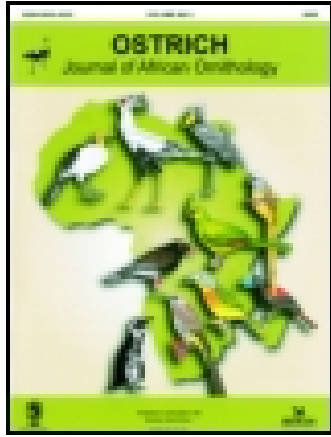


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### Implications of forest utilisation on bird conservation

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# Implications of forest utilisation on bird conservation

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This paper gives a summary of the effect of selective logging upon forest bird communities. Some differences may exist from one region to another due to environmental as well as ecological factors. However, the general responses of bird communities to defined logging operations are predictable. A case study from Uganda's Kibale National Park, is presented. Intensive mist-netting, counts and monitoring of breeding birds showed that species that are primarily adapted to exploiting forest edges, tree fall gaps and secondary habitats occurred and bred in large numbers in logged forest, but some species typical of forest interior were unable to adapt to logged forest. The long-term effects on the conservation of primary forest dependants are discussed.

## INTRODUCTION

The amount of information on the response of birds to selective logging from different parts of the tropics is growing steadily. It may therefore be possible to predict the effects of defined logging operations upon forest bird communities (Johns 1992). However, differences may exist from one region to another due to environmental and ecological factors that prevail in those regions. Studies from Papua New Guinea, Australia, Malaysia, Guiana and Cameroon (Bell 1982; Smith 1983; Lambert 1992; Johns 1986, 1991; Thiollay 1992; Fotso 1994) all showed that forest bird species richness and diversity declined in logged forest. Contrary to those results (Dranzoa 1995; Owiunzi 2000) indicated higher species richness and diversity in the logged than primary forest in Uganda's Kibale and Budongo Forests.

There are however areas of general consensus from all the different regions, that forest birds that occur in large numbers in logged forest are those species that are primarily adapted to exploiting forest edges, tree fall gaps and secondary habitats. In Uganda, Scarlet-chested Sunbird *Nectarinia senegalensis*, Grey-headed Bush-shrike *Malaconotus blanchoti*, Bronze Mannikin *Lonchura cucullata*, Common Bulbul *Pycnonotus barbatus*, Banded Prinia *Prinia bairdii*, White-chinned Prinia *P. leucopogon*, and Yellow-whiskered Greenbul *Andropadus latirostris* (Dranzoa 1995). This is probably because of an increased vegetation volume of the shrub layer which favours their survival, since they are able to exploit the resources of such fast-growing secondary vegetation.

## STUDY AREA

The Kibale National Park lies in the west of Uganda in Kabarole district. The 766 km<sup>2</sup> of forest is classified as medium-altitude moist Tropical Rain Forest (Langdale-Brown *et al.* 1964) and details are found in Kingston (1967). Kibale Forest is one of Uganda's richest parks in terms of biological diversity. It is contiguous with the northern part of Queen Elizabeth National Park. Gazetted as a forest reserve in 1932, timber extraction from the northern end of the forest started since 1950s and carried on until the status was uplified to a National Park in 1993. By the 1980s about 13% had been mechanically harvested, 18% was severely encroached, and the rest remained undisturbed (Horward 1991). All encroachers were evicted from the forest after it was declared a National Park by an act of parliament.

Two close compartments (3 km apart) with different management history were selected for this study. Both sites are located at Kanyawara, a Biological Field Station in the northern part of the forest (Figure 1). The unlogged forest compartment covers an area of 300 ha and generally characterised by large trees mainly of *Parinari excelsa*, *Strombosia scheflera*, *Olea welwitschii*, *Mimusops bagshawei*, *Diaspyros abyssinica*, *Uvariopsis congensis* and *Celtis*

spp. The selectively logged compartment is about 3 km away from the unlogged forest and is bordered by a forest compartment that was lightly logged. This compartment covers an area of 350 ha and it was heavily logged from 1968–1969. About 62% of the canopy was opened (Kasenene 1987). Small forest patches of varying sizes were left scattered within a matrix of dense secondary vegetation. The most common trees here are *Diaspyros abyssinica*, *Celtis durandii*, *Celtis africana*, *Milletia dura*, *Uvariopsis gongensis*, *Fagaropsis angolensis* and *Olea welwitschii*. The understorey comprises mainly *Mimusops* spp and *Acanthus*.

