird Areas (EBA) in the world should prompt concerned parties to increase its protection efforts in the area and ensure the long-term preservation of its biodiversity.

Key words: Avifauna, Philippine birds, Luzon birds, Lowland forest birds, Endemic bird area, Biodiversity, U. P. Laguna Land Grant, Wildlife conservation.

Introduction

The Philippines contains a rich and diverse avifauna, amounting to more than 556 species, 1,019 races scattered among the 7,100 islands of the archipelago. Endemism is high, especially on the islands, with a total of 169 species (30.4%), with a higher degree of endemism at the subspecies level with 708 races (69.5%) (Dickinson *et al.* 1991).

With respect to the composition of species on each island group, biodiversity in the Philippines can be divided into five distinct faunal regions, namely Luzon, Mindanao, Negros-Panay, Mindoro and Palawan (Heaney 1986). Most of these faunal regions have been severely degraded, such as Luzon which is considered as the most diverse island group, containing 50 or so wildlife species endemic only to the island (Hauge *et al.* 1986).

The island of Luzon is considered to have two distinct biogeographical areas: the northern and the southern area (Goodman and Gonzales 1990). The majority of the forest habitats remaining on the island are concentrated on the highlands mostly on these northernmost and southernmost parts. The avifauna of both extreme parts have been well studied, as well as studies of the central Luzon lowlands. However, most of these studies were expeditions to collect museum specimens taking little account of ecological relationships (Poivre 1751, Dussumier 1818, Kittlitz 1829, Lindsay 1830, Cuming 1836, Jagor 1860, Steere 1874, Maitland-Heriot 1883, Marche 1879, Zimmer 1908, Parkes, 1956,

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Rabor 1977 as well as the collections of the Philippine National Museum) as cited from Dickinson *et al.* 1991.

Luzon contains numerous areas of high bird species diversity and endemism, the island alone having two hotspots for the many highly threatened species found among Endemic Bird Areas (EBA's), namely the Luzon mountains (E01) and the Luzon lowlands and foothills (E02). E02 includes most of the forested areas around Central Luzon (less than 1,300 meters above sea level) of which is listed sixth in priority for all EBA's globally (Bibby *et al.* 1992).

The areas in central Luzon with significant remnants of intact tropical forests are found in Laguna, Quezon, Nueva Ecija, Zambales and Batangas provinces. It is doubtful, however, how much lowland forest is left in these areas. But with proximity to Manila, Laguna has so far considerable forested areas remaining around mountains such as Mt. Makiling, Mt. Banahaw and the ridges along Paete, Pakil and Kalayaan.

This study aims to describe the avifaunal assemblage in a disturbed forest area within the EBA of Central Luzon, and thus provide justification for its immediate protection. The U. P. Laguna Land Grant, being a property of a government academic institution would be an ideal field laboratory for research on tropical biodiversity.

Study Area and Methods

The U. P. Laguna Land Grant (14°23'N, 121°29'E) is a 3,500 hectare area owned by the University of the Philippines. It is located along the municipalities of Paete, Pakil and Kalayaan in the province of Laguna and partly of Real, Quezon province. It is a mountainous area 300 to 400 m.a.s.l., containing mostly disturbed lowland Dipterocarp forests and secondary growth.

Much of the original areas has been cleared by logging and slash-and-burn farming, especially on the outlying areas of Balian and Saray in Pakil. Logging activities started during the 1920's increasing thereafter in the 1960's, but some portions of the selectively logged area regrew, and is now being exploited by illegal loggers, cutting some trees of secondary growth less than 50 cm in diameter. Firewood collectors, subsistence hunters, slash-and-burn farmers, tree fern collectors and insurgency problems add up to the degradation of the Land Grant, which have similarly taken its toll on the adjacent U. P. Quezon Land Grant. A number of ornithologists visited the Land Grant or within its immediate vicinity such as collections made by R. McGregor and A. Celestino of the Philippine Bureau of Science in Dumangil in Pangil, and in Barrio Balian in Pakil. Other noted collectors include M. Celestino and J. Ramos (Philippine National Museum), collectors of J. du Pont, D. Rabor, M. de Schayensee, K. Parkes, E. McClure and M. Leelavit. The land grant and its immediate vicinity has been an important type locality for some endemic species and subspecies, e.g. *Ptilinopus merrilli merrilli*, *Napothera rabori mesoluzonica*, and *Arachnothera clarae luzonensis*.

Four 2 km transect sites were chosen for the study within the vicinity of the land grant based on different habitat gradients. There were Tibag—a mature secondary forest, Amiakan 1—a heavily disturbed forest, Amiakan 2—a grassland with scattered remnant

Fig. 1. Map of the study area (U.P. Laguna Land Grant, Paete-Pakil-Kalayaan, Laguna, Luzon, Philippines): transects (1) Saray, (2) Amiakan 2, (3) Amiakan 1, (4) Tibag. Irregularly shaped box shows enclosed perimeter of land grant.

forest trees, and Saray—a second growth forest with mixed cultivated areas (Fig. 1, Photo 1).

Transect counts, bioacoustic observations and mistnetting were done for a period of 3–5 days per transect. The area was surveyed from the late dry season to early wet season from May 5 to 19, 1992. We had occasional rains during this period.

Another team of ecologists and botanists studied the floral assemblage of the U. P. Laguna Land Grant. Much of the descriptions given for each transect area was based on these studies. Floristic composition was determined using the point center quarter method. A total of 36 tree species in 18 families were noted (Gruezo *et al.* 1992).

