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PRIORITIES FOR BIODIVERSITY CONSERVATION IN THE UDZUNGWA MOUNTAINS, TANZANIA— BASED ON BIRD DATA

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ABSTRACT

An evaluation of biodiversity values of ten forest areas has been made in the Udzungwas, based on all data available on the distribution of restricted-range forest birds. The analysis shows that the evergreen forests in West Kilombero (Ndundulu and Nyumbanitu Mountains), Udzungwa Scarp north, Mwanihana and Udzungwa Scarp south contain all species of concern and have the highest conservation priority. The other forest areas: Kisinga-Rugaro, Dabaga, Kigogo, Image and Matundu are of lower importance for restricted-range birds; however, they still have high conservation value. For two areas, Nyanganje and Iyondo (forest at river Mngeta), no data were available. Mwanihana (3rd priority) is within the Udzungwa Mountains National Park. It is proposed that the 1st (West Kilombero), 2nd (Udzungwa Scarp North) and 4th (Udzungwa Scarp South) ranked sites should be conserved by supporting adjacent local communities and by giving one or more of these areas National Park status. Some management options are discussed.

INTRODUCTION

The Eastern Arc Mountains are widely recognised for their unique biodiversity values (Lovett, 1988; Lovett & Wasser, 1993). The Udzungwa Mountains are of particular importance for the conservation of primates and duikers (Rodgers & Homewood, 1982; Dinesen *et al.*, in prep.), and are the richest area for restricted-range forest birds (Jensen & Brøgger-Jensen, 1993; Dinesen *et al.*, 1993; Stattersfield *et al.*, 1998). Besides the ecoclimatic and geological uniqueness of the Udzungwas, and the Eastern Arc Mountains in general (Griffith, 1993, Lovett, 1993), the forest fragments in the Udzungwas have retained populations of some restricted-range bird species due to the large area of evergreen forest habitat (Rodgers & Homewood, 1982; Dinesen *et al.*, in prep.).

Within each Eastern Arc forest block large biological differences exist at a local scale. Differences are most probably maintained and reinforced by local microclimatic differences within an overall rather stable climatic situation. The forests within the Udzungwas should therefore, from a conservation point of view, be viewed as fragments of a forest once unbroken now containing different biological communities with different species and with different abundance patterns.

The aim of this paper is to provide an overview of biodiversity values in the Udzungwas by assessing conservation priorities within the forests (and to point out areas for further research) using data on the distribution of restricted-range forest birds. Although information is lacking from two areas, data are adequate for pointing out four areas within the Udzungwas that are of particular importance for the conservation of restricted-range birds. A sociological study in a village adjacent to one of the high priority areas provided information on local people's management of the forest and the need to distinguish between values and products from evergreen forest and Miombo woodland, respectively (Dinesen & Lehmberg, 1996).

METHODS

The Udzungwa Mountains are divided into ten areas, which include all the major forests (figure 1). Most forest areas are separated by non-forest land such as fire-dependent grassland, agricultural land or swamps. However, separated forest fragments with a similar bird composition are regarded as one area. Some large continuous forest areas have been divided due to the differences in avifauna composition or research effort. For two of the areas no data were available. Survey effort in the different areas varies and further surveys may suggest more detailed and perhaps other ecological demarcations of the Udzungwa forest areas. All restricted-range and globally threatened bird species (see Collar *et al.*, 1994; IUCN, 1996; Stattersfield *et al.* 1998) recorded in the Udzungwas have been listed within these ten areas. Priorities are given according to simple numbers of endemics, globally threatened and other restricted-range birds in each area. The distributional data have been compiled during a review of the literature based on extensive surveys in the Udzungwas in the 1980s and 1990s (Dinesen *et al.*, 1993; Jensen & Brøgger-Jensen, 1992; Moyer, 1993; Rahner, 1994, Dinesen *et al.*, in prep.) and unpublished data collected together with T. Lehmberg, L.A. Hansen, J.O. Svendsen and T. Romdal. Additional data were kindly provided by D. Moyer and J. Fjeldså. Level of human threat to the different forest areas needs more detailed investigation and could be applied within the proposed areas on a geographically more detailed scale.