## METHODS

The methods employed in this study were mist-netting for understorey birds and transect counts for canopy species (for detailed descriptions see Pomeroy (1992)). A total of 182 860 metre net hours with 5 417 captures provided data from mist netting. About 147 km of transect were walked. Breeding records were obtained by walking and searching for nesting birds within 5 000 x

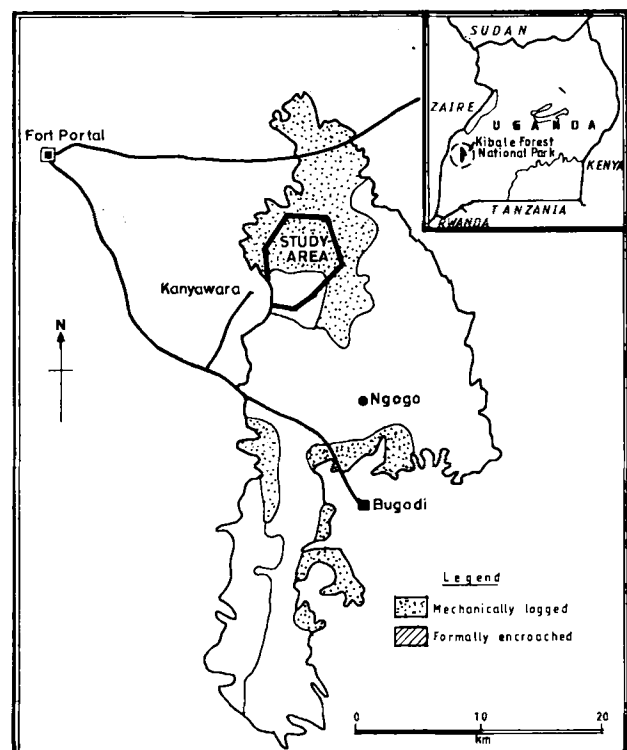


Figure 1. The map showing the location of Kibale National Park in Uganda and the study area.

20 m transects in each compartment and the breeding condition of bird caught was assessed by examining cloacal protuberance and brood patch.

Standard methods of vegetation sampling (Brower & Zar 1984) were used with some moderate modifications (Dranzoa 1995). Stratified nested quadrant sample plots of varying sizes were used; trees with > 9.5 cm DBH and those with DBH range of 5–9.4 cm were enumerated and measured within quadrates of 10 m x 20 m and 10 m x 10 m respectively. The ground vegetation cover was estimated in 1 m x 1 m quadrates.

## RESULTS

### Resource base in unlogged and logged forests

Table 1 shows the differences between resources available to forest birds in the unlogged and logged areas of Kibale. It is clear that the vegetation characters and structures of the logged forests were severely altered thereby reflecting remarkable differences in terms of total vegetation cover and vegetation volume. These differences in vegetation structure determine the types of forest birds resident in each area.

Table 2 demonstrates that flowering and fruiting increased, but there was loss of nest sites in the logged forest. These losses in breeding sites were further reflected by a significant reduction in numbers of birds that were found nesting in crevices and holes in logged compartment (Table 3). Although the majority of crevice/hole nesters did not breed in logged areas, their numbers were comparable to those in unlogged forest (Figure 2).

The bird communities in this study were classified into 13 feeding guilds (Table 4), based upon the level of feeding and type of food taken. There were no major alterations in numbers of species that comprised each guild. However, significant changes occurred in densities and biomasses of some of the guilds following logging (Table 4).