1. Tibag was found on a mature secondary growth forest along a logging road in Barrio Tibag, traversing through several rivers and creeks where the forest was currently being logged. This transect had a large number of species with trunks falling under 20–30 cm in diameter (diameter at breast height) although some noticeable trees with larger diameters were also found. The most dominant species were white lauan *Shorea contorta*, bagtikan *Parashorea malaanonan* and apitong *Dipterocarpus grandiflorus*. The estimated volume of commercial and non-commercial trees in Tibag are 3 times larger than that of Amiakan. Tibag had higher densities of white putian *Alangium meyeri* and tangsang-bayawak *Ficus variegata*. Vertical stratification averaged 10–20 meters, with some trees reaching up to 20–30 meters (tallest at 31 meters). The lack of tall trees (> 40 m.) were obvious effects of severe logging activities.

2. Amiakan 1 was situated in a secondary growth forest along a logging road dominated by second growth dipterocarps. A high density of trunks were under the 10–

Photo 1. Vegetative cover of study area (U. P. Laguna Land Grant, Paete-Pakil-Kalayaan, Laguna, Luzon, Philippines): transects (1) Saray, (2) Amiak 2, (3) Amiak 1, (4) Tibag.

Table 1. Species richness of the four (4) transects in the U.P. Laguna Land Grant, Paete-Pakil-Kalayaan, Laguna province, Philippines from May 5–19, 1992.

Sites	Habitat	No. of species.	No. of individuals	Species richness
Amiakan 1	second growth	35	337	44.87%
Tibag	mature second growth	44	369	56.41%
Amiakan 2	grassy area	38	283	48.72%
Saray	cultivated area	35	177	44.87%
Total		78	1166	

20 cm (dbh) and a few within the 50–60 cm. This area was previously selectively logged, and the trees were allowed to regrow, but the canopy was still open and the understorey dense, showing a distinct vertical layering. Most trees on this site were 10–20 m in height, with a few at 20–30 m, apparently a result of illegal logging activities. Dominant tree species are the same for Tibag and Amiakan 1, although the two transects varied in disturbance gradients. Other significant tree species noted in Amiakan 1 are marang *Litsea perrottetii* and katong-matsing *Chisocheto cumingianus*. Other vascular plants found were species belonging to families Araceae, Pandanaceae, Melastomataceae, Rubiaceae, Euphorbiceae, Moraceae and Meliaceae.

3. Amiakan 2 is a highly disturbed area in the overlogged forest with very few stands of secondary growth on the outlying areas. The area is open for cogon *Imperata cylindrica* to grow profusely, but some tall sparsely branched trees remain, most of which are fig trees (Moraceae), and other non-commercial tree species. Some trees are leafless and dead, but still have moderate epiphytic cover. Reforested areas at midpoint of the transect harbour exotic *Acacia* species and some palms (Palmae).

4. Saray has the transect area nearest to the vicinity of the base camp, with numerous old logging roads leading to Barrio Saray and Barrio Balian. This area is located outside the boundaries of the land grant, was characterized by a mixture of coconut and coffee plantations, with adjacent mature secondary growth forests. Coconut made up the upper strata and five meter tall coffee trees comprises the understorey where bushy plants, vines and epiphytes are moderately thick. The outlying areas were planted mostly to non-native species, as well as exotic fruit trees such as jackfruit *Artocarpus*, guava *Psidium guajava* and mango *Mangifera indicus*, traversing through the Saray river.

Results

1. Species richness

A total of 101 avian species were recorded in the land grant which includes ca. 41 families in 13 orders. Out of the total, 78 species were recorded during transect counts in four transect sites, Saray with 35 species, Amiakan 1 with 38, Amiakan 2 with 35 and Tibag with 44 (Table 1, Appendix I). Tibag, a currently logged lowland forest, had the highest species richness with 56.4%, perhaps because the forest was relatively mature with a somewhat intact canopy, except for the open breaks or gaps caused by the removal of

Table 2. Status of birds found on the different transects of the U. P. Laguna Land Grant, Paete-Pakil-Kalayaan, Laguna province, Philippines.

Sites	Residency				Conservation status			Total
	Endm	Migr	NeRes	Intr	NTr	Tr	LuEndm/RR	
Amiakan 1	21	3	10	0	3	2	1	35
Tibag	31	0	13	0	6	2	7	44
Amiakan 2	16	5	16	1	2	1	1	38
Saray	15	3	17	0	2	0	1	35
Total	42	6	28	1	4	2	7	78

Legend: Endm-Philippine endemic species; Migr-winter migrant; NeRes-Non-endemic resident; Intr-Introduced species; NTr-Near-threatened species (ICBP); Tr-Threatened species (ICBP); LuEndm/RR-Luzon endemic and restricted range species.

large canopy trees through extensive logging activities. Amiakan 2 was overlogged with no evident canopy, mostly an open cogonal area (*Imperata cylindrica*) with scattered trees in the periphery suitable for grassland bird species, has nominal amount of diversity, possibly due to an intrusion of colonizing species. The relatively high species richness (48.7%) is accounted for the dominance of fig trees (Moraceae) in the adjacent secondary growth plus the ecotonal effect of a mixture of tolerable forest species and colonizing grassland species. Amiakan 1 had lower species richness than Amiakan 2, but the same species richness with Saray. Both had 44.9% species richness, probably a result of similar habitat affinity, since both occurs as second growth. Although Amiakan 1 had a relatively low canopy (approximately 5 to 10 years regrowth) the numerous fruiting non-dipterocarp trees like figs (Moraceae) and other colonizing species provided habitat for frugivorous and omnivorous birds. A similar scenario is drawn in Saray in which the area includes plantation crops like coconut *Cocos nucifera* and coffee *Coffea* spp., exotic fruit trees and non-dipterocarp trees also found at Amiakan 2.

