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Observations of threatened birds in the East Usambara Mountains, Tanzania

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Observations sur les oiseaux menacés dans les montagnes des Usambaras orientales, Tanzanie. Les observations et les résultats préliminaires d'un inventaire ornithologique des montagnes des Usambaras orientales, au nord-est de la Tanzanie, sont présentés. En utilisant des comptages par points standardisés et des observations opportunistes, les auteurs ont collecté des informations concernant la distribution, le choix de l'habitat et l'abondance relative des espèces ayant la plus haute importance pour la conservation. Parmi les 124 espèces recensées pendant l'inventaire, six se trouvent sur la Liste Rouge et neuf sont à répartition restreinte. Un nombre significatif d'espèces d'importance pour la conservation a été trouvé à la lisière des forêts et dans les habitats cultivés. Les exigences en matière d'habitat des espèces menacées varient selon les espèces : tandis que celles qui cherchent leur nourriture au sol (Merle des Usambaras *Turdus* (*olivaceus*) *roehli*, *Modulatrix* spp.) ont clairement besoin de forêts intactes, le Souimanga d'Amani *Hedydipna pallidigastra*, le Souimanga à col rouge *Anthreptes rubritorques*, le Touraco de Fischer *Tauraco fischeri*, le Rufipenne de Kenrick *Poeoptera kenricki* et la Couturière de Moreau *Artisornis moreaui* sont aussi fréquents dans des habitats secondaires perturbés, le long des lisières des forêts ou même dans les milieux cultivés relativements ouverts. Ceci semble indiquer que certaines espèces menacées pourraient bénéficier d'initiatives de conservation limitant la dégradation des lisières et des milieux cultivés (par exemple, la plantation d'arbres indigènes utiles).

Summary. We report the preliminary observations and results of a survey of the birds of the East Usambara Mountains, north-east Tanzania. Using standardised point counts and opportunistic searches, we collected information on the distribution, habitat selection and relative abundance of those species of greatest conservation concern. Amongst the 124 species recorded during the survey, six are listed in the global Red Data book and nine are considered to be restricted-range. Forest edges and agricultural habitats had notable numbers of species of conservation importance. Habitat requirements of the species of conservation concern differed: whilst ground-foragers (Usambara Thrush *Turdus* (*olivaceus*) *roehli*, *Modulatrix* spp.) are clearly dependent on intact forest, Banded Sunbird *Anthreptes rubritorques*, Amani Sunbird *Hedydipna pallidigastra*, Fischer's Turaco *Tauraco fischeri*, Kenrick's Starling *Poeoptera kenricki* and Long-billed Tailorbird *Artisornis moreaui* are also frequent in successional habitats created by disturbance, at forest edges or even in relatively open, agricultural landscapes. This suggests that some threatened species might benefit from conservation initiatives (e.g., planting of useful indigenous trees) specifically targeted to counter the degradation of such 'fringe' habitats.

The East Usambara Mountains, in north-eastern Tanzania, form part of the Eastern Arc Mountains, a geologically ancient range that runs from southern Kenya to northern Mozambique, wherein geographic isolation and climatic stability have produced remarkable endemic biodiversity (Burgess *et al.* 2007a). The main habitat in the Eastern Arc is montane forest that grades into lowland forest. Due to the small area of remaining forest and the severe human impact (Burgess *et al.* 2007a,b), the Eastern Arc is one of the most endangered biodiversity hotspots in the world (Brooks *et al.* 2002).

More than 50% of the original forest cover of the East Usambaras has been removed for cultivation (Hamilton & Bensted-Smith 1989), which comprises intensively managed tea plantations and traditional shifting agriculture practiced by local inhabitants and migrant workers. Although commercial timber extraction was banned in Tanzanian montane forests in the late 1980s, pressure is still exerted on the remaining forest of the

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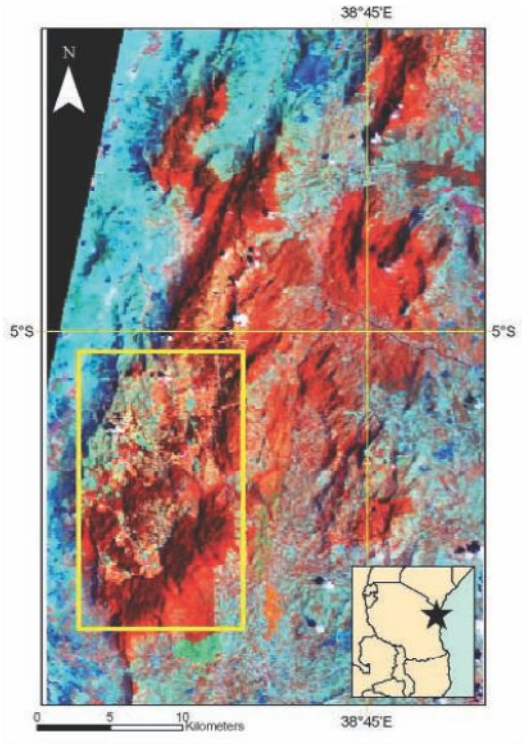


Figure 1. The East Usambara Mountains In this infra-red satellite image, forest is deep red, tea and tree plantations are orange or green, and bush blue. The yellow rectangle highlights the study area.