## DISCUSSION

Crevice nesters such as Brown-chested Alethe were common and abundant in the logged forest despite the fact that no egg-laying was registered, since there was no evidence to indicate that the specialist-crevice nesters actively used nest-sites in the logged forest. The numbers of crevice/hole nest sites were remarkably depressed due to logging of forest. Johns (1992) argues that these problems of losses of appropriate nest sites may be averted by retaining refuges in the logged areas. The available refuges in K-15 mainly comprised young stands of non-commercial trees, which did not have crevices or holes (Dranzoa 1995). Therefore the numbers of trees with crevices and holes still remained low in the logged forest.

A large population of crevice nesters in the logged forest probably come from the surrounding unlogged forests. Although the potential nesting-sites for some crevice/hole nesters were lowered in logged area, other resources e.g. nesting materials were abundant, especially for species such as Yellow-whiskered Greenbul *Andropadus latirostris*, Blue-shouldered Robin Chat *Cossypha cyanocamptus*, Masked Apalis *Apalis binotata* and African Broadbill *Smithornis capensis* that preferred building nests on the fast growing *Acanthus* vegetation in the logged forest compartment.

### Bird community structure in primary and logged forests

Although the majority of the stenotypic or "true" forest birds also occurred within the logged compartment the results from this study suggest that forest bird community transformation occurred in the logged forest (Table 4). The results in this study concurs with that from Cameroon, (Fotso 1994) and elsewhere in Malaysia and Amazonia (Wong 1985; Driscoll & Kikkawa 1989; Johns 1989a, 1991). The most common bird species in the primary forest was not the most abundant in the logged forest and Yellow-whiskered Greenbul contributed 26% of the total understorey population in the logged forest, whilst the common species in unlogged forest