2. Endemicity and residency status

Endemicity is high at 53.9% for the land grant, implying that more than half of the total species are endemic to the Philippines. Endemicity of races was even higher (Table 2). Tibag had the most number of endemic species (29) followed by Amiakan 1 (20), both areas were relatively forested with more or less native vegetation; although disturbed parts had smaller values of endemicity compared to undisturbed forest habitats. About 68 of the total 203 species recorded in the Palanan Wilderness area more than a hundred species were Philippine endemics, whereas 78 endemic species (from the total 241 birds) were recorded in the northern Sierra Madre mountains (Danielsen *et al.* 1994). Saray and Amiakan 2 has 15 and 14 endemic species, respectively. These areas offer less forest birds which comprises the bulk of the endemic Philippine species. Migrants comprise a very small percentage of the species, with only 5 known winter visitors recorded in all transects, except on Tibag. This was probably due to the relatively late period in the wintering season of which the study was conducted, that is at May, where most of the migrants would have returned to their breeding grounds, thus fewer species to be observed. There

Table 3. Families and number of species found at the different transect sites in the U. P. Laguna Land Grant, Paete-Pakil-Kalayaan, Laguna province, Philippines from May 5-10, 1992.

Family	Number of species				Total
	Amiakan 1	Tibag	Amiakan 2	Saray	
Accipitridae	2	3	3	3	6
Falconidae	1	1	—	—	1
Rallidae	—	—	1	—	1
Turnicidae	1	—	—	—	1
Phasianidae	—	1	—	1	1
Columbidae	1	4	1	2	6
Psittacidae	2	1	2	2	2
Cuculidae	4	5	2	4	7
Tytonidae	—	—	—	1	1
Strigidae	1	1	—	1	3
Caprimulgidae	—	—	1	1	1
Podargidae	—	1	—	—	1
Apodidae	4	4	5	3	5
Trogonidae	—	1	—	—	1
Alcedinidae	—	3	—	1	3
Bucerotidae	2	2	1	1	2
Capitonidae	1	1	1	1	1
Picidae	—	1	1	1	2
Campephagidae	—	2	2	—	2
Rhabdornithidae	—	—	1	—	1
Hirundinidae	—	—	1	—	1
Pycnonotidae	1	1	2	2	2
Dicruridae	1	1	1	1	1
Corvidae	—	—	1	1	1
Paridae	1	1	—	—	1
Timaliidae	—	1	—	—	1
Turdidae	1	—	—	—	1
Sylviidae	2	2	1	2	3
Muscicapidae	1	—	2	—	2
Pachycephalidae	1	—	—	—	1
Motacillidae	1	—	1	1	2
Laniidae	1	—	1	1	1
Sturnidae	—	—	2	—	2
Artamidae	—	—	1	—	1
Nectariniidae	1	1	2	3	4
Dicaeidae	3	4	2	2	5
Zosteropidae	1	1	—	1	2
Total (families)	23	23	24	22	35
(species)	36	44	38	35	78

were fewer non-endemic residents than endemics. Some would also have endemic races and shared species with those of the Southeast Asian region. The area was extremely tolerant to habitat disturbance. There were only 2 species known to be introduced to the area. The most common species was the Crested Myna *Acridotheres cristatellus* on

Table 4. Similarity (Sorensen's indices) of four study sites on U.P. Laguna Land Grant, Paete-Pakil-Kalayaan, Laguna, Luzon, Philippines.

	Amiakan 1	Tibag	Amiakan 2	Saray
Amiakan 1	X	21	18	20
Tibag	53.2	X	18	19
Amiakan 2	49.3	43.9	X	22
Saray	57.1	24.1	30.1	X

Sorensen's index of Similarity (S) = $2C/A+B$ (Odum 1971) where: C=no. of species similar to both sites, A=no. of species in site A, B=no. of species in site B

Amiakan 2, due to its close association with feral Water buffalo *Bubalus bubalis*.

3. Species composition and similarity indices among sites

The most represented avian family among the 41 families recorded was Cuculidae (7 species), followed by Accipitridae and Columbidae (both with 6 species) and then Apodidae and Dicaeidae (5 species). The number of families varied little among the four transects, however in composition, there was an extremity of species of Cuculids in Tibag and Apodidae in Amiakan 2 (Table 3).

Twelve species were recorded in all transects (Appendix I). These species can be considered tolerant to strong disturbance in the forest, probably less affected by changes in the habitat. These are Philippine Serpent Eagle *Spilornis holospilus*, Philippine Hanging Parrot *Loriculus philippensis*, Philippine Coucal *Centropus viridis*, Glossy Swiftlet *Collocalia esculenta*, Island Swiftlet *Collocalia vanikorensis*, Luzon Hornbill *Penelopides manillae*, Coppersmith Barbet *Megalaima haemacephala*, Philippine Bulbul *Hypsipetes philippinus*, Balicassiao *Dicrurus balicassius*, Philippine Tailorbird *Orthotomus castaneiceps*, Orange-breasted Flowerpecker *Dicaeum trigonostigma*, and White-bellied Flowerpecker *Dicaeum hypoleucum*. Although eight other species were found in three out of the four transects, tolerance may be limited. About half the total number (36 species) were found on only one transect area. Fifteen of which were found only on Tibag and 10 on Amiakan 1. These 15 species were highly restricted to forest habitats, and 10 were restricted to a more open and grassy area. Some were also restricted to specific habitat, such as Indigo-banded Kingfisher *Alcedo cyanopectus* which requires a nearby stream to forage. It was found only on Tibag and Saray where streams traversed the transect. No streams traverse Amiakan 1 and Amiakan 2.

