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Mpingo Bird Conservation:
impacts of harvesting on Tanzanian forest avifauna

Interim Report
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SUMMARY

Coastal forests in Tanzania are an avian biodiversity hotspot of global importance, but are highly threatened by the interacting effects of illegal logging and forest fires. Despite the importance of this habitat, little is known about the status of bird species therein, and virtually nothing is known about their response to habitat degradation. One way of preventing habitat degradation is to develop Participatory Forest Management schemes. Under PFM village communities are encouraged to set aside some of the forest growing in their locality as a Village Land Forest Reserve (VLFR), but there are legal obligations to ensure the forest are sustainably managed The aims of this project are to gain insights into the effects of habitat degradation on birds and primates and to find effective biological indicators of sustainable use.

We recorded 15 biome-restricted species and two near-threatened species (Plain-backed Sunbird and Southern-banded Snake Eagle) in forested areas within Kilwa District. We also recorded the Rondo Green Barbet and Reichenow's Barbet. These two taxa are endemic to the region, and if elevated to full specific status would qualify the forests as an endemic bird area. Our surveys also highlighted the importance of several forest blocks within Kilwa District that are not currently included as part of the Kilwa District Coastal Forests IBA. Foremost amongst these is Uchungwe Forest (9° 01' S, 39° 11' E). This forested area was the only one in which Rondo Green Barbet was found and was one of only two areas in which Reichenow's Batis was found. It also hosts the near-threatened Southern-banded Snake Eagle and Plain-backed Sunbird. The Nainokwe Coastal Forest area adjoining Uchungwe is also important, as are Migeregere and Kisangi and Ruhatwe Village Forest Reserve. The work on the impacts of habitat degradation on birds and primates is ongoing and results are not presented in this interim report.

Of all the species recorded during surveys of coastal forests, only six are good indicators of forest health, being recorded in the majority of undegraded forest and being absent from degraded forest. Of these, two: African Broadbill and Crested Guineafowl are easy to identify. The African Broadbill would make a highly effective indicator of forest health as it makes a highly distinctive and far-carrying noise during display flights and is sufficiently abundant for meaningful abundance indices to be calculated. The Crested Guineafowl is likely to be well known by villagers as it is hunted for food, but it can be rather shy and retiring. Moreover, it has a tendency to congregate in flocks and as such abundance indices are highly sensitive to whether or not a flock is detected. We thus recommend the use of African Broadbill abundance as an effective biological indicator of sustainable forest management.

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INTRODUCTION

Mpingo is the Swahili name for the East African Blackwood (*Dalbergia melanoxylon*), a tree which is much used by local people to supply western and local demand for musical instruments and to make Makonde tribal carvings. Forests containing Mpingo are vulnerable to harvesting, and are also severely threatened by forest fires and illegal logging. The latter opens up the canopy increasing encouraging the growth of a flammable understory. In disturbed areas, more than half of all forest are consumed by forest fires each year. These impacts lead to a substantial change in habitat structure, which in turn affects biodiversity. The forests in which Mpingo trees are found are a biodiversity hotspot of global importance. They contain some of the highest densities of endemic flora and fauna of anywhere in the world. . No fewer than nine species of primate and 11 species of bird associated with this are classified as threatened, near-threatened or data-deficient (BirdLife International 2007; IUCN 2007). However, despite the importance of these forests, little is known about the status of threatened bird and primate species therein, and virtually nothing is known about their response to harvesting (Nilsen 2007). Indeed, so little is known about Mpingo forest avifauna and primates that several species were only discovered recently. The forests around Kilwa are amongst the least studied in East Africa and new species possibly await discovery. There is an urgent need to assess and monitor the impacts of harvesting on bird species in Mpingo forest and to map the distribution and abundance of Mpingo forest avifauna. We intend to develop new techniques for doing the latter, which can be applied widely to other flora and fauna in instances where complete spatial coverage cannot be achieved.

PROJECT AIMS

The aims of the project are to:

(a) gain insight into the effects of forest degradation on birds and primates

(b) conduct baseline surveys to establish the distribution and abundance of species present within forest around Kilwa in southern Tanzania.

(c) develop new techniques for rapidly mapping the distribution and abundance of birds in developing countries.

(d) develop avian indicators of forest health that could be used to monitor sustainable forest use.

METHOD

Bird and diurnal primate surveys (completed)

Fifteen forested areas in Kilwa district were visited by expedition team members between the 19th of June and 16th of August 2008. At each location, 10 minute point counts were to record the presence of birds and primates. In total 222 point counts were conducted. During each point count, the identity, distance from observer, time after commencement of point count and whether the not the bird or primate was first seen or heard was recorded. The location of each count was marked and recorded using a Garmin etrex® GPS and was later visited for vegetation surveys. Additionally, at each site, an inventory of all species recorded by any of the expedition team members was made.

Nocturnal primate surveys (completed)

At each of the fifteen forested locations visited, several hours were spent searching for Galagoes. The search effort was generally dictated by logistics and safety, being highly constrained by the presence of elephants at the majority of sites, which prevented expedition team members searching the forest on foot. Searches were made using a bright torch and also through aural detection. Galagoes are highly vocal and best identified by their call. At each one encountered, vocal recordings were made using a Senheiser® ME66 microphone and K6 power module coupled with a Sony® MP3 player. These will be matched to sound files given to the team by a resident Galago expert (Andrew Perkin).