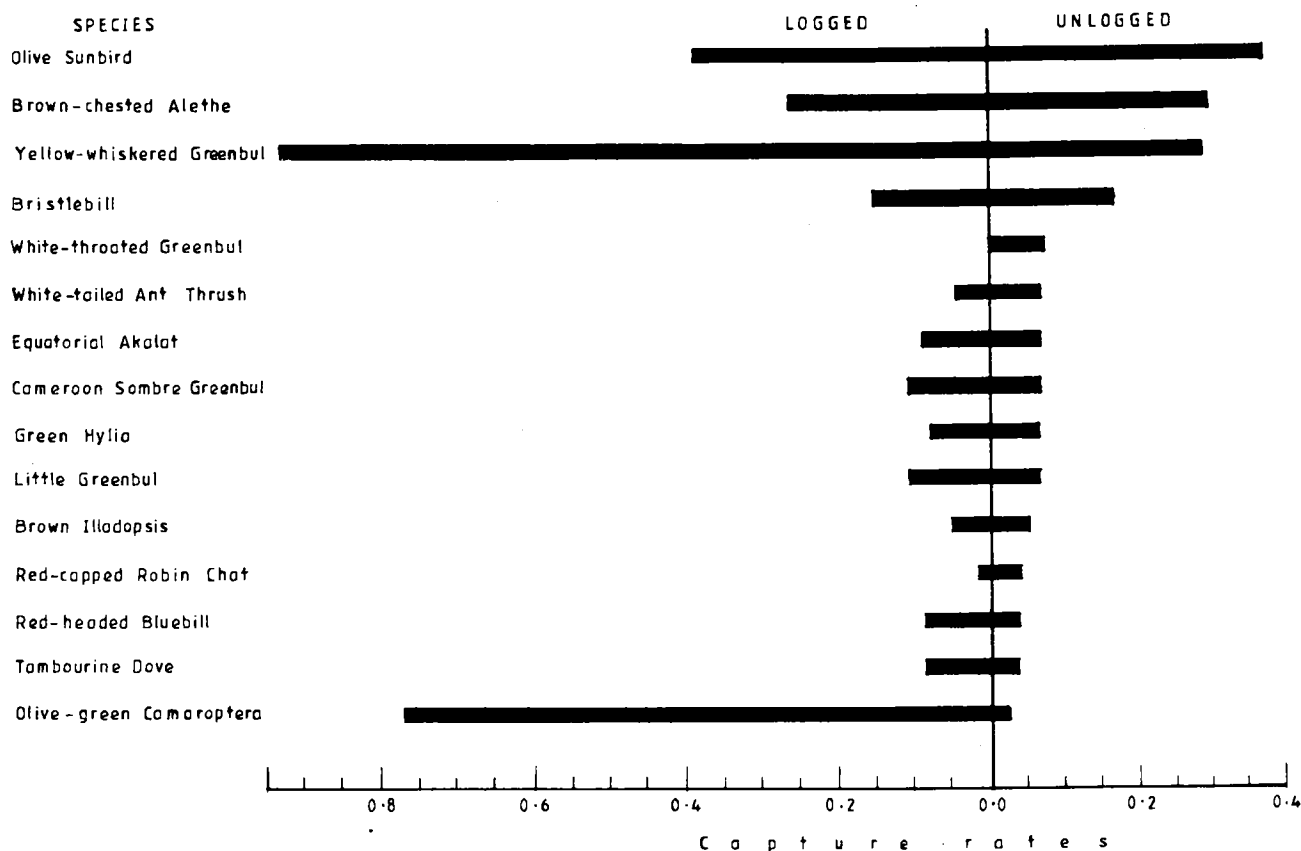


Figure 2. Comparison of capture rates of the most common species found in the unlogged and logged forest in Kibale.

**Table 1.** The changes in resources for understorey forest birds 23 years after logging in Kibale Forest National Park. Density is measured per ha, the mean percentage vegetation cover were obtained from 200 samples. Figures in parenthesis are standard deviations. Level of significance \*\*\* =  $P < 0.001$ ; \* =  $P < 0.05$ ; GVC = Ground vegetation cover; NS = Non significant difference.

Variable	Sites			
	Unlogged	Logged	Chi-test	P
<b>(a) DBH = &gt;9.5 cm</b>				
Stem density (live trees)	678.3	516.3	21.9	***
Stem density of common food trees	208.3	286.3		*
Stem density (dead trees)	11.7	11.3	0.07	NS
Basal area (m <sup>2</sup> /ha)	62.2	46.4	2.29	NS
Climber density	10.0	3.8	2.79	NS
Dead log density	22	5	10.7	***
<b>(b) DBH 5–9.4 cm</b>				
Stem density (live)	920.0	692.5	32.09	***
Stem density (dead)	3.3	12.5	5.36	*
Climber density	13.3	15.0	0.1	NS
Basal area	13.3	11.5	0.14	NS
<b>2) Percentage vegetation cover</b>				
			Z-test	
GVC	43.4 (17)	55.1 (21.8)	5.97	***
1–2 m	43.7 (13.2)	62.6 (20.6)	10.92	***
2–5 m	55.1 (7.8)	44.8 (13.3)	9.44	***
5–15 m	66.3 (4.6)	42.5 (15.1)	21.3	***
Vegetation height	12.7 (5.3)	10.8 (13.6)		
Total vegetation cover	251.1	226.4		
Foliage height diversity	1.6	1.1		
Vegetation volume index	50.7	27.0		

**Table 2.** The effect of selective logging on other resources in Kibale National Park.

Resource	Dranzoa (1995)	Kalina (1988)
Nest sites (crevice/hole)	-ve	-ve
Arthropod abundance	NS	
Density of flowering trees	+ve	
Density of fruiting trees	+ve	

**Table 3.** The list of birds found nesting in crevice (c) and hole (h), obtained through physical search (a) and from trapped birds (b). And a summary of other breeding records. Note: the data for other nesters were combined all species.