Les Usambaras orientales. Sur cette image satellite infrarouge, la forêt est rouge, les plantations de thé et d'arbres sont oranges ou vertes, et la brousse bleue. Le rectangle jaune indique la zone d'étude.

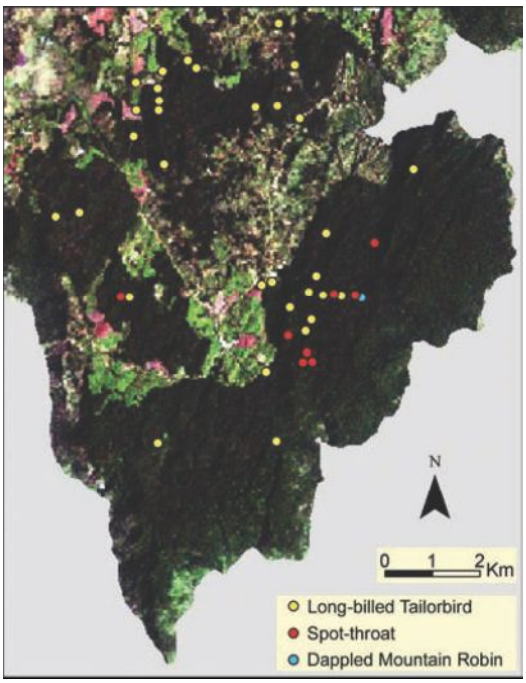


Figure 2. Records of Long-billed Tailorbird *Artisornis moreaui*, Spot-throat *Modulatrix stictigula* and Dappled Mountain Robin *M. orostruthus* within the study area, East Usambara Mountains. In this satellite image, forest appears as deep green, tea plantations as light green or reddish and smallholder agricultural areas are a fine-grain mosaic of different shades of green. Areas below 700 m appear as grey.

Les observations de la Couturière de Moreau *Artisornis moreaui*, la Modulatrice à lunettes *Modulatrix stictigula* et la Modulatrice grivelée *M. orostruthus* dans la zone d'étude, Usambaras orientales. Sur cette image satellite la forêt est vert sombre, les plantations de thé sont vert clair ou rougeâtre et zone cultivées forment une mosaïque de différentes teintes de vert. Les zones en dessous de 700 m sont grisées.

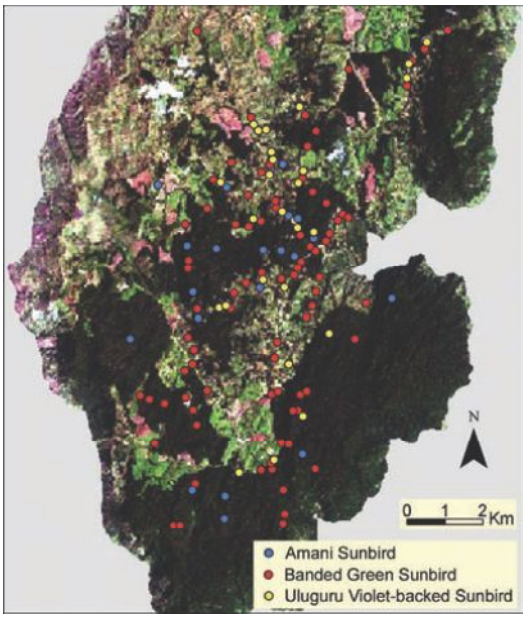


Figure 3. Records of threatened sunbirds (Amani Sunbird *Hedydipna pallidigastra*, Banded Sunbird *Anthreptes rubritorques* and Uluguru Violet-backed Sunbird *Anthreptes neglectus*) in the study area, East Usambara Mountains. Map key as in Fig. 2.

Les observations des souimangas menacés (Souimanga d'Amani *Hedydipna pallidigastra*, Souimanga à col rouge *Anthreptes rubritorques* et Souimanga des Ulugurus *A. neglectus*) dans la zone d'étude, Usambaras orientales. Couleurs de la carte comme dans la fig. 2.

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Southern Banded Snake Eagle / Circaète barré *Circaetus fasciolatus* (Hugh Chittenden)



Male Amani Sunbird / Souimanga d'Amani *Hedydipna pallidigastra* (Steve Garvie)



Female Amani Sunbird / Souimanga d'Amani *Hedydipna pallidigastra* (Steve Garvie)

East Usambaras. The main current environmental issues are the expansion of smallholder shifting agriculture (cardamom *Elettaria cardamomum*, clove *Syzygium aromaticum*, cinnamon *Cinnamomum verum*, sugarcane *Saccharum* sp., as well as numerous traditional food crops), illegal timber extraction by local people and by tea companies which use large amounts of firewood for drying tea, the widespread trapping and hunting of mammals, and the spread of invasive species, especially the tree *Maesopsis eminii*, which was introduced from Western Africa for forestry purposes in the early 20th century (Viisteensaari *et al.* 2000, Cordeiro *et al.* 2004).