Vegetation surveys (completed)

At each of the locations at which point counts were conducted, canopy, understory and tree measurements were taken. Canopy cover was estimated as an average of spherical densitometer readings taken at four random locations within 50 m of the point count location. Understory was measured in two ways: as a proxy of the extent of understory shrub development, a two metre pole was swung round at breast height at five locations within 50m of the point count location and the number of woody stems it touched counted. To measure the lower understory, five 2 m x 2 m plots were randomly chosen within 50 m of the point count location and the percentage of grass, woody herbaceous and bare cover estimated in each. Tree sizes and densities were measured using the circumference at breast height (CBH) and by dividing this into the following categories: 10-50 cm, 50 cm - 1 m, 1-2 m and metre categories thereafter (up to 8-9m, the size of the largest tree), and counting the number of trees in each category. Additionally 20 trees were selected at random and measured precisely. This will allow a statistically valid means of translating the categorical data into precise estimates.

Remote-sensing and vegetation mapping (in progress)

Recent, cloud free Landsat ETM images of Kilwa forest will be obtained from the Global Land Cover Facility at the University of Maryland (http://glcf.umiacs.umd.edu/data/landsat/). False colour composite images will be created using three combinations of Bands two, three, four, five and seven. The location of point counts will be plotted on these images. Using the vegetation data described above, principal components and cluster analyses will be used to categorize several broad forest types ranging from open miombo to dense riverine forest. Each point count location will then be assigned a forest type. Using a parallelepiped classifier available in the ArcView® GIS image analysis extension (ESRI, Redlands, CA), areas of the composite images with similar reflectance values to these known forest-type locations will then be found.

Species distribution and abundance mapping (in progress)

To map the distribution and abundance of species, a novel technique of integrating spatial-kriging techniques with habitat association modelling will be developed. Relationships between bird densities and habitat variables at two spatial-scales will be modelled: macro-scales where habitat information is discernable from remotely-derived Landsat ETM imagery and micro-scales, where habitat information is discernible only from on the ground data. At the macro-scale species could be mapped over the entire study using the satellite imagery, applying techniques developed previously by the expedition leader (Maclean *et al.* 2006; Maclean *et al.* in review). The maps will then be refined using spatial-kriging of micro-habitat data. The novel aspects of this work are two-fold: (1) the integration of macro- and micro-habitat modelling into a single framework by assessing spatial correlations at the two-scales and (2) in the use of data from each single point-count, rather than from overall estimates of density, necessitating the full integration of Distance software and habitat-association modelling techniques. The advantage of the first novel development is that more accurate abundance maps can be produced and the advantage of the second is that approximately one-twentieth of the data are needed to achieve the same level of accuracy, thus improving the efficiency of mapping considerably. The method is likely to be broadly applicable to a broad range of taxa in any habitat.

Selecting indicators for sustainability monitoring (completed)

Based on vegetation characteristics, the 11 forested areas visited were categorised into good forest (i.e. sustainably managed) and degradaded/open forest (see Table 1). Forests with a low canopy cover (<30%) and a high percentage of grass understory (> 33%) were considered open/degraded. To select bird species indicative of good forest, the species inventory of each site was used. Each species was assigned a good forest association score by assigning a score of one for each good forest site if the species was present and a score of one for each degraded site if the species was absent and then summing across sites. Thus, a score of 11 indicates that the species was present at the seven good forest sites, but absent from all the degraded sites, whereas a score of zero indicates the species was present only at degraded sites.

For effective monitoring by non-expert rural villagers, it is essential that the indicator species selected is easy to detect and identify. Thus, using the expedition team's expert knowledge of bird behaviour and identification, each species was also assigned a monitoring ease category based on it's ease of identification and detection. A species assigned a category of easy is one which is encountered regularly and easily and is readily recognised by its appearance or call with very little training required. A species could be assigned a category of moderate in two ways. Either it could be a species that is easy to identify but is relatively difficult to detect due to its skulking behaviour or low abundance, but nevertheless not so rare that or skulking that a trained observer would have little chance of encountering it. Alternative, it could be a species which is easy to detect and regularly encountered, but which may pose some difficulty in identification without optics. A species assigned a category of hard if either it is very infrequently encountered or, even with training and optics, it is hard to identify.

A matrix approach was used to assess the suitability of each species as an indicator of sustainable forest management. The suitability of a species was considered *very high* if its good forest association score was greater than 10 and it had a monitoring ease category of *easy*. The suitability of a species was considered *high* if its good forest association score was greater than eight and it had a monitoring ease category of *easy*. The suitability of a species was considered *moderate* if its good forest association score was greater than 10 and it had a monitoring ease category of *moderate*. The suitability of a species was considered *low* if its good forest association score was greater than eight and it had a monitoring ease category of *moderate*. The suitability of a species was considered *very low* if its good forest association score was greater than 10 and it had a monitoring ease category of *hard*. All other species were considered entirely unsuitable.

Table 1. Mean percentage canopy cover (Canopy) and mean percentage grass understory (Grass) were used to distnguish between good forest (Y) and degradaded/open forest (N).

Site	Canopy	Grass	Good Forest
Kikole	56.13	30.11%	Y
Kisangi	59.43	26.07%	Y
Liwiti	61.17	12.04%	Y
Lukride Riverine	52.07	14.80%	Y
Migeregere Forest	53.83	19.45%	Y
Migeregere Miombo	13.14	46.47%	N
Nainoke Coastal Forest	69.77	12.87%	Y
Nainokwe Miombo	12.39	37.69%	N
Nangurukuru	28.51	34.97%	N
Ruhatwe Village	18.66	50.41%	N
Uchungwe	75.60	1.20%	Y

RESULTS

Bird and diurnal primate surveys

A full inventory of the bird species recorded at each location is given in Appendix 1. A similar inventory for primates is awaiting the identification of galagoes based on their vocal recordings. An inventory of key and notable species, i.e. categorised as threatened or near-threatened by Birdlife International (2008) or categorised as endemic or biome-restricted in Baker & Baker (2002), is given in Table 2. The location of these forested areas is shown in Figure 1.

Table 2. List of key species at each of the forested areas visited (see Figure 1). In the status column EN = Endemic, NT = near-threatened and BR = biome restricted. All the near-threatened species are also biome restricted.