Species	Number of individuals			
	Unlogged <sup>a</sup>	Unlogged <sup>b</sup>	Logged <sup>a</sup>	Logged <sup>b</sup>
<i>Alethe poliocephala</i> (c)	13	14	0	11
<i>Bycanistes subcylindricus</i> (h)	4	0	1U	0
<i>Cossypha natalensis</i> (c)	4	4	0	0
<i>Neocossyphus poensis</i> (h)	1	4	0	2
<i>Trachylaemus purpuratus</i> (h)	1	0	0	0
<i>Lybius hirsutus</i> (h)	1	0	0	0
<i>Pogoniulus bilineatus</i> (h)	0	7	1	6
<i>Sheppardia aequatorialis</i> (c)	0	9	0	2
<i>Stizorhina fraseri</i> (c)	0	1	0	1
<i>Mesopicos xantholophus</i> (h)	0	1	0	0
<i>Pogoniulus scolopaceus</i> (h)	0	0	0	1
Total confirmed breeding records	67	160	59	381
Total crevice nesters	17**	28	0	14
Total hole nesters	7*	12*	1	1
Others (none crevice/hole nesters)	43	120	57	358
% Forest specialist birds	37**	13	13.6	12.1

Note: U = unconfirmed record \*\*\* =  $P < 0.001$ ; \*\* =  $P < 0.01$ ; \* =  $P < 0.05$

were Olive Sunbird and Brown-chested Alethe, contributing 18% and 15% respectively (Dranzoa 1998.) It is suggested that a single species dominating a community may account for the loss of some congenics (due to competition) from the locality (see Karr 1977). The repercussions on the community may be drastic especially if birds that are eliminated have important roles to play in the complex ecosystem functioning processes e.g. pollinating, seed dispersal agents and insect pest control in a natural forest.

Studies elsewhere suggest that certain species may be prone to local extinction following logging; e.g. ant followers, understorey flycatchers, woodpeckers, trogons etc. (Johns 1989a; Lambert 1990; Thiollay 1992; Terborgh 1995) but others such as granivores, frugivore-insectivores and nectarivores do well in logged area (see Johns 1991; Thiollay 1992; Lambert 1992). They also suggested that some of these birds may re-colonise the logged habitat at a later state of regeneration. In Kibale, I identified seven species that have either become extinct from the logged forest after logging operation or have failed to recolonise 23 years after logging took place (Dranzoa in prep.). A number of reasons have been suggested for their absence. Comparative assessment also indicated that recovery of the Kibale bird community in the logged forest is very low compared with that from Malaysia (Johns 1985). These ultimately have important conservation consequences. It appears that the logged forest may not regain those lost species and may continue losing further species as long as the regenerative capacity of the logged compartment remains retarded (Struhshaker *et al.* 1995). This is expected to affect the long-term survival of most of the uncommon birds that have persisted in the logged forest.

### Selective logging and forest bird conservation

The ability of most species to survive in logged forest was shown in a separate study (Dranzoa 1995). The survival of true forest birds however was at least partly dependent upon the remnant forest patches left within the logged forest mosaic. Forest patches as small as 0.7 ha. (but in an intact state) were able to support some territorial breeding birds (Dranzoa 1995). This finding was in agreement with reports from Malaysian Sabahan forests (Johns 1989b, 1995).

The presence of birds with brood patches within the populations from both compartments suggested that breeding took place in the two forests although the breeding populations of stenotypic forest birds and crevice nesters were depressed in the logged forest. Further evidence was provided by discovering active nesting, eggs and even ringing of fledglings of certain species. However, the lack of active nesting of crevice nesters (such as the Brown-chested Alethe, Equatorial Akalat *Sheppardia aequatorialis* and others) creates some doubts on their breeding performance in the logged forest. The low number of suitable breeding sites for crevice nesters within the logged forest appears to aggravate the problem for this particular group of nesters. It is therefore not yet clear as to how and where the large populations of crevice nesters in the logged forest came from. One possibility is the 'Source-Sink' theory (Harrison 1991) that most of these populations are coming from optimal unlogged habitats into the sub-optimal logged habitat. Therefore there is need for further research, so as to track movements, study where colonists come from and how often, and assess population structure of some species.