The East Usambaras host several globally threatened and restricted-range species of birds (Stattersfield *et al.* 1998, IUCN 2006). However, despite these mountains having a long history of ornithological research (e.g. Moreau 1935, Stuart 1983; reviewed in Cordeiro 1998), there is a dearth of information on the current status, habitat selection and population trends of most birds in the area. In particular, almost all biological research in the Usambaras has traditionally focused on forest, whilst habitat mosaics created by smallholder agriculture have been very little studied: these habitats can host considerable species diversity in Central America (Luck & Daily 2003) and Uganda (Naidoo 2004), and might therefore have some conservation value also in tropical East Africa.

In early 2006, we commenced a multi-year monitoring programme of the threatened bird species in the East Usambaras. In the long term, this is expected to provide detailed information on population size, numerical trends and habitat selection of the birds at greatest risk. We envisage that these data will form a baseline against which results of future monitoring can be compared. Here we report some preliminary findings obtained during the first year of field work.

Study area and research methods

Our study focuses on an area of *c.*200 km^2 at altitudes of 750–1,200 m in the southern East Usambara Mountains (Fig. 1); approximately half of this area is protected by the Amani Nature Reserve. The study area covers a range of habitats, including tea plantations, primary and degraded forest, isolated forest fragments, as well as settlements and open areas occupied by permanent or

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shifting agriculture. We established a network of 354 sampling points along 32 transects, each one with 10–13 points spaced 200 m apart. For each point, we recorded geographical coordinates using a GPS and documented the habitat type (smallholder agriculture, degraded forest with more than 15% *Maesopsis*, and undisturbed/slightly disturbed forest with 15% or less *Maesopsis*) within a radius of 100 m; *Maesopsis* has been previously used as an indicator of disturbance and habitat quality (Newmark 2006). In general, we surveyed each habitat in proportion to its representation within the study area. However, we avoided tea and *Eucalyptus* plantations because of their low bird diversity (John & Kabigumila 2007). Of the 354 sample points, 92 were in smallholder agriculture, 79 in disturbed forest, 84 in undisturbed/slightly disturbed forest, and 99 were classified as ecotones.

We established the network of census points in January 2006 and performed initial counts. All 354 points were resampled between 7 September and 14 October 2006. We surveyed the avifauna of each point using limited-distance, ten-minute duration point counts, during which all the birds seen or heard within a 200 m radius were recorded. Counts were undertaken between 06:00 and 10:30 hrs. During the survey, we also made opportunistic observations of all species of conservation concern. These records provide additional information concerning the species' distribution across the landscape.

As we suspected that the Long-billed Tailorbird *Artisornis moreaui*, a Critically Endangered species (IUCN 2006), was underrecorded during the counts due to its secretive behaviour and preference for extremely dense vegetation (see Cordeiro *et al.* 2001), we undertook additional work focused on this species, using playback.

Results

During the point counts we recorded 5,306 observations (6,988 individuals) of 124 species, of which seven are considered threatened or Near Threatened (IUCN 2006) and nine have restricted ranges (i.e. less than 50,000 km^2: Stattersfield *et al.* 1998; Table 1). We recorded significant numbers of threatened and restricted-range species in all habitats. Edges and smallholder agriculture usually had high numbers of some species of conservation concern, in part due to the abundance of Kenrick's Starling *Poeoptera kenricki* (which was never observed in the forest interior), but Amani *Hedydipna pallidigastra*, Banded *Anthreptes rubritorques* and Uluguru Violet-backed Sunbirds *Anthreptes neglectus*, and Fischer's Turaco *Tauraco fischeri* were also regularly recorded in these habitats (Table 2). Undisturbed forest had the highest diversity of ground-foraging species (Spot-throat *Modulatrix stictigula*, Dappled Mountain Robin *M. orostruthus*, Sharpe's Akalat *Sheppardia sharpei* and Usambara Thrush *Turdus* [*olivaceus*] *roehli*), the first two of which had some of the lowest encounters overall (Table 1).

Notes on selected species

Southern Banded Snake Eagle *Circaetus fasciolatus*

This Near-Threatened species was observed nine times during the standardised counts, and a further ten locations were pinpointed at other times during the survey. Although it was observed in all habitat types (Table 1), mean frequencies appeared higher in undisturbed forest than in other habitats (Table 2), but our sample size is too small to reach definitive conclusions for now. Numbers in forest habitats might have been under-estimated as silent individuals flying above the canopy might have gone undetected. In September–October 2006, the species was very vocal and probably breeding. We obtained a possible breeding record on 19 September, when one was observed carrying nest material to a tree in a *Eucalyptus* plantation. Proven breeding was noted in October 2005 (NJC pers. obs).

Our data, whilst still limited, suggest that the Southern Banded Snake Eagle prefers forest habitats in the East Usambaras, but also uses, at least for foraging, and perhaps even for nesting, anthropogenic habitats adjacent to forest.