Species Name	Scientific Name	Status	Liwiti	Migeregere Forest	Migeregere Miombo	Nainoke Coastal Forest	Nainokwe Miombo	Ruhatwe VFR	Nangurukuru	Kisangi	Lukride Riverine	Uchungwe	Kilwa Town	Kikole	Tong'omba	Ruhatwe Village
Southern-banded Snake-eagle	*Circaetus fasciolatus*	NT		x				x		x		x		x		
Brown-headed Parrot	*Poicephalus cryptoxanthus*	BR	x	x	x	x	x	x	x	x				x		x
Mangrove Kingfisher	*Halcyon senegaloides*	BR											x			
Green Tinkerbird	*Pogoniulus simplex*	BR	x	x		x							x			
Brown-breasted Barbet	*Lybius melanopterus*	BR											x			
Rondo Green Barbet	*Stactolaema olivacea*	EN	x									x				
Fischer's Greenbul	*Phyllastrephus fischeri*	BR								x					x	
Tiny Greenbul	*Phyllastrephus debillis*	BR	x	x								x			x	
Kretchmer's Longbill	*Macrosphenus kretschmeri*	BR	x													
Pale Batis	*Batis soror*	BR		x	x		x	x	x	x						
Reichenow's Batis	*Batis reichenowi*	EN				x						x				
Mouse-coloured Sunbird	*Nectarinia veroxii*	BR	x					x					x			
Plain-backed Sunbird	*Anthreptes reichenowi*	NT	x	x				x				x				
Uluguru Violet-backed Sunbird	*Anthreptes neglectus*	BR	x	x						x	x					
Four-coloured Bush-shrike	*Telophorus quadricolor*	BR							x							
Chestnut-fronted Helmet-shrike	*Prionops scopifrons*	BR				x					x	x				
Black-bellied Starling	*Lamprotornis corruscus*	BR					x					x				

Nocturnal primate surveys

Results pending.

Vegetation surveys

The mean canopy cover and percentage grass understory at each of the sites visited is shown in table 1. Other vegetation survey results are pending.

Remote-sensing and vegetation mapping

Results pending

Species distribution and abundance mapping

Results pending

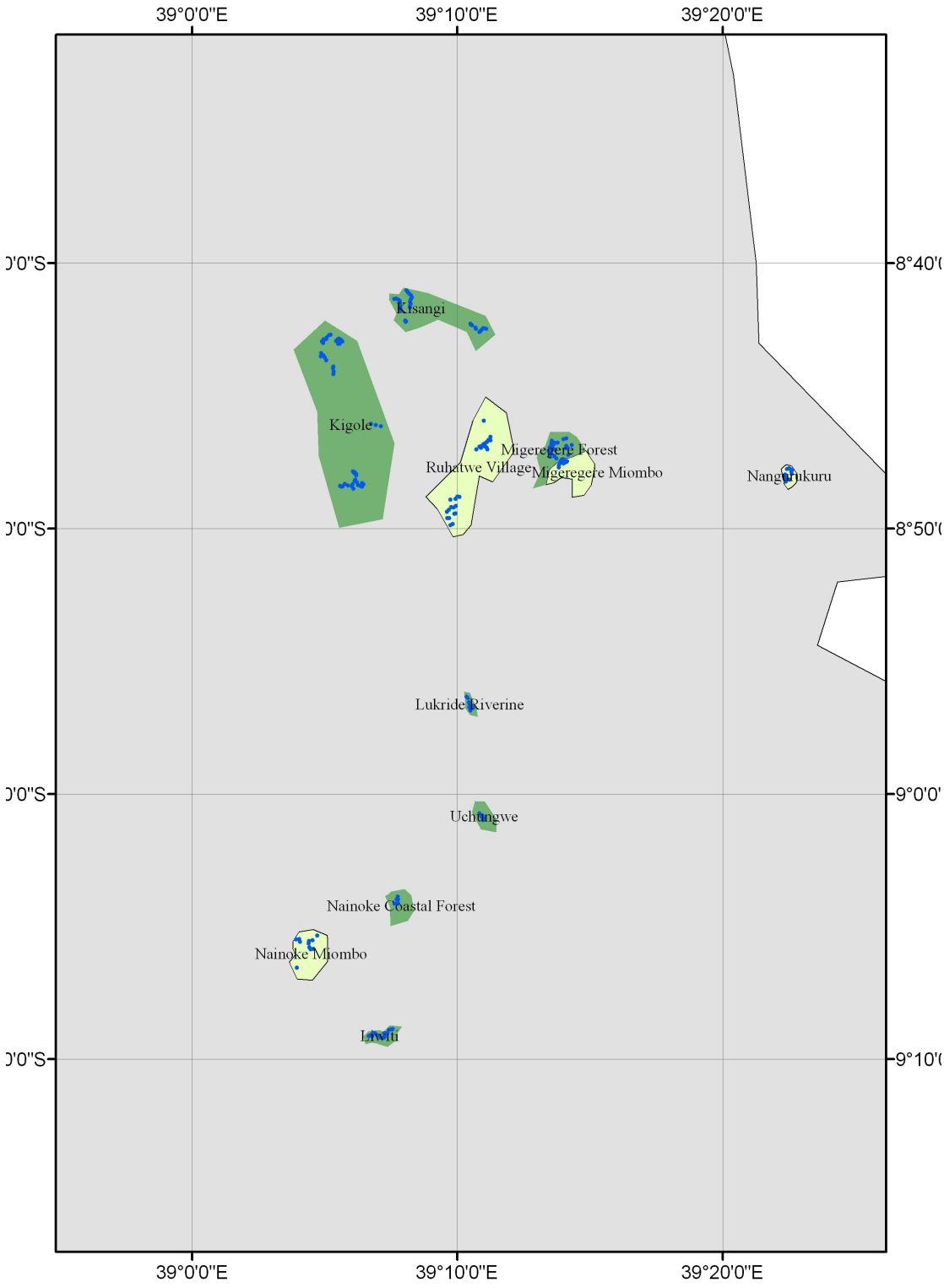

Figure 1. The location of each of the forested areas surveyed in Kilwa District. Dark green shading represents good forest, i.e. that which is likely to be sustainably managed. Light green shading represents degraded forest and open areas.