### Species of conservation concern

Species that are likely to disappear first following habitat disturbance have some common features. According to Johns (1989b) - birds that have low population densities or those with patchy distributions or both - those with an inability to colonise recently logged habitat, or which gradually decline due to an inability to tolerate the changed conditions, are all likely to disappear from logged habitats. This study has identified a number of species and feeding guilds affected adversely (Table 4). The rare, stenotypic or forest interior species were most affected. Populations of bark gleaning and sallying substrate insectivores and large frugivores were significantly reduced in the logged forest compartment. These are some of the guilds to be monitored.

### CONCLUSION

The usefulness of logged forest in conserving forest dependent species will depend on the level of damage and most importantly the availability of unlogged forest refuges within the concession

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**Table 4.** Responses of different guilds to different forest management. Results are based on transect counts/species vulnerable to logging/disturbance. Data were obtained from monthly transect counts. Density = Number of birds /ha; Biomass = body mass/ha. The differences in density and biomass from the two sites were tested with Mann-Whitney U test, P = level of significance: \*\*\* = P < 0.001; \*\* = P < 0.01; \* = P < 0.05.

Feeding guilds	# spp Unlogged	# spp Logged	Density Unlogged	Density logged	P	Biomass Unlogged	Biomass Logged	P
UTSI	11	9	1.52	1.29	NS	54.84	39.1	*
UFGI	7	7	2.25	4.81	***	63.88	81.29	***
AFGI	17	16	2.59	3.16	NS	48.7	28.01	**
SSI	16	14	1.78	1.28	*	39.65	20.57	**
BGI	5	4	1.02	0.49	*	37.27	25.04	*
Frugivores	12	11	1.58	1.25	NS	823.96	233.56	***
F/I	11	11	3.81	7.38	***	126.55	212.69	***
F/G	4	6	0.41	0.57	N	56.58	160.69	•
P/I	5	8	0.26	0.84	***	12.2	35.92	***
S/R	10	11	0.06	0.33	NS	140.94	235.70	NS
G/I	7	10	1.15	2.44	**	405.29	762.45	**
N/I	8	8	2.24	2.17	NS	22.94	21.37	NS
Granivore	4	5	0.08	0.24	•	1.34	6.02	*
Total	117	120	18.76	26.86	*	1 837.14	1 862.41	NS

Key: UTSI - Understorey terrestrial specialist insectivores; UFGI - Understorey foliage gleaning insectivores; AFGI - Arboreal foliage gleaning insectivores; SSI - Salling substrate insectivores; BGI-Bark gleaning insectivores; F/I-Frugivore /insectivores; F/G-frugivore/granivore; P/I- Predator/insectivore; S/R-Scavenger/raptor; N/I - Nectarivore/insectivore.

area (Dranzoa 1995; Johns 1995). The survival of such bird populations may be influenced by the quality of the forest patches rather than their area. Dranzoa (1995) showed that forest patches covering about 35% of the logged compartment retained large populations of primary forest interior bird species. Therefore leaving more forest patches will enhance species diversity and help retain species that are intolerant of conditions that exist in a logged area, and must be prescribed as a requirement in granting concessions to loggers.

Intensive logging like in Kibale is not compatible with the long-term survival and biological conservation of some forest birds since there are some species totally eliminated from logged areas and others largely unable to breed there. Despite much research into the understanding of ecological processes in forest ecosystems, there is still so much that remains unknown to mankind and yet these individually unique forest ecosystems are the most threatened by extinction. It is therefore safer to retain these remaining forest fragments without tampering with their integrity least we cause irreversible changes. Hence, management decisions must be based on long term monitoring of the ecosystem that incorporates demographic parameters of the fauna. It is through such monitoring that a more accurate understanding of the dynamics of the flora and fauna in disturbed ecosystems can be obtained.

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