Fischer's Turaco *Tauraco fischeri*

Fischer's Turaco is a restricted-range, Near-Threatened species endemic to the East African coast, from southern Somalia to northern Tanzania, but also penetrates inland to some montane massifs in northern Tanzania, including the East Usambaras (Britton 1980). Fischer's Turaco was frequently recorded in all habitats, partly because its loud calls could be heard from several hundreds metres distance. Our data (Table 1)

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Table 1. List of species observed during the counts performed in September–October 2006, in 354 sample points in the southern East Usambara Mountains. Total numbers of individuals observed in the four major habitat types are also listed. Threat status follows IUCN (2006) and definition of restricted-range species Stattersfield *et al.* (1998). Abbreviations: NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered.

Table 1. Liste des espèces observées lors des comptages exécutés en septembre–octobre 2006 à 354 points d'échantillonage dans la partie sud des Usambaras orientales. Le nombre total d'individus observés dans les quatre principaux types d'habitat est également mentionné. Le statut des espaces menacées suit la classification de l'UICN (2006), la définition des espèces à répartition restreinte suit Stattersfield *et al.* (1998). Abréviations: NT = Quasi menacé; VU = Vulnérable; EN = Menacé d'extinction; CR = Gravement menacé d'extinction.

Common name	Scientific name	Threat status	Restricted range	Undisturbed forest	Disturbed forest	Edge	Smallholder agriculture
Olive Ibis	*Bostrychia olivacea*			0	4	0	0
Southern Banded Snake Eagle	*Circaetus fasciolatus*	NT		4	1	3	2
African Harrier Hawk	*Polyboroides typus*			0	0	2	1
African Goshawk	*Accipiter tachiro*			3	1	1	0
Little Sparrowhawk	*Accipiter minullus*			0	0	1	1
Black Sparrowhawk	*Accipiter melanoleucus*			1	0	0	2
Augur Buzzard	*Buteo augur*			0	0	1	3
Long-crested Eagle	*Lophaetus occipitalis*			0	0	1	4
Crowned Eagle	*Stephanoaetus coronatus*			0	3	1	0
African Green Pigeon	*Treron calvus*			0	6	10	25
Tambourine Dove	*Turtur tympanistria*			29	38	47	35
Blue-spotted Wood Dove	*Turtur afer*			0	0	0	5
Eastern Bronze-naped Pigeon	*Columba delegorguei*			28	18	6	1
Lemon Dove	*Columba larvata*			4	4	0	0
Red-eyed Dove	*Streptopelia semitorquata*			0	1	1	6
Fischer's Turaco	*Tauraco fischeri*	NT	*	38	20	27	22
Barred Long-tailed Cuckoo	*Cercococcyx montanus*			7	2	0	0
African Emerald Cuckoo	*Chrysococcyx cupreus*			0	0	2	1
Klaas's Cuckoo	*Chrysococcyx klaas*			0	0	0	1
Yellowbill	*Ceuthmochares aereus*			3	0	0	0
White-browed Coucal	*Centropus superciliosus*			0	0	5	11
African Palm Swift	*Cypsiurus parvus*			0	0	1	0
Little Swift	*Apus affinis*			0	0	2	0
Speckled Mousebird	*Colius striatus*			0	0	54	137
Bar-tailed Trogon	*Apaloderma vittatum*			15	2	0	0
Brown-hooded Kingfisher	*Halcyon albiventris*			0	0	7	5
Green Wood-hoopoe	*Phoeniculus purpureus*			0	0	2	1
Trumpeter Hornbill	*Bycanistes bucinator*			0	0	5	7
Silvery-cheeked Hornbill	*Bycanistes brevis*			113	109	87	64
White-eared Barbet	*Stactolaema leucotis*			4	4	41	51
Green Barbet	*Stactolaema olivacea*			93	79	79	33
Moustached Green Tinkerbird	*Pogoniulus leucomystax*			37	27	32	38
Scaly-throated Honeyguide	*Indicator variegatus*			5	7	5	7
Mombasa Woodpecker	*Campethera mombassica*			4	1	1	0
Olive Woodpecker	*Dendropicos griseocephalus*			0	0	0	1
Cardinal Woodpecker	*Dendropicos fuscescens*			1	0	3	10
African Broadbill	*Smithornis capensis*			20	7	0	0
Black Saw-wing	*Psalidoprocne pristoptera*			0	0	63	67