Based on the indices of similarity (Sorensen's Index), Amiakan 1 and Saray had the most similar avian assemblages (57.1%), probably due to its close proximities in the study area (see Fig. 1). Amikan 1 and Tibag are also sites with high similarity indices (53.2%), where more than half the species were common to both sites. This was also ascribed to close proximities among sites, but more tolerant forest species were found common to both sites. Amiakan 2 and Saray were the least similar sites (30.1%) (Table 4). Although both were highly disturbed areas, fewer species were common to both (Odum 1971).

Table 5. Trophic groups/feeding guilds of each transect site at the U. P. Laguna Land Grant, Paete-Pakil-Kalayaan, Luzon, Philippines.

Transect sites	Number of species per feeding guild													
	R	P	TI	FGI	BGI	SwI	SaI	FF	AIF	TIF	IN	TF	AF	Total
Amiakán 1	4	0	4	5	0	4	2	2	5	1	1	1	6	35
Tibag	5	1	5	6	2	5	0	2	7	1	1	2	7	44
Amiakán 2	3	0	3	4	2	8	2	1	7	1	2	0	5	38
Saray	5	1	3	6	0	4	0	1	5	1	3	1	5	35
Total	11	1	9	9	3	9	3	2	12	2	4	2	11	78

Legend: R-raptorial; P-piscivore; TI-terrestrial insectivores; FGI-foliage gleaning insectivore; BGI-bark gleaning insectivore; SwI-sweeping insectivore; SaI-sallying insectivore; TIF-terrestrial insectivore/frugivore; AIF-arboreal insectivore/frugivore; FF-faunivore/frugivore; IN-insectivore nectarivore; AF-arboreal frugivore; TF-terrestrial frugivore.

4. Stratification of trophic groups

The trophic groups comprised a variety of adaptations to different food resources, with 15.4% (12) considered to be carnivorous, 42.3% (33) insectivorous, 25.6% (20) carnivorous and 16.7% (13) frugivorous. The largest number of carnivores were found in both Tibag and Saray, coinciding with the higher murid fauna on both sites (*Rattus everetti* and *Rattus exulans*). Insectivores were more concentrated in Amiakán 1 and Tibag, frugivores in Tibag and Amiakán 2, and omnivores in Amiakán 1 and Tibag (Table 5). The most significant feeding guild was an arboreal insectivore/frugivore type (12 species), followed by both raptorial and arboreal frugivory (11). There was a considerable number of arboreal insectivore/frugivores in Tibag and Amiakán 1, while arboreal frugivores concentrated at Tibag. However insectivores still dominate the trophic level in the land grant, omnivory and frugivory combined is equivalent to the total number of insectivores.

5. Conservation status of birds of UPLLG

There are a total of 20 species (13 endemic) of birds considered for their commercial value and they are considered vulnerable due to excessive hunting and illegal trade. Those include Oriental Honey-buzzard *Pernis ptilorhynchus*, Brahminy Kite *Haliastur indus*, Chinese Sparrowhawk *Accipiter soloensis*, Philippine Hawk-Eagle *Spizaetus philippensis*, Changeable Hawk-Eagle *Spizaetus cirrhatus*, Rufous-bellied Eagle *Hieraaetus kienerii*, Philippine Serpent Eagle, Philippine Falconet *Microhierax erythrogenys*, Eurasian Ketrel *Falco tinnunculus*, Australasian Grass Owl *Tyto longimembris*, Philippine Hawk-Owl *Ninox philippensis*, Philippine Eagle-Owl *Bubo philippensis*, Philippine Scops-Owl *Otus megalotis*, Philippine Hanging Parrot, Guiabero *Bolbopsittacus lunulatus*, Luzon Bleeding Heart *Gallicolumba luzonica*, Red-crested Malkoha *Phaenicophaeus superciliosus*, Scale-feathered Malkoha *P. cymingi*, Luzon Hornbill and Rufous Hornbill *Buceros hydrocorax*. All of which are elaborately colored or with significance to the pet trade, especially raptors and parrots. Large birds were very attractive for subsistence hunters or trappers. Fifteen species are listed on Appendix II of Council for the International Trade of Endangered Species (CITES). Three listed in International Union for the Conservation of Nature and

Natural Resources's (IUCN) Red Data Book (1993). Other birds not important in the pet trade are possible victims of habitat loss due to forest destruction and logging. Blackish Cuckoo-shrike *Coracina coerulescens* and Luzon Wren-babbler *Napothera rabori* are listed as threatened, while Philippine Hawk-Eagle, Rufous Coucal *Centropus unirufus*, Philippine Eagle-Owl and Spotted Wood Kingfisher *Actenoides lindsayi* are listed as near-threatened by the (ICBP) International Council for Bird Preservation (Collar and Andrew 1988). Seven species, mostly Luzon island endemics are considered as restricted-range species by ICBP. Those are Luzon Bleeding Heart, Red-crested Malkoha, Scale-feathered Malkoha, Rufous Coucal, Blackish Cuckoo-shrike, Luzon Wren-babbler and Greybacked Tailorbird *Orthotomus derbianus* (Bibby *et al.* 1992). These species are included in the list of restricted-range species of E02, the Endemic bird areas (EBA) inclusive of the Luzon lowlands. More recently, six species (5 endemic) are listed as threatened and 11 endemic species are listed as near-threatened in Birds to Watch 2 (Collar *et al.* 1994).