Selecting indicators for sustainability monitoring

The good forest association score, monitoring ease category and indicator suitability category for all species with a forest association score of eight or more is shown in table 3. African Broadbill and Crested Guineafowl are the two species with the highest indicator suitability.

Table 3. Good forest association score, monitoring ease and indicator suitability for selected species recorded during during surveys in Kilwa District Coastal Forests. In the monitoring ease column, E = easy, M = moderate and H = hard.

Species	Good forest association score	Monitoring ease	Indicator Suitability
African Broadbill	11	E	VERY HIGH
Yellow-streaked Greenbul	11	H	LOW
Eastern Bearded Scrub-Robin	11	M	MODERATE
Crested Guineafowl	10	E	VERY HIGH
Livingstone's Flycatcher	10	M	MODERATE
Eastern Olive Sunbird	10	H	LOW
Dark-backed Weaver	10	M	MODERATE
Purple-crested Turaco	9	E	HIGH
Yellow-rumped Tinkerbird	9	M	LOW
Blue-mantled Crested Flycatcher	9	M	LOW
Square-tailed Drongo	9	H	UNSUITABLE
African Black-headed Oriole	9	E	HIGH
Southern-banded Snake-eagle	8	E	HIGH
African Goshawk	8	M	LOW
Little Sparrowhawk	8	M	LOW
Crowned Eagle	8	E	HIGH
Livingstone's Turaco	8	E	HIGH
Mottled Spinetail	8	M	LOW
Narina Trogon	8	E	HIGH
Green Wood-hoopoe	8	M	LOW
Common Scimitarbill	8	M	LOW
Crowned Hornbill	8	E	HIGH
Yellow-fronted Tinkerbird	8	M	LOW
Black Cuckoo-shrike	8	M	LOW
Zanzibar Sombre Greenbul	8	H	UNSUITABLE
Yellow-breasted Apalis	8	H	UNSUITABLE
Ashy Flycatcher	8	H	UNSUITABLE
Yellow White-eye	8	M	LOW
Uluguru Violet-backed Sunbird	8	H	UNSUITABLE

DISCUSSION

General

As the majority of data analyses is in progress, the discussion of this interim report focuses on two aspects: the species present in the various forest blocks surveyed in Kilwa District and the selection of suitable species for monitoring sustainable forest management. Each of these are discussed in turn.

Bird species

Of the 13 biome-restricted species known to be present within the Kilwa District Coastal Forest Important Bird Area (IBAs) (Baker & Baker 2002), we were able to locate all but the Zanzibar Red Bishop. We also confirmed the presence of Kretchmer's Longbill and Brown-breasted barbet, two species thought maybe to be present, but not known to be present with certainty. Additionally, we recorded Mangrove Kingfisher, in mangrove swamps around Kilwa Town. This species was not thought to be present within the area encompassed by the IBA. Two additional species are worthy of mention: Rondo Green Barbet and Reichenow's Batis. The taxonomy surrounding these species is uncertain, but should they prove to be separate species from the closely related African Green Barbet and Forest Batis respectively, the area would qualify as an Endemic Bird Area.

Our surveys also highlighted the importance of several forest blocks within Kilwa District that are not currently included as part of the Kilwa District Coastal Forests IBA. Foremost amongst these is the Uchungwe Forest Block located between the Mitaurure and Rungo Forest Reserves shown on the Kilwa District Coastal Forests IBA map in Baker & Baker (2002). This forested area was the only one in which Rondo Green Barbet was found and was one of only two areas in which Reichenow's Batis was found. It also hosts the near-threatened Southern-banded Snake Eagle and Plain-backed Sunbird. The Nainokwe Coastal Forest area adjoining Uchungwe is also important, hosting Reichenow's Batis as well as other biome-restricted species such as Brown-headed Parrot, Green Tinkerbird and Chestnut-fronted Helmet-shrike. We also highlight the importance of Migeregere and Kisangi Forests. These two sites host seven and five biome-restricted species respectively. Both host the near-threatened Southern-banded Snake Eagle and the former also hosts the near-threatened Plain-backed Sunbird. Ruhatwe and Kikole also hosted the former species and Ruhatwe the latter also.

Sustainability indicators

One of the core aims of the Mpingo Conservation Project is to capitalise on a recent change in Tanzanian law, which permits rural householders to claim ownership of forest, provided it is sustainably managed. The Mpingo Conservation Project is working along side the District Forestry Office in Kilwa, helping them to develop Participatory Forest Management (PFM) in the district. Under PFM communities are encouraged to set aside some of the forest growing in their locality as a Village Land Forest Reserve (VLFR), which will then be under the control of the village government. To do this they have to design and then follow a management plan for the forest which must be approved by the District Council. Once such a plan is approved then the village government owns the rights to all timber trees, including mpingo, within the VLFR. One of the key elements of this management plan is that the forest should be managed sustainably. Although in part, the term "sustainable" refers to resources such as Mpingo timber extracted from the forests, it is increasingly recognised that there is a need to extend to wider elements of "sustainability", such as ensuring that forest management is compatible with biodiversity conservation.