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Lesser Striped Swallow	*Cecropis abyssinica*			0	0	1	14
Yellow Wagtail	*Motacilla flava*			0	0	1	0
Mountain Wagtail	*Motacilla clara*			0	1	5	0
African Pied Wagtail	*Motacilla aguimp*			0	0	4	3
Black Cuckoo-shrike	*Campephaga flava*			0	0	2	0
Grey Cuckoo-shrike	*Coracina caesia*			30	18	14	1
Shelley's Greenbul	*Andropadus masukuensis*			53	43	14	2
Stripe-cheeked Greenbul	*Andropadus milanjensis*			55	48	24	0
Little Greenbul	*Andropadus virens*			67	81	112	47
Yellow-bellied Greenbul	*Chlorocichla flaviventris*			0	0	0	1
Cabanis's Greenbul	*Phyllastrephus cabanisi*			14	13	8	0
Yellow-streaked Bulbul	*Phyllastrephus flavostriatus*			57	39	20	1
Tiny Greenbul	*Phyllastrephus debilis*			14	2	0	1
Common Bulbul	*Pycnonotus barbatus*			3	21	172	217
Eastern Nicator	*Nicator gularis*			3	5	8	0
White-starred Robin	*Pogonocichla stellata*			0	0	2	0
Sharpe's Akalat	*Sheppardia sharpei*		*	16	8	0	0
White-browed Robin Chat	*Cossypha heuglini*			0	0	8	11
Common Stonechat	*Saxicola torquatus*			0	0	20	3
White-chested Alethe	*Alethe fuelleborni*			25	19	8	0
Red-tailed Ant Thrush	*Neocossyphus rufus*			1	4	4	0
Orange Ground Thrush	*Zoothera gurneyi*			7	4	0	0
Usambara Thrush	*Turdus (olivaceus) roehli*		*	17	20	7	0
Kurrichane Thrush	*Turdus libonyanus*			0	0	0	4
Evergreen Forest Warbler	*Bradypterus lopezi*			9	32	15	6
Little Rush Warbler	*Bradypterus baboecala*			0	0	5	2
African Yellow Warbler	*Chloropeta natalensis*			0	0	4	12
Yellow-throated Woodland Warbler	*Phylloscopus ruficapilla*			43	36	13	1
Long-billed Tailorbird	*Artisornis moreaui*	CR	*	3	1	0	0
Red-faced Cisticola	*Cisticola erythrops*			0	0	37	85
Tawny-flanked Prinia	*Prinia subflava*			0	0	54	61
Black-headed Apalis	*Apalis melanocephala*			57	42	35	3
Grey-backed Camaroptera	*Camaroptera brachyura*			0	3	23	19
Southern Black Flycatcher	*Melaenornis pammelaina*			0	0	2	6
African Dusky Flycatcher	*Muscicapa adusta*			8	8	30	10
White-tailed Crested Flycatcher	*Elminia albonotata*			38	40	5	1
African Paradise Flycatcher	*Terpsiphone viridis*			36	28	24	4
Black-and-white Flycatcher	*Bias musicus*			0	0	1	2
Black-throated Wattle-eye	*Platysteira peltata*			0	0	4	1
Forest Batis	*Batis mixta*			22	6	0	2
Pale Batis	*Batis soror*			0	0	15	10
Pale-breasted Illadopsis	*Illadopsis rufipennis*			5	7	2	0
Arrow-marked Babbler	*Turdoides jardineii*			0	0	0	2
Spot-throat	*Modulatrix stictigula*		*	6	2	0	0
Dappled Mountain Robin	*Modulatrix orostruthus*	VU	*	1	0	0	0
Uluguru Violet-backed Sunbird	*Anthreptes neglectus*			2	2	14	16
Banded Sunbird	*Anthreptes rubritorques*	VU	*	6	9	33	29
Eastern Olive Sunbird	*Cyanomitra olivacea*			107	101	140	97
Amethyst Sunbird	*Chalcomitra amethystina*			0	0	4	22
Scarlet-chested Sunbird	*Chalcomitra senegalensis*			0	0	1	4
Collared Sunbird	*Hedydipna collaris*			24	20	85	50
Amani Sunbird	*Hedydipna pallidigastra*	EN	*	5	6	6	5
Purple-banded Sunbird	*Cinnyris bifasciatus*			0	0	30	78
Variable Sunbird	*Cinnyris venustus*			0	0	1	5
Yellow White-eye	*Zosterops senegalensis*			7	19	35	72
Common Fiscal	*Lanius collaris*			0	0	5	12

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Black-fronted Bush-shrike	*Telophorus nigrifrons*			56	34	15	1
Sulphur-breasted Bush-shrike	*Telophorus sulfureopectus*			0	0	0	1
Brown-crowned Tchagra	*Tchagra australis*			0	0	6	7
Black-backed Puffback	*Dryoscopus cubla*			3	5	30	36
Tropical Boubou	*Laniarius aethiopicus*			0	3	10	20
Green-headed Oriole	*Oriolus chlorocephalus*			44	59	58	14
African Golden Oriole	*Oriolus auratus*			0	0	3	13
Square-tailed Drongo	*Dicrurus ludwigii*			73	53	34	1
Fork-tailed Drongo	*Dicrurus adsimilis*			0	0	22	37
Kenrick's Starling	*Poeoptera kenricki*		*	0	0	21	52
Waller's Starling	*Onychognathus walleri*			19	25	63	55
Red-winged Starling	*Onychognathus morio*			0	0	0	1
Black-bellied Starling	*Lamprotornis corruscus*			1	3	88	121
Violet-backed Starling	*Cinnyricinclus leucogaster*			0	0	6	26
Baglafecht Weaver	*Ploceus baglafecht*			0	0	9	46
Spectacled Weaver	*Ploceus ocularis*			0	0	28	57
Dark-backed Weaver	*Ploceus bicolor*			39	38	31	4
Thick-billed Weaver	*Amblyospiza albifrons*			0	0	0	10
Yellow Bishop	*Euplectes capensis*			0	0	0	1
Green Twinspot	*Mandingoa nitidula*			0	1	0	0
Red-faced Crimsonwing	*Cryptospiza reichenovii*			3	2	5	3
Yellow-bellied Waxbill	*Estrilda quartinia*			0	0	22	45
Common Waxbill	*Estrilda astrild*			0	0	24	28
Red-headed Bluebill	*Spermophaga ruficapilla*			1	0	0	0
Red-throated Twinspot	*Hypargos niveoguttatus*			1	4	1	0
Bronze Mannikin	*Lonchura cucullata*			0	0	0	4
Black-and-white Mannikin	*Lonchura bicolor*			0	14	20	64
Pin-tailed Whydah	*Vidua macroura*			0	0	0	1
African Citril	*Serinus citrinelloides*			0	0	29	117
Cabanis's Bunting	*Emberiza cabanisi*			0	2	7	26
Total	**124**	**6**	**9**	**1,390**	**1,265**	**2,079**	**2,254**