6. Notes on significant species

One significant observation was the relative abundance of Blackish Cuckoo Shrikes at the relatively open forest edge of Amiakan 1. This species was also recorded in Tibag. It is not in immediate danger of extinction due to tolerance to habitat disturbance. This species was moved from the threatened list (Collar & Andrew 1988) to the near-threatened list (Collar *et al.* 1994). Other species known to be restricted to forest habitats were observed to venture in less suitable habitats. Those were Luzon Hornbill, Rufous Hornbill, Philippine Hanging Parrot, Guiabero, Sooty Woodpecker *Mullericipicus funebris*, Philippine Pygmy Woodpecker *Dendrocopos maculatus*, Orange-breasted Flowerpecker and White-bellied Flowerpecker. All of those were found also in heavily disturbed habitats, such as Amiakan 2 and Saray. However, some species require the occurrence of nearby suitable habitats. For example, Luzon Hornbill and Rufous Hornbill used mature secondary growth forest at the edges of plantation areas. Birds use ecotones to move along variable habitat gradients, frugivores may have been attracted to fruits in plantations and orchards. Stripe-headed Rhabdornis *Rhabdornis mysticalis* may have been attracted to Amiakan 2 where numerous dead trees were used as foraging areas for creepers and woodpeckers, Rhabdornis was similarly recorded in open areas with a few trees in Mt. Makiling (Miranda 1987).

Several species were observed to breed. Most of which were observed with their fledglings. Philippine Falconet had two young almost ready to fledge in Amiakan 1. Similarly Orange breasted Flowerpecker, had a penduline-like purse-nest hanging from a tree fern frond *Cyathea* spp. with feathered young. Rufous Hornbill and Sooty Woodpecker had a single young already flying and foraging with the parents (noticeable from the drabber, ruffled feathers and smaller size) at Tibag, respectively.

Flocking was especially evident in Luzon Hornbill at Saray, where a group of 13 individuals noisily passed through each large fig tree. But Philippine Hanging Parrot also had small flocks of up to seven, mostly one to two males and several females (and juveniles). Mixed feeding groups were observed, consisting mostly of insectivores

inhabiting well forested habitats. These included Elegant Tit *Parus elegans*, Balicassiao, Stripe-headed Rhabdornis, Philippine Bulbul, Dubois' Leaf Warbler *Phylloscopus cebuensis*, Philippine Whistler *Pachycephala philippensis* and White-eyes *Zosterops* spp. Mixed groups of aerial insectivores such as swiftlets *Collocalia* spp., Fork-tailed Swift *Apus pacificus* and Pacific Swallow *Hirundo tahitica* were observed in open habitats. Two species of Parrots were observed feeding together on leaf buds and fruits of *Ficus variegata*. Flowerpeckers *Dicaeum* spp. were often seen feeding on fruits of *Ficus minahassae*.

Discussion

1. Habitat disturbance, a key factor in diversity

The U. P. Laguna Land Grant has a diverse avifauna with high endemism typical of lowland forests in the Philippines. However, the area is in severe threat of degradation by illegal logging operations. Comparison of four habitat gradients on different transect sites suggests that in a mature secondary growth forest, species diversity and endemism is very high, with a concentration of significant rare species. Disturbance brought about by logging activities and other human factors resulted in the absence of species previously recorded in the area, such as Creambellied Fruit Dove *Ptilinopus merrilli*, Whiskered Pitta *Pitta kochi*, Black-crowned Tree-Babbler *Stachyris nigrocapitata*, Golden-crowned Babbler *Stachyris dennistouni*, Mountain Tailorbird *Orthotomus cucullatus*, Naked-faced Spiderhunter *Arachnothera clarae*, Sunda Ground Thrush *Zoothera andromedae*, Brown-headed Thrush *Turdus chrysolaus* and Streaked Reed Warbler *Acrocephalus sorghophilus*; however, the last three species may be absent since the study was conducted late in the wintering season. Selective logging made a significant reduction on the number of sallying insectivores in Tibag, although the total number of species was not greatly reduced. The aftermath of logging seen in Amiakan 1 resulted in an overall reduction of species, the intrusion of less significant species, and a decrease in endemism. In Amiakan 2, the species diversity increased due to the colonization of species preferring open and grassy areas following succession due to a result of overlogging. Only a few generalist species were recorded common to the forest species of Amiakan 1 and Tibag. These were species typical of ecotones. Saray was the final result of human intrusion. This was a permanent effect since non-native plantation crops and other agricultural management practices prevent natural plant succession. However, several species were still able to tolerate habitat change. Colonization of new species to the area is not known to occur in the inner forested areas. This displaces other similar species which could adapt to the same resource.