Currently, resource extraction elements to sustainable forest management are monitored by the villagers themselves, and entails the adoption of simple techniques for monitoring timber stocks. One of the aims of our project was to adopt the same ethos to biodiversity monitoring: find a taxa or suite of taxa that can be easily monitored by the villagers themselves and is representative of the general "health" of the forests. In selecting appropriate taxa for sustainability monitoring, there are two elements to consider: (1) the taxa should indeed be indicative of the state of the forest and (2) it should be easy to monitor. We suggest that bird species would make more effective indicators than other animal taxa (we do not rule out the possibility of plants or fungi being effective indicators). The need for the species to be easy to

identify, even by untrained rural villagers, rules out all invertebrate taxa with the exception of butterflies. The need for the taxa to be easy to detect eliminates the majority of mammal species (except highly active diurnal primates). The need for it to be sufficiently frequently encountered (so that meaningful indices of abundance can be created) rule out these highly active diurnal primates, amphibians and reptiles. The need for the taxa to be broadly indicative of forest health rules out fish. It is possible that some butterfly species would make effective indicators or forest health. However, as they prefer sunny areas and often more abundant in open areas created by illegally felled trees, there abundance is unlikely to be congruent with other elements of sustainable forest management. Thus, birds are the taxanomic group most likely to be an effective indicator of sustainable forest management. Our results suggest that only six bird species (African Broadbill, Yellow-streaked Greenbul, Eastern Bearded Scrub-Robin, Crested Guineafowl, Livingstone's Flycatcher, Eastern Olive Sunbird and Dark-backed Weaver are very good indicators of good forest. All were found in the majority of forested areas classified as "good" and were generally absent from degraded forest. Of these species, only two: African Broadbill and Crested Guineafowl are relatively easy to detect and identify, the former being found in 100% of good forests and absent in 100% of degraded forests.

The African Broadbill is a resident of dense forests, predominantly in south-east Africam but also at isolated locations in West Africa. It is relatively abundant in the lower story of most lowland evergreen forest, except primary rainforest (Urban *et al.* 1997). In Kilwa District it appears to be confined to well forested areas that have not been degraded. The Crested Guineafowl is resident from Guinea-Bissau east to southern Somalia and south to Natal. It is generally fund in denser Brachystegia woodlands with underlying evergreen forests (Urban *et al.* 1997). In Kilwa District it appears to be found in almost all of the good forest areas and is absent from all degraded forests. The African Broadbill is readily recognisable and highly detectable as a result of its loud, distinctive, mechanical sound made during its display flights. The flights occur sufficiently frequently to allow easy monitoring, are highly distinctive (once known, they could not be mistaken for anything else) and it is audible at a distance of over 50m. In Kilwa District forests, it appears to be sufficiently abundant for meaningful abundance indices to be constructed. The Crested Guineafowl is easy to recognise and is likely to be a species well known to local villagers as it is often hunted for food. The extent to which it is hunted can make it rather shy and retiring in some areas, although in the early morning a single observer walking quietly through forest in which it is present would be almost certain to locate it. However, one problem associated with constructing a meaningful index of abundance would be that it is generally encountered in flocks. Thus, the overall abundance is likely to be dictated by flock sizes and will be highly-sensitive to whether or not flocks are encountered. Overall therefore, we recommend that the abundance of African Broadbills would be the best measure of the health of a forest and indicative of whether or not it is sustainable managed. In order numbers recorded to be indicative of actual abundance, it would be necessary to standardise the way in which data are collected through time. Factors that might need to be considered and are worthy of further investigation are whether or not the species is more vocal at some times of day then at others and whether or not display flights occur more frequently at some times of year than at others. Such questions could be easily answered by implementing a pilot monitoring survey in which calls are monitored at intervals throughout the day and year.

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APPENDIX 1

Species Name	Scientific Name	Liwiti	Migeregere Forest	Migeregere Miombo	Nainoke Coastal Forest	Nainokwe Miombo	Ruhatwe VFR	Nangurukuru	Kisangi	Lukride Riverine	Uchungwe	Kilwa Town	Kikole	Tong'omba	Ruhatwe Village
Cattle Egret	*Bubulcus ibis*														x
Hamerkop	*Scopus umbretta*	x				x			x						x
Hadada Ibis	*Bostrychia hagedash*	x										x			
Yellow-billed Stork	*Mycteria ibis*											x			
African Open-billed Stork	*Anastomus lamelligerus*							x							x
Woolly-necked Stork	*Ciconia episcopus*	x													x
Marabou Stork	*Leptoptilos crumeniferus*														
Egyptian Goose	*Alopochen aegyptiaca*	x													
White-faced Whistling-duck	*Dendrocygna viduata*											x			
Yellow-billed Kite	*Milvus aegyptius*							x				x	x		
Black-shouldered Kite	*Elanus axillaris*							x							
African Fish-eagle	*Haliaeetus vocifer*		x									x			
Palm-nut vulture	*Gypohierax angolensis*													x	
White-backed Vulture	*Gyps africanus*					x									
Ruppell's Griffon Vulture	*Gyps rueppellii*			x	x										
Lappet-faced Vulture	*Torgos Tracheliotus*						x								
Hooded Vulture	*Necrosyrtes monachus*										x				
Brown Snake-eagle	*Circaetus cinereus*	x		x											
Southern-banded Snake-eagle	*Circaetus fasciolatus*		x				x		x		x		x		
Dark Chanting-goshawk	*Melierax metabates*			x		x		x							
Eastern Chanting-goshawk	*Melierax poliopterus*												x		
Lizard Buzzard	*Kaupifalco monogrammicus*			x		x			x				x		x
African Harrier-hawk	*Polyboroides typus*													x	
Bat Hawk	*Macheiramphus alcinus*											x			x
Shikra	*Accipiter badius*					x					x	x			x
African Goshawk	*Accipiter tachiro*	X	x			x			x	x	x		x		x
Gabar Goshawk	*Melierax gabar*											x			
Little Sparrowhawk	*Accipiter minullus*	x	x		x				x						
African Hawk-eagle	*Hieraaetus spilogaster*	x							x						
Ayres's Hawk-eagle	*Hieraaetus ayresii*		x	x											
Bateleur	*Terathopius ecaudatus*	x		x		x	x		x		x	x		x	x
Long-crested Eagle	*Lophaetus occipitalis*								x						
Booted Eagle	*Hieraaetus pennatus*														x
Wahlberg's Eagle	*Aquila wahlbergi*												x		x
Martial Eagle	*Polemaetus bellicosus*						x	x							
Crowned Eagle	*Harpyhaliaetus coronatus*	x							x	x	x				
Dickinson's Kestrel	*Falco dickinsoni*														
Peregrine Falcon	*Falco peregrinus*														x
Pygmy Falcon	*Polihierax semitorquatus*			x											
Helmeted Guineafowl	*Numida meleagris*	x		x			x	x					x		
Crested Guineafowl	*Guttera pucherani*	x	x		x				x		x		x		
Coqui Francolin	*Francolinus coqui*					x									
Hildebrandt's Francolin	*Francolinus hildebrandti*							x					x		
Crested Francolin	*Francolinus sephaena*		x						x						x
Red-necked Spurfowl	*Francolinus afer*	x		x											