Table 2. Red-listed and restricted-range species, and their mean frequencies (number of individuals/point), in the four habitat types in the East Usambara Mountains (sample size: 354 point counts).

Tableau 2. Liste des espèces de la Liste Rouge et à répartition restreinte avec leur fréquence moyenne (nombre d'individus/point) dans les quatre types d'habitat des Usambaras orientales (taille de l'échantillonage: 354 points de comptage).

Common name	Undisturbed forest	Disturbed forest	Edge	Smallholder agriculture	Overall average
Southern Banded Snake Eagle	0.05	0.01	0.03	0.02	0.03
Fischer's Turaco	0.45	0.25	0.27	0.24	0.30
Sharpe's Akalat	0.19	0.10	0.00	0.00	0.07
Usambara Thrush	0.20	0.25	0.07	0.00	0.13
Long-billed Tailorbird	0.04	0.01	0.00	0.00	0.01
Spot-throat	0.07	0.03	0.00	0.00	0.02
Dappled Mountain Robin	0.01	0.00	0.00	0.00	0.00
Uluguru Violet-backed Sunbird	0.02	0.03	0.14	0.17	0.10
Banded Sunbird	0.07	0.11	0.33	0.32	0.22
Amani Sunbird	0.06	0.08	0.06	0.05	0.06
Kenrick's Starling	0.00	0.00	0.21	0.57	0.21

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show that this species is abundant in the East Usambara submontane forest. It was most frequent in undisturbed forest, whilst in disturbed forest and farmland habitats it was noticeably rarer (Table 2). Nevertheless, turacos were regularly observed outside forest, even in very small patches of isolated trees, often planted by people, around watercourses and within the agricultural matrix.

Sharpe's Akalat *Sheppardia sharpei*
A restricted-range species endemic to the Eastern Arc. Rarely seen, but quite frequently heard (91% of 22 contacts) at altitudes ranging from 900 to 1,100 m. Similar to Newmark's (1991, 2006) findings, we recorded it only in forest, with frequencies in undisturbed forest almost twice those of disturbed forest (Table 2). The species appears to be highly sensitive to changes in forest quality.

Usambara Thrush *Turdus* (*olivaceus*) *roehli*
Although current systematics treat Usambara Thrush as a subspecies of the widespread Olive Thrush *T. olivaceus*, molecular analyses suggest that this taxon is better considered a separate species, endemic to the North Pare and Usambara mountains (Bowie *et al.* 2005). We agree with this, given the clear differences in both vocalisations and ecology compared to the northern (*abyssinicus*) races. In our survey, Usambara Thrush was observed in relatively good numbers (32 records), both in disturbed and undisturbed forest, more rarely at edges (Table 2); outside forest, the species was replaced by the congeneric Kurrichane Thrush *T. libonyanus*. Recent studies suggest that Usambara Thrush is undergoing a long-term decrease (Newmark 1991, 2006). Despite this trend, our data suggest that it is still relatively widespread in the study area, although it is confined to forest habitats.

Long-billed Tailorbird *Artisornis moreaui*
This Critically Endangered species is known only from the East Usambaras and from a single locality in northern Mozambique where it was recently rediscovered (Ryan & Spottiswoode 2003). During standardised counts we obtained only four records, but as we suspected this to be an underestimate—this species occurs in extremely densely vegetated habitats and can only be located when it sings, which does not occur frequently—we undertook specific searches along the transects using playback. As a result, a further 28 territories were located within the study area (Fig. 2). Of these, 14 were at forest edge and 18 in forest interior. The number of territories located on the edge of, or within, disturbed forest was equal to those in undisturbed forest (16 vs. 16). Twelve of the 32 territories were along streams, whilst the rest were in large open gaps or at forest edge. In all cases, the canopy was open and the undergrowth was occupied by dense tangles of vines, climbers or *Lantana camara* (*Lantana* is invasive in this area).