2. Conservation efforts at the U. P. Land Grant

Conservation priorities should be directed immediately to both the U. P. Laguna Land Grant and the adjacent U. P. Quezon Land Grant. Both are important strongholds for many endemic species of birds as well as other Philippine wildlife. About 57 species of birds were recorded in the U. P. Quezon Land Grant (Tabaranza 1987) and 43 species

are found in U. P. Laguna Land Grant. Although a considerable degree of disturbance has occurred in the two land grants there is already enough reduction in diversity and uniqueness and natural renewal of the forest may still allow the recovery of some species. Logging activities in the land grant have become uncontrollable, probably due to the lack of efforts given by the government to its protection. The lack of support to the staff of both land grants from the institution itself many inhibit the implementation of regulations within the land grant.

The area can be included as part of the Endemic bird areas of Philippines, which includes the lowland forests of Luzon island (E01). This EBA is one of the most critical EBA's in the world. Species diversity is high along with endemism in lowland forest areas and severe degradation of the habitat. A large percentage of the endemic species is either rare or threatened. Seventeen species recorded in the U. P. Laguna Land Grant are either Threatened or Near-threatened species, Ashy-breasted Flycatcher *Muscicapa randi*, Philippine Hawk-Eagle, Cream-bellied Fruit Dove, Rufous Coucal, Philippine Eagle-Owl, Spotted Wood Kingfisher, Whiskered Pitta, Blackish Cuckooshrike, Luzon Wren Babbler, Streaked Reed Warbler, Spotted Buttonquail *Turnix ocellata*, Indigo-banded Kingfisher, Rufous Hornbill, Luzon Hornbill, Luzon Bleeding-heart, Naked-faced Spiderhunter and Golden-crowned Babbler (Collar & Andrew 1988; Collar *et al.* 1994). These should be significant reasons for the immediate protection of the study area.

Comparatively, the U. P. Laguna Land Grant avifauna is among the most diverse assemblages in Central Luzon. Quezon National Park, contains 42 species of birds (Scharringa 1990), whereas, 57 species can be found in the U. P. Quezon land grant (Tabaranza 1987). There are about 164 bird species found in Mt. Makiling National Park, (Mendoza 1987, Gonzalez 1994) and about 79 species in Mt. Banahaw-San Cristobal National park, (Miranda 1978). These areas are among the few remaining forested habitats near the study area, and thus together form crucial areas for conservation.

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フィリピン、ルソン島のフィリピン大学 Laguna Land Grant の鳥相

ルソン島南部のフィリピン大学 Laguna Land Grant の鳥類相は、41 科、101 種の鳥類により構成されている。4 種類の異なる生息環境に設定されたトランセクトに沿ってセンサスを行い、全部で 78 種の鳥を記録した。環境別には、成熟した 2 次林で 44 種、人為的攪乱が進んだ森林で 35 種、森林性の樹木が所々に残された草地で 38 種、2 次林と耕作地帯が入り交じった地域で 35 種が観察された。各トランセクトにおいて、種多様度および個体数を算出した。また、各種について、採食ギルド、定住性、保護の現状を議論した。種の多様性および固有性が甚しく減少している理由は、主に商業目的並びに地域住民による大規模な樹木の伐採活動がもたらした生息環境の悪化によるものと考えられた。広域性の種が、伐採の進んだ地域に定着できるのに引き替え、厳密に森林性の鳥類は本来の植生以外の環境に対する許容度が低いからである。

環境保全のための方策としては、ルソン島の低地林、例えば Paete-Pakil-Kalayaan のような場所を、世界的に最も緊急を要する固有種保全地域 (Endemic Bird Areas) の一つとして登録することが考えられる。これによって、関係諸機関によるそれらの地域の環境保全の努力が高まり、長期に渡って種の多様性を確実に保存できるだろう。

(百瀬 浩訳)

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Appendix I. List of bird species recorded on the four transect sites in the U. P. Laguna Land Grant, Paete-Pakil-Kalayaan, Luzon, Philippines and their corresponding feeding guild, includes species previously recorded by other authors and observations outside the transect counts.