Species Name	Scientific Name	Liwiti	Migeregere Forest	Migeregere Miombo	Nainoke Coastal Forest	Nainokwe Miombo	Ruhatwe VFR	Nangurukuru	Kisangi	Lukride Riverine	Uchungwe	Kilwa Town	Kikole	Tong'omba	Ruhatwe Village
Common Button-quail	*Turnix suscitator*			x											
Senegal Lapwing	*Vanellus lugubris*					x				x					X
Grey Plover	*Pluvialis squatarola*											x			
Three-banded Plover	*Charadrius tricollaris*														
Common Sandpiper	*Actitis hypoleucos*											x			
Terek Sandpiper	*Xenus cinereus*											x			
Common Greenshank	*Tringa nebularia*											x			
Whimbrel	*Numenius phaeopus*											x			
Great Crested Tern	*Sterna bergii*											x			
Whiskered Tern	*Chlidonias hybrida*											x			
African Green Pigeon	*Treron calva*	x	x	x			x		x				x		x
Olive Pigeon	*Columba arquatrix*	x	x												
Lemon Dove	*Aplopelia larvata*								x				x		
Emerald-spotted Wood-Dove	*Turtur chalcospilos*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Blue-spotted Wood-dove	*Turtur afer*	x													
Tamborine Dove	*Turtur tympanistria*														
Namaqua Dove	*Oena capensis*														
Red-eyed Dove	*Streptopelia semitorquata*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ring-necked Dove	*Streptopelia capicola*			x		x	x	x	x			x	x		x
Laughing Dove	*Streptopelia senegalensis*			x				x				x	x		x
Brown-headed Parrot	*Poicephalus cryptoxanthus*	x	x	x	x	x	x	x	x				x		x
Brown-necked Parrot	*Poicephalus suahelicus*		x	x	x	x	x		x		x		x		x
Purple-crested Turaco	*Tauraco porphyreolophus*	x	x			x	x		x	x	x		x		
Livingstone's Turaco	*Tauraco livingstonii*	x	x						x				x		
Thick-billed Cuckoo	*Pachycoccyx audeberti*														
Klaas's Cuckoo	*Chrysococcyx klaas*	x							x			x			x
Yellowbill	*Ceuthmochares aereus*													x	
Burchell's Coucal	*Centropus burchelli*	x				x	x	x	x			x		x	x
African Wood-owl	*Strix woodfordii*	x	x						x		x				x
Barn Owl	*Tyto alba*	x					x								x
White-faced Scops-owl	*Otus leucotis*		x												
Verreaux's Eagle-owl	*Bubo lacteus*	x													
Spotted Eagle-owl	*Bubo africanus*	x		x											
Pearl-spotted Owlet	*Glaucidium perlatum*	x													x
African Barred Owlet	*Glaucidium capense*	x							x		x				
Square-tailed Nightjar	*Caprimulgus fossii*			x								x		x	x
Fiery-necked Nightjar	*Caprimulgus pectoralis*	x					x							x	
Little Swift	*Apus affinis*	x										x			
African Palm Swift	*Cypsiurus parvus*			x					x		x	x	x	x	x
Bohm's Spinetail	*Neafrapus boehmi*	x		x		x			x		x				x
Mottled Spinetail	*Telacanthura ussheri*	x	x						x				x		
Speckled Mousebird	*Colius striatus*			x								x			x
Blue-naped Mousebird	*Urocolius macrourus*											x			
Red-faced Mousebird	*Urocolius indicus*											x			
Narina Trogon	*Apaloderma narina*	x	x						x				x	x	
Pied Kingfisher	*Ceryle rudis*											x			x
Striped Kingfisher	*Halcyon chelicuti*			x		x			x			x	x		x