According to Stattersfield *et al.* (1998) the total number of birds with a world range of less than 50,000 km² is 34 for the Tanzania-Malawi mountains. Thus they pooled the Eastern Arc Mountains (from the Taita Hills to the Makombako Gap, as defined by Lovett, 1990) and forests in the Malawi Rift area into one Endemic Bird Area. Although the species list from their book is used here, the focus is on the Eastern Arc and the Udzungwa Mountains in particular.

RESULTS

Priorities based on ornithological criteria

In total 25 (74 %) of the Tanzania-Malawi endemics are found in the Udzungwa Mountains (Dinesen *et al.*, in prep.) and 20 of these are confined to wet evergreen forest. The remaining five are Uhehe Fiscal *Lanius marwitzi*, Black-lored Cisticola *Cisticola nigriloris*, Churring Cisticola *Cisticola njombe*, Yellow-browed Seedeater *Serinus whytii* and Buff-shouldered Widowbird *Euplectes psammocromius,* which are confined to forest edge, bracken areas and grassland; the Uhehe Fiscal also occurs on agricultural land. Of these 20

forest birds, 11 are globally threatened (Collar *et al.*, 1994; IUCN, 1996). Furthermore, the Udzungwa Forest Partridge *Xenoperdix udzungwensis* and the Rufous-winged Sunbird *Nectarinia rufipennis* are endemic to the Udzungwas (see table 1). The evergreen forest areas are listed below in rank for conservation importance with comments on their importance for birds (see figure 2 for data on number of restricted-range species found in each area).

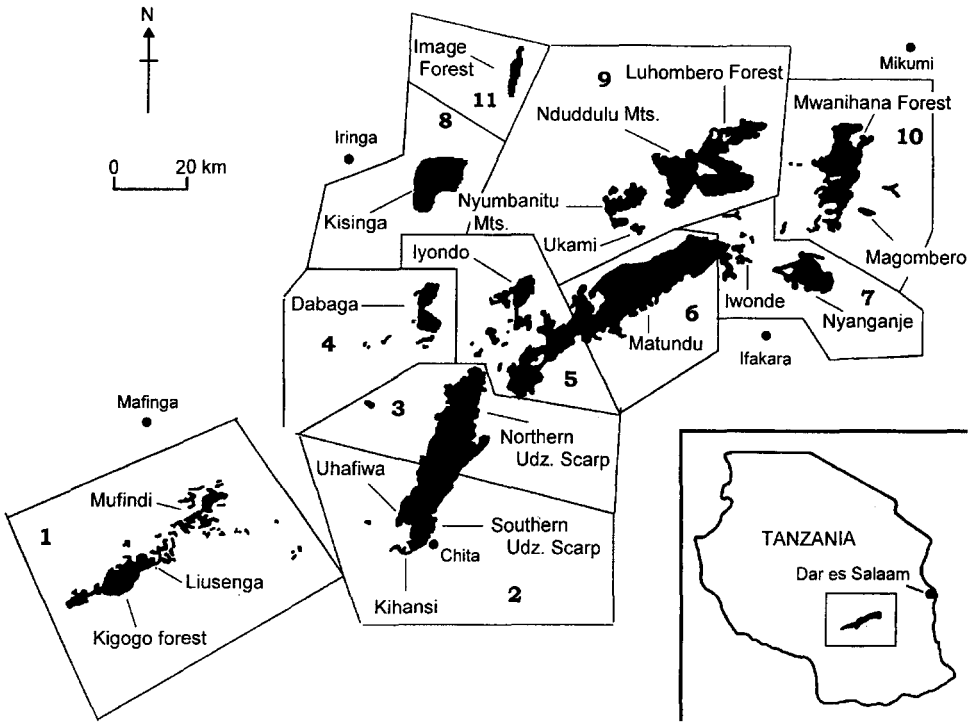

Figure 1. Forest areas in the Udzungwas (in black, after Lovett & Moyer, 1992). Map showing demarcation of eleven areas treated in the text.