Family/Species		Remarks	Transect site				Feeding guild
			Amiakn 1	Tibag	Amiakn 2	Sardy	
Accipitridae							
Oriental Honeybuzzard <i>Pernis ptilorhynchus</i>	Q	NObs					
Brahminy Kite <i>Haliastur indus</i>	Q	Obs				X	R
Chinese Goshawk <i>Accipiter soloensis</i> ⁺		Obs			X	X	R
Philippine Hawk Eagle <i>Spizaetus philippensis</i> *	V	Obs		X			R
Changeable Hawk-Eagle <i>Spizaetus cirrhatus</i>		Obs	X	X			R
Rufous-bellied Eagle <i>Hieraaetus kienerii</i>		Obs			X		R
Philippine Serpent Eagle <i>Spilornis holospilus</i> ^{1*}	Q	Obs	X	X	X	X	R
Falconidae							
Philippine Falconet <i>Microhierax erthrogenys</i> *	Q	Obs	X	X			R
Eurasian Kestrel <i>Falco tinnunculus</i> ⁺		NObs					
Phasianidae							
Red Junglefowl <i>Gallus gallus</i>		Obs		X	X	X	TIF
Turnicidae							
Barred Buttonquail <i>Turnix susciator</i>		NObs					
Spotted Buttonquail <i>Turnix ocellata</i> *	N	Obs	X				TIF
Columbidae							
Pompadour Green Pigeon <i>Treron pompadora</i>		Obs			X		AF
Pink-necked Green Pigeon <i>Treron vernans</i>		NObs					
White-browed Brown Dove <i>Phapitreron leucotis</i> *	Q	Obs				X	AF
Amethyst Brown Dove <i>Phapitreron amethystina</i> *		NObs					
Luzon Bleeding Heart <i>Gallicolumba luzonica</i> **	N, Q	Obs		X			TF
Cream-bellied Fruit Dove <i>Ptilinopus merrilli</i> **	N	Pre					
Green Imperial Pigeon <i>Ducula aenea</i>		Obs		X			AF
Philippine Cuckoo-Dove <i>Macropygia tenuirostris</i> ^{2*}		Obs		X			AF
Emerald Dove <i>Chalcophaps indica</i>	Q	Obs	X	X		X	TF
Psittacidae							
Philippine Hanging Parrot <i>Loriculus philippensis</i> *	Q	Obs	X	X	X	X	AF
Guiabero <i>Bolbopsittacus lunulatus</i> *	Q	Obs	X		X	X	AF
Cuculidae							
Plaintive Cuckoo <i>Cacomantis merulinus</i>	Q	Obs		X		X	FGI
Red-crested Malkoha <i>Phaenicophaeus superciliosus</i> **	Q	Obs	X	X		X	AIF
Scale-feathered Malkoha <i>Phaenicophaeus cumingi</i> **	Q	Obs		X			AIF
Philippine Coucal <i>Centropus viridis</i> *	Q	Obs	X	X	X	X	TI
Lesser Coucal <i>Centropus bengalensis</i>		Obs	X		X	X	TI
Rufous Coucal <i>Centropus unirufus</i> **	N	Obs		X			TI
Common Koel <i>Eudynamys scolopacea</i>		Obs	X				AIF
Tytonidae							
Australasian Grass Owl <i>Tyto longimembris</i> ³		Obs				X	R
Strigidae							
Philippine Hawk Owl <i>Ninox philippensis</i> *	Q	Obs				X	R
Philippine Eagle Owl <i>Bubo philippensis</i> *	Q	Obs	X				R
Philippine Scops Owl <i>Otus megalotis</i> *	Q	Obs		X			R
Caprimulgidae							
Gread Eared Nightjar <i>Eurostopodus macrotis</i>		Obs			X	X	SwI

Appendix I. (Continued)

Family/Species	Remarks		Transect site				Feeding guild
			Amiakán 1	Tibag	Amiakán 2	Sardy	
Podargidae							
Philippine Frogmouth <i>Batrachostomus septimus</i> *	Obs				X		SwI
Apodidae							
Glossy Swiftlet <i>Collocalia esculenta</i>	Q Obs		X	X	X	X	SwI
Pygmy Swiftlet <i>Collocalia troglodytes</i> *	Obs		X	X	X		SwI
Island Swiftlet <i>Collocalia vanikorensis</i>	Obs		X	X	X	X	SwI
Purple Needletail <i>Hirundapus celebensis</i>	Q Obs			X	X	X	SwI
Fork-tailed Swift <i>Apus pacificus</i> †	Q Obs		X		X		SwI
Trogonidae							
Philippine Trogon <i>Harpactes ardens</i> *	Q Obs			X			FGI
Alcedinidae							
Indigo-banded Kingfisher <i>Alcedo cyanopecta</i> *	N Obs			X		X	P
Ruddy Kingfisher <i>Halcyon coromanda</i>	Obs			X			TI
Spotted Wood Kingfisher <i>Actenoides lindsayi</i> *	N, Q Obs			X			TI
Meropidae							
Blue-tailed Bee-eater <i>Merops philippinus</i>	NObs						
Bucerotidae							
Rufous Hornbill <i>Buceros hydrocorax</i> *	N, Q Obs		X	X			FF
Tarctic Hornbill <i>Penelopides manillae</i> **	N, Q Obs		X	X	X	X	FF
Capitonidae							
Coppersmith Barbet <i>Megalaima haemacephala</i>	Obs		X	X	X	X	AIF
Picidae							
Philippine Pygmy Woodpecker <i>Dendrocopos maculatus</i> *	Obs			X			BGI
Sooty Woodpecker <i>Mulleripicus funebris</i> *	Q Obs			X	X		BGI
Pittidae							
Whiskered Pitta <i>Pitta kochi</i> **	V Pre						
Campephagidae							
Bar-bellied Cuckoo-shrike <i>Coracina striata</i>	Obs			X	X		AIF
Blackish Cuckoo-shrike <i>Coracina coerulescens</i> **	N Obs			X	X		AIF
Pied Triller <i>Lalage nigra</i>	NObs						
Rhabdornithidae							
Stripe-headed Rhabdornis <i>Rhabdornis mystacalis</i> *	Obs				X		BGI
Hirundinidae							
Pacific Swallow <i>Hirundo tahitica</i>	Obs				X		SwI
Pycnonotidae							
Yellow-vented Bulbul <i>Pycnonotus goiavier</i>	Q Obs				X	X	AIF
Yellow-wattled Bulbul <i>Pycnonotus urostictus</i> *	Q NObs						
Philippine Bulbul <i>Hypsipetes philippinus</i> *	Q Obs		X	X	X	X	AIF
Dicruridae							
Balicassiao Drongo <i>Dicrurus balicassius</i> *	Q Obs		X	X	X	X	FGI
Oriolidae							
Black-naped Oriole <i>Oriolus chinensis</i>	Q NObs						
Corvidae							
Large-billed Crow <i>Corvus macrorhynchos</i>	Obs				X	X	AIF
Paridae							
Elegant Tit <i>Parus elegans</i> *	Q Obs		X	X			FGI
Timaliidae							