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Brown-hooded Kingfisher	*Halcyon albiventris*	x					x		x		x		x		x
Mangrove Kingfisher	*Halcyon senegaloides*											x			
African Pygmy Kingfisher	*Ceyx pictus*	x													
Malachite Kingfisher	*Alcedo cristata*														x
Little Bee-eater	*Merops pusillus*	x	x	x		x	x		x			x	x		x
Bohm's Bee-eater	*Merops boehmi*	x		x	x					x					
Swallow-tailed Bee-eater	*Merops hirundineus*					x					x				
Madagascar Bee-eater	*Merops superciliosus*		x	x			x	x	x			x	x	x	x
Lilac-breasted Roller	*Coracias caudatus*			x								x			x
Racket-tailed Roller	*Coracias spatulatus*					x									
Green Wood-hoopoe	*Phoeniculus purpureus*	x	x		x	x	x		x		x		x	x	x
African Hoopoe	*Upupa africana*					x									
Common Scimitarbill	*Rhinopomastus cyanomelas*		x						x		x		x		
African Grey Hornbill	*Tockus nasutus*			x		x							x		
Pale-billed Hornbill	*Tockus pallidirostris*						x								
Crowned Hornbill	*Tockus alboterminatus*	x	x	x	x	x	x		x	x	x		x	x	x
Trumpeter Hornbill	*Bycanistes bucinator*	x	x	x		x	x		x		x		x	x	x
Silvery-cheeked Hornbill	*Bycanistes brevis*		x								x				
Southern Ground Hornbill	*Bucorvus cafer*	x		x					x		x		x		
Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*	x	x		x		x	x	x	x	x	x	x		x
Green Tinkerbird	*Pogoniulus simplex*	x	x		x							x			
White-eared Barbet	*Stactolaema leucotis*								x		x				
Red-fronted Tinkerbird	*Pogoniulus pusillus*					x	x								
Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	x	x			x	x		x		x	x	x		
Brown-breasted Barbet	*Lybius melanopterus*											x			
Black-collared Barbet	*Lybius torquatus*			x		x	x						x		
Green Barbet	*Stactolaema olivacea*	x									x				
Greater Honeyguide	*Indicator indicator*						x								x
Scaly-throated Honeyguide	*Indicator variegatus*		x						x						
Lesser Honeyguide	*Indicator minor*			x			x		x				x		x
Speckle-throated Woodpecker	*Campethera scriptoricauda*	x				x									
Green-backed Woodpecker	*Campethera cailliautii*								x				x		x
Golden-tailed Woodpecker	*Campethera abingoni*		x	x		x	x		x				x	x	x
Cardinal Woodpecker	*Dendropicos fuscescens*	x	x	x		x	x	x	x			x			
Bearded Woodpecker	*Thripias namaquus*								x		x				
African Broadbill	*Smithornis capensis*	x	x		x				x	x	x		x		
Flappet Lark	*Mirafra rufocinnamomea*			x				x		x					
Grassland Pipit	*Anthus cinnamomeus*											x			x
Yellow-throated Longclaw	*Macronyx croceus*														
Mosque Swallow	*Hirundo senegalensis*			x					x						x
Lesser-striped Swallow	*Hirundo abyssinica*	x	x	x	x		x	x	x		x	x	x	x	x
Wire-tailed Swallow	*Hirundo smithii*					x			x			x	x		x
Eastern Saw-wing	*Hirundo abyssinica*	x									x		x		
Black Cuckoo-shrike	*Campephaga flava*	x	x	x	x				x				x	x	
White-breasted Cuckoo-shrike	*Coracina pectoralis*				x	x							x		
Eastern Nicator	*Nicator gularis*		x						x		x	x	x		x
Common Bulbul	*Pycnonotus barbatus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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Yellow-streaked Greenbul	*Phyllastrephus flavostriatus*	x	x		x				x	x	x		x	x	
Zanzibar Sombre Greenbul	*Andropadus importunus*	x	x	x	x		x	x	x	x	x	x	x	x	x
Fischer's Greenbul	*Phyllastrephus fischeri*								x					?	
Tiny Greenbul	*Phyllastrephus debillis*	x	x								x			x	
Yellow-bellied Greenbul	*Chlorocichla flaviventris*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Terrestrial Brownbul	*Phyllastrephus terrestris*							x	x			x		x	
White-browed Robin-Chat	*Cossypha heuglini*	x		x			x					x			x
Red-capped Robin-Chat	*Cossypha natalensis*	x	x						x					x	
Kurrichane Thrush	*Turdus libonyanus*			x		x									
Red-tailed Ant-thrush	*Neocossyphus rufus*		x								x				
White-headed Black Chat	*Myrmecocichla arnoti*					x									
White-browed Scrub-Robin	*Cercotrichas leucophrys*		x	x		x	x	x		x			x		x
Eastern Bearded Scrub-Robin	*Cercotrichas quadrivirgata*	x	x		x				x	x	x		x		
Collared Palm Thrush	*Cichladusa arquata*			x											x
Familiar Chat	*Cercomela familiaris*			x											
Kretchmer's Longbill	*Macrosphenus kretschmeri*	x													
Red-faced Crombec	*Sylvietta whytii*			x		x			x						
Green-capped Eremomela	*Eremomela scotops*			x		x			x						
Yellow-bellied Eremomela	*Eremomela icteropygialis*					x									
Yellow-bellied Hyliota	*Hyliota flavigaster*					x									
Croaking Cisticola	*Cisticola natalensis*							x							
Rattling Cisticola	*Cisticola chiniana*							x							
Winding Cisticola	*Cisticola galactotes*						x		x			x			x
Red-faced Cisticola	*Cisticola erythrops*		x				x	x							x
Singing Cisticola	*Cisticola cantans*														x
Siffling Cisticola	*Cisticola brachypterus*			x								x			x
Piping Cisticola	*Cisticola fulvicapilla*					x			x						
Red-winged Warbler	*Heliolais erythropterus*			x		x	x		x						
Tawny-flanked Prinia	*Prinia subflava*	x		x		x	x	x	x			x	x		x
Green-backed Camaroptera	*Camaroptera brachyura*	x	x	x	x	x	x	x	x	x	x		x	x	x
Miombo Wren-Warbler	*Calamonastes undosus*					x									
Yellow-breasted Apalis	*Apalis flavida*	x	x	x	x		x	x	x	x	x		x	x	x
Southern Black Flycatcher	*Melaenornis pammelaina*		x			x	x	x	x		x				x
Pale Flycatcher	*Bradornis pallidus*		x	x		x	x								
Ashy Flycatcher	*Muscicapa caerulescens*		x				x		x		x		x		
Lead-coloured Flycatcher	*Myioparus plumbeus*		x ??						x		x				
Pale Batis	*Batis soror*		x	x		x	x	x	x						
Black-headed Batis	*Batis minor*						x		x			x	x		x
Reichenow's Batis	*Batis reichenowi*				x						x				
Black-and-white Shrike-flycatcher	*Bias musicus*	x							x						x
Black-throated Wattle-eye	*Platysteira peltata*	x							x			x			
African Paradise-flycatcher	*Terpsiphone viridis*		x					x					x	x	
Blue-mantled Crested Flycatcher	*Trochocercus cyanomelas*	x	x		x		x	x	x	x	x		x	x	x
Livingstone's Flycatcher	*Erythrocercus livingstonei*	x	x		x		x	x	x	x	x		x	x	
Pale-breasted Illadopsis	*Illadopsis rufipennis*							x				x			
Arrow-marked Babbler	*Turdoides jardineii*					x						x			x
Rufous-bellied Tit	*Parus rufiventris*					x									