Our data suggest that Long-billed Tailorbird is relatively widespread within the study area (see also Cordeiro *et al.* 2001). Previous estimates of extreme rarity might in part be due to the difficulty of observing the species, even when playback is used. The species might be sensitive to forest fragmentation, as it has been found in only two of 12 small forest fragments sampled since 2000 (NJC pers. obs.; see Newmark 1991), even when microhabitat conditions appeared suitable (see McEntee *et al.* 2005). However, within forest, it is little affected by habitat degradation, as we often found it along powerline cuts and in gaps dominated by exotic shrubs. Long-billed Tailorbird selects early successional habitats (forest gaps with open canopy and dense undergrowth) and thus its conservation might hinge on recurrent disturbance (e.g., landslides, floods, treefalls, selective logging) that creates forest gaps of appropriate size.

Spot-throat *Modulatrix stictigula*
The genus *Modulatrix* is endemic to the Eastern Arc and comprises two species, both of which occur in the East Usambaras. Spot-throat was the more frequently recorded of the two, but numbers were still quite low. We obtained eight records (Fig. 2), all of singing birds in dense, closed-canopy forest at 880–1,020 m. It was recorded in both disturbed and undisturbed forest, but numbers were higher in undisturbed habitats (Table 2). As demonstrated by Newmark (1991, 2006), this species appears to be highly sensitive to relative forest quality in this region of the East Usambaras; further north, in Nilo Forest Reserve, it is more abundant in lightly degraded and more pristine forest at 1,100–1,400 m (Cordeiro 1998, Seddon *et al.* 1999a,b).

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Dappled Mountain Robin *Modulatrix orostruthus*
The rarer of the two *Modulatrix* species in our study area (see also Newmark 1991, 2006). We obtained just one record (Fig. 2), a singing individual heard on 26 September 2006, at 960 m, deep in undisturbed forest. Although numbers might have been under-estimated due to the species' skulking behaviour, Dappled Mountain Robin is certainly one of the rarest species in the East Usambaras and its total population might just be a few pairs. It is severely threatened within the study area (see also Newmark 1991).

Uluguru Violet-backed Sunbird *Anthreptes neglectus*
Previously listed as Near Threatened (Collar & Stuart 1985), this sunbird is currently treated as Least Concern (IUCN 2006). It was generally silent during our survey and, like Amani Sunbird, its abundance might have been under-estimated. The species was recorded, sometimes in groups of up to six, almost exclusively at edges and in agricultural habitats (Fig. 3), where it foraged in remnant forest trees (especially *Allanblackia stuhlmannii*) or in planted species (*Grevillea robusta*, *Cupressus lusitanica*). Twice we recorded it inside forest, where it joined mixed-species flocks. Its frequency in forest might have been under-estimated due to its silent behaviour: individuals can be detected only when they are very close. When systematically observing mixed-species flocks 200–600 m inside the forest, we frequently recorded this sunbird. In contrast, standardised census counts revealed fewer individuals (NJC unpubl.). A nest was found in a *Grevillea* tree, in a small village near the Derema tea estates, on 14 September 2006; other nests were found at the forest edge between September and December in multiple years (NJC unpubl.).

Banded Sunbird *Anthreptes rubritorques*
This restricted-range species, classified as Vulnerable (IUCN 2006), is endemic to the Eastern Arc Mountains of Tanzania. Its main stronghold is in the East Usambaras and the species appears to be uncommon in the other Eastern Arc forests (the Ngurus, Ulugurus, West Usambaras: Britton 1980). The species was usually easy to detect due to its frequently uttered, penetrating call, which carries more than 200 m. Banded Sunbird was observed in good numbers, in all habitats, but with a clear preference for edges and smallholder agriculture with sufficient numbers of large trees (Table 2; Fig. 3). In September 2006 the species was very active and probably breeding: we observed several males singing from treetops and engaging in territorial behaviour. We found two nests, one under construction on a tree planted by the side of the road, in an open habitat near Amani village, on 19 September, and one active on a forest edge adjoining tea plantations on 22 December.

Amani Sunbird *Hedydipna pallidigastra*
This Endangered and restricted-range species (IUCN 2006) was contacted less frequently than Banded Sunbird. However, as its vocalisations are softer and less frequently uttered than those of Banded Sunbird, usually only individuals at close range were recorded. Amani Sunbird was observed with similar frequencies in all habitats (Table 2); however, it usually did not venture far into cultivated areas (maximum recorded distance from forest was *c.*800 m; Fig. 3). A nest was found by one of us (JJ) in a *Eucalyptus* plantation near Monga tea estate in 2004.

Kenrick's Starling *Poeoptera kenricki*
This restricted-range East African endemic was frequently recorded in flocks of up to 16 during the point counts, and even larger groups (up to 30) at other times. All observations were made in smallholder agriculture or at forest edges, and it was never observed in forest habitats. Although our data do not permit us to eliminate the possibility that Kenrick's Starling does at some seasons move toward the forest interior (NJC unpubl.), it would appear that the species is largely dependent on open, non-forest environments in the East Usambaras. However, elsewhere in this range (e.g. Nilo Forest Reserve: Cordeiro 1998, Seddon *et al.* 1999a,b; Mtai Forest Reserve: Evans & Anderson 1993), and in other Eastern Arc forests such as the Udzungwas, Ulugurus and Ngurus, Kenrick's Starling behaves as a true forest species (Stuart *et al.* 1987, Jensen & Brøgger-Jensen 1992, Romdal 2001). Because this starling can undertake extensive movements, and due to the species' preference for the canopy, it is possible that our sampling methods failed to sufficiently detect the species in dense forest. Longer-term data should provide a better assessment of this potential sampling bias.