Appendix I. (Continued)

Family/Species	Remarks	Transect site				Feeding guild
		Amiakán 1	Tibag	Amiakán 2	Sardy	
Luzon Wren-babbler <i>Napothera rabori</i> **	V Obs		X			TI
Black-crowned Babbler <i>Stachyris nigrocapitata</i> **	Pre					
Golden-crowned Babbler <i>Stachyris dennistouni</i> **	N Pre					
Turdidae						
Sunda Ground-Thrush <i>Zoothera andromedae</i>	Pre					
Brown-headed Thrush <i>Turdus chrysolaus</i> ⁺	Pre					
White-browed Shortwing <i>Brachypteryx montana</i>	Obs	X				TI
White-browed Shama <i>Copsychus luzoniensis</i> *	Obs					
Sylviidae						
Lemon-throated Leaf warbler <i>Phylloscopus cebuensis</i> *	Obs	X			X	FGI
Philippine Tailorbird <i>Orthotomus castaneiceps</i> *	Q Obs	X	X	X	X	FGI
Grey-backed Tailorbird <i>Orthotomus derbianus</i> **	Obs		X			FGI
Mountain Tailorbird <i>Orthotomus cucullatus</i>	Pre					
Streaked Reed-Warbler <i>Acrocephalus sorghophilus</i>	V Pre					
Muscicapidae						
Ashy-breasted Flycatcher <i>Muscicapa randi</i> *	E Obs	X		X		SaI
Grey-streaked Flycatcher <i>Muscicapa griseisticta</i> ⁺	Obs			X		SaI
Monarchidae						
Pied Fantail <i>Rhipidura javanica</i>	NObs					
Blue-headed Fantail <i>Rhipidura cyaniceps</i> *	Q NObs					
Pachycephalidae						
Yellow-bellied Whistler <i>Pachycephala philippinensis</i> *	Q Obs	X				SaI
Motacillidae						
Gray Wagtail <i>Motacilla cinerea</i> ⁺	Obs	X		X	X	TI
Forest Wagtail <i>Dendronanthus indicus</i> ⁺	Obs			X		TI
Laniidae						
Brown Shrike <i>Lanius cristatus</i> ⁺	Q Obs	X		X	X	FGI
Sturnidae						
Crested Myna <i>Acridotheres cristatellus</i> ⁺	Obs			X		AIF
Coledo <i>Sarcops calvus</i> *	Q Obs			X		AIF
Artamidae						
White-breasted Woodswallow <i>Artamus leucorhynchus</i>	Obs			X		SwI
Nectariniidae						
Plain-throated Sunbird <i>Anthreptes malacensis</i>	Q Obs	X			X	IN
Purple-throated Sunbird <i>Nectarinia sperata</i>	Obs		X		X	IN
Olive-backed Sunbird <i>Nectarinia jugularis</i>	Obs			X	X	IN
Flaming Sunbird <i>Aethopyga flagrans</i> *	Q Obs			X		IN
Naked-faced Spiderhunter <i>Arachnothera clarae</i> *	N Pre					
Dicaeidae						
Olive-backed Flowerpecker <i>Prionochilus olivaceus</i> *	Q Obs		X			AF
Striped Flowerpecker <i>Dicaeum aeruginosum</i> *	Obs	X				AF
Bicolored Flowerpecker <i>Dicaeum bicolor</i> *	Q Obs	X	X			AF
Orange-breasted Flowerpecker <i>Dicaeum trigonostigma</i>	Q Obs	X	X	X	X	AF
White-bellied Flowerpecker <i>Dicaeum hypoleucum</i> *	Q Obs	X	X	X	X	AF
Zosteropidae						
Philippine White-eye <i>Zosterops meyeri</i> *	Obs				X	AIF
Golden-yellow White-eye <i>Zosterops nigrorum</i> *	Q Obs	X	X			AIF

Appendix I. (Continued)

Family/Species	Remarks	Transect site				Feeding guild
		Amiakan 1	Tibag	Amiakan 2	Sardy	
Estrildidae						
Chestnut Munia <i>Lonchura malacca</i>	NObs					
Ploceidae						
Tree Sparrow <i>Passer montanus</i> *	NObs					

Legend: Obs—Observed within the study transect counts, NObs—Observed outside the study transect counts, Pre—Previously recorded by other authors, * Philippine endemic, ** Luzon endemic/Restricted range species, + a migrant, # Introduced species, Q Species recorded at the U. P. Quezon Land Grant. Note: taken from Collar *et al.* 1994, V—Vulnerable, E—Endangered, N—Near-threatened. R—raptorial; P—piscivore; AF—arboreal frugivore; TF—terrestrial frugivore; TIF—terrestrial insectivore/ frugivore; AIF—arboreal insectivore/frugivore; FF—faunivore/frugivore; IN—insectivore/nectarivore; TI—terrestrial insectivore; BGI—bark gleaning insectivore; FGI—foliage glaning insectivore; SaI—sallying insectivore; and SwI—sweeping insectivore (adopted from Johns, 1986). Note: taken from Dickinson *et al.* 1991, ¹—considered as *Spilornis cheela holospilus*, ²—considered as *Macropygia phasianella tenuirostris*, ³—considered as *Tyto capensis amaurotona*, ⁴—considered as *Penelopides panini manilloe*