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African Penduline-Tit	*Anthoscopus caroli*			x		x									
Yellow White-eye	*Zosterops senegalensis*	x							x		x		x		
Amethyst Sunbird	*Nectarinia amethystina*	x	x	x		x	x	x	x			x			
Eastern Olive Sunbird	*Cyanomitra olivacea*	x	x	x	x		x		x	x	x	x	x	x	
Mouse-coloured Sunbird	*Nectarinia veroxii*	x					x					x			
Purple-banded Sunbird	*Nectarinia bifasciata*	x	x	x	x		x	x	x			x	x		
Scarlet-chested Sunbird	*Nectarinia senegalensis*	x	x	x		x	x	x	x			x	x		x
Collared Sunbird	*Hedydipna collaris*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Plain-backed Sunbird	*Anthreptes reichenowi*	x	x				x				x				
Western Violet-backed Sunbird	*Anthreptes longuemarei*					x			x						
Uluguru Violet-backed Sunbird	*Anthreptes neglectus*	x	x						x	x					
Tropical Boubou	*Laniarius aethiopicus*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brubru	*Nilaus afer*			x		x									
Black-backed Puffback	*Dryoscopus cubla*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black-crowned Tchagra	*Tchagra senegala*			x		x		x		x		x			x
Brown-crowned Tchagra	*Tchagra australis*			x		x									x
Sulphur-breasted Bush-shrike	*Malaconotus sulfureopectus*	x	x	x		x	x	x			x			x	x
Grey-headed Bush-shrike	*Malaconotus blanchoti*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Four-coloured Bush-shrike	*Telophorus quadricolor*							x							
White-crested Helmet-shrike	*Prionops plumatus*			x		x	x								
Chestnut-fronted Helmet-shrike	*Prionops scopifrons*				x					x	x				
Retz's Helmet Shrike	*Prionops retzii*			x			x		x		x		x		
Fork-tailed Drongo	*Dicrurus adsimilis*	x		x	x	x	x	x	x		x	x	x		x
Square-tailed Drongo	*Dicrurus ludwigii*	x	x						x	x	x		x	x	x
Pied Crow	*Corvus albus*							x				x			x
House Crow	*Corvus splendens*											x			
African Black-headed Oriole	*Oriolus larvatus*	x	x	x	x		x		x	x	x	x	x	x	x
Black-bellied Starling	*Lamprotornis corruscus*					x					x				
Southern Blue-eared Glossy-starling	*Lamprotornis elisabeth*						x								
House Sparrow	*Passer domesticus*							x				x			
Southern Grey-headed Sparrow	*Passer diffusus*					x						x			x
Yellow-throated Petronia	*Petronia superciliaris*					x									
Black-headed Weaver	*Ploceus cucullatus*							x	x		x			x	x
Spectacled Weaver	*Ploceus ocularis*											x			x
African Golden Weaver	*Ploceus subaureus*						x		x			x			x
Dark-backed Weaver	*Ploceus bicolor*	x	x	x	x		x		x	x	x		x	x	
Grosbeak Weaver	*Amblyospiza albifrons*						x								
Red-headed Weaver	*Anaplectes rubriceps*								x						
Red-billed Quelea	*Quelea quelea*			x											x
Red-headed Quelea	*Quelea erythrops*								x						x
Fan-tailed Widowbird	*Euplectes axillaris*														x
Bishop sp.	*Euplectes spp*														x
Green-winged Pytilia	*Pytilia melba*			x			x			x		x			x
Orange-winged Pytilia	*Pytilia afra*												x		
Peters's Twinspot	*Hypargos niveoguttatus*	x	x												
Green-backed Twinspot	*Mandingoa nitidula*		x												
Red-faced Crimsonwing	*Cryptospiza reichenovii*		x												

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Southern Cordonbleu	*Uraeginthus angolensis*						x					x			x
Red-billed Firefinch	*Lagonosticta senegala*	x										x	x		x
Jameson's Firefinch	*Lagonosticta rhodopareia*							x							x
African Firefinch	*Lagonosticta rubricata*														
Common Waxbill	*Estrilda astrild*											x	x		x
Bronze Mannikin	*Lonchura cucullata*	x							x			x	x		x
Black-and-white Mannikin	*Lonchura bicolor*	x													
Magpie Mannikin	*Lonchura fringilloides*														x
Broad-tailed Paradise-Whydah	*Vidua obtusa*					x									
Eastern Paradise-Whydah	*Vidua paradisaea*								x						
Pin-tailed Whydah	*Vidua macroura*											x	x		
Village Indigobird	*Vidua chalybeata*											x			
Variable Indigobird	*Vidua funerea*						x								
Brimstone Canary	*Serinus sulphuratus*											x			
Yellow-fronted Canary	*Serinus mozambicus*			x		x	x					x	x		
Yellow-rumped Seedeater	*Serinus xanthopygius*											x			
African Golden-breasted Bunting	*Emberiza flaviventris*					x									
Cabanis's Bunting	*Emberiza cabanisi*					x									