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Discussion

We recorded six globally threatened species. Other globally threatened species known to occur in the area either prefer higher elevations (Usambara Weaver *Ploceus nicolli*), are very localised (Usambara Hyliota *Hyliota usambara*), or are nocturnal and not easily encountered using our survey techniques (Usambara Eagle Owl *Bubo vosseleri*).

The main result of this survey is that, in the East Usambaras, some threatened or restricted-range birds use human-modified habitats, at least for foraging, and sometimes also for nesting. All of the sunbirds, as well as Fischer's Turaco, Southern Banded Snake Eagle and Kenrick's Starling were regularly observed at forest edges and in agricultural areas where significant tree cover remained. Only ground-foraging species (Usambara Thrush, Sharpe's Akalat, Spot-throat, Dappled Mountain Robin) were never found outside forest.

Another, encouraging, result is that Long-billed Tailorbird was found to be relatively widespread in its very specialised habitat, when searched for using playback. Although at this early stage of our survey we are unable to produce reliable numerical estimates, we suspect that the species' population might be larger than the 150–200 individuals conservatively estimated by Cordeiro *et al.* (2001). Moreover, Long-billed Tailorbird appears to be resistant to disturbance, as we often found it in severely degraded habitats (e.g. along powerline cuts). Such disturbed areas often host *Lantana* bushes and remnant trees covered with vines; a habitat that is removed by the tea estates in favour of *Eucalyptus* plantations. This could be detrimental to populations and further efforts to verify this possibility will ensue shortly. Furthermore, our data, as well as previously published information (e.g. McEntee *et al.* 2005), reveal that this tailorbird inhabits gaps or edges within large patches of natural forest. This might represent a conservation problem, as the introduced tree *Maesopsis eminii* regenerates very rapidly within forest gaps and closes them in short time, swiftly making them unsuitable for the tailorbird. *Maesopsis* might therefore pose a severe threat not only to the tailorbird, but to all gap-selecting species.

Forest gaps are usually created and maintained by various types of physical disturbance, such as landslides, treefalls, tree-felling, floods or shifting agriculture. The habitat requirements of Long-billed Tailorbird contrast with those of ground-foraging forest-interior birds, as the former appears to require a certain amount of habitat disturbance, whereas the latter are negatively affected by it. Current conservation strategies, which mainly focus on reducing or eliminating all types of disturbance from the forest, might not be favourable to this species. Further research to establish more accurately habitat selection by Long-billed Tailorbird is urgently needed in order to test this hypothesis.

An important finding is that within forest, species abundance and diversity are higher in undisturbed areas, rather than in disturbed forest where *Maesopsis eminii* is abundant. This agrees with the results of Newmark (2006), who already pointed out the reduced value of even slightly disturbed forest for terrestrial insectivores in the East Usambaras, results echoed by others for Congo-Kinshasa (Plumptre 1997), Amazonia (Stouffer *et al.* 2006) and Costa Rica (Şekercioğlu *et al.* 2002). Our results therefore depict a complex situation and perhaps raise some important questions. In particular, the early stages of our monitoring programme revealed that traditional agricultural landscapes in the East Usambaras can often host surprisingly high numbers of species of conservation concern. We acknowledge that our survey technique mainly targeted foraging individuals and thus provides only an incomplete picture of the importance of agricultural zones vs. forest as a habitat for endangered birds. Clearly, a more complete evaluation would require an assessment of breeding success in different environments. However, we believe that our survey shows that edges and agricultural landscapes can be important at least as foraging sites for several species. Traditional agricultural areas now provide a varied environment, in which fields are intermixed with remnant forest trees and shrubland, where a rich avifauna can persist (Naidoo 2004, Bolwig *et al.* 2006). These habitats have probably been part of the landscape of the East Usambaras for centuries, but their physical structure is now to a large extent dependent on the vagaries of commercial markets and on nationwide political choices (Conte 1999). Any intensification leading to a reduction of tree cover or the substitution of the present mix of extensive polycultures with homogenous intensive monocultures will have detrimental effects on the avian assemblage, as we

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observed in the tea plantations, where species diversity is extremely low.

Conservation of avian diversity in the East Usambaras might benefit from an increased attention toward rural landscapes, and we suggest that specific conservation programmes in the area could benefit if the larger landscape features of this entire habitat mosaic are considered. Such programmes could include initiatives to stimulate the use of useful indigenous species (such as *Allanblackia stuhlmannii*) in tree-planting near villages and houses. Moreover, economic incentives could be provided to stimulate more eco-compatible crops, such as coffee or cloves, rather than tea, as it is clear that intensive tea cultivations have no value to the local threatened fauna.

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