Rank 1 (area 9) West Kilombero montane forest area

Seventeen restricted-range species have been recorded in the West Kilombero montane and submontane forests of Ndundulu and Nyumbanitu Mountains. Nine are categorised as globally threatened, including the two Udzungwa endemics, the Udzungwa Forest Partridge and the Rufous-winged Sunbird. This is the highest number in the Udzungwas. The Ndundulu and Nyumbanitu Mountains have been surveyed over several months in both the dry and wet seasons by J. O. Svendsen, L. Hansen, T. Lehmberg and L. Dinesen (Dinesen *et al.*, 1993 and later unpublished studies). The entire population of the Udzungwa Forest Partridge is found within about 300 km² of forest cover (flat projection) in the two West Kilombero montane forests. The total population is roughly estimated to be about 3,700 birds (Dinesen *et al.* in prep.). The Rufous-winged Sunbird is also found in Udzungwa Scarp north and Mwanihana forests. An undescribed subspecies of the Amani Sunbird *Anthreptes pallidigaster* (Dinesen *et al.*, 1993) has so far been located only in this area. A large part of the Luhombero forest (see figure 1) is situated within the National Park. However, the surveyed parts in the Ndundulu are situated outside the Park.

Table 1. List of restricted-range forest birds in the Udzungwa Mountains following Stattersfield et al. *(1998) and the number of areas in which they occur in the Udzungwas (see figure 1 for location of areas). * Birds threatened by global extinction are classified in either Endangered, Critical or Vulnerable categories (IUCN 1996). Birds not threatened by global extinction, but still of conservation concern, are classified as either near-threatened or least concern. (Collar* et al. *1994).*

Restricted-range species In taxonomic order	Global status*	Udzungwa endemic	East. Arc endemic	Present in area No
Xenoperdix udzungwensis	Endangered	+	+	9
Bubo vosseleri	Vulnerable		+	3
Andropadus chlorigula	Least concern			1–4, 8–11
Laniarius fuelleborni	Least concern			1–4, 8–11
Swynnertonia swynnetoni	Vulnerable			2, 3, 9, 10
Sheppardia sharpei	Least concern			2–4, 6, 8–10
Sheppardia lowei	Vulnerable			1–4, 8, 9
Modulatrix stictigula	Least concern			1–4, 8–11
Arcanator orostruthus	Vulnerable		+	2, 3, 9,10
Apalis chariessa	Vulnerable			2, 3, 9,10
Apalis chapini	Least concern			1–4, 6, 8–10
Bathmocercus winifredae	Vulnerable		+	10
Orthotomus metopias	Least concern			1–4, 8, 9
Anthreptes pallidigaster	Vulnerable			9
Anthreptes rubritorques	Vulnerable		+	9, 10
Nectarinia moreaui	Near-thr.		+	?
Nectarinia rufipennis	Vulnerable	+	+	3, 9, 10
Serinus melanochrous	Near-thr.			1–4, 8, 9
Ploceus nicolli	Vulnerable		+	2, 3, 9, 10
Poeoptera kenricki	Least concern			1–3, 9, 10

Rank 2 (area 3) Central and northern Udzungwa Scarp area

Fifteen restricted-range species have been recorded, including the first record in the Udzungwas of the Nduk Eagle Owl *Bubo vosseleri* (D. Moyer, *in lit.*). Seven of these are categorised as globally threatened, including Rufous-winged Sunbird, which is present at high densities. The Udzungwa Forest Partridge, Banded Sunbird *Anthreptes rubritorques* and Amani Sunbird (see table 1) have not been recorded. The area has been surveyed during several weeks by J. Fjeldså and D. Moyer in the wet season (J. Fjeldså, pers. comm.). It is not likely to find the partridge here; however, one or both sunbirds might be found with further surveys.

Rank 3 (area 10) Mwanihana forest area

Thirteen restricted-range species have been recorded in Mwanihana Forest. Seven species are categorised as globally threatened, including a large population of Rufous-winged Sunbird (Jensen, 1983). This is the only locality within the Udzungwa Mountains for Mrs Moreau's Warbler *Bathmocercus winifredae,* which is reported to be rare (Jensen & Brøgger-Jensen, 1992). The lower parts of the Mwanihana Forest have been surveyed, especially by F.P. Jensen and S. Brøgger-Jensen, for several months in the dry season and in a week in the wet season (Jensen & Brøgger-Jensen, 1992) but field studies from the highest parts are still lacking. It is therefore expected that additional restricted-range species occur at Mwanihana, *e.g.* Iringa Akalat *Sheppardia lowei*, which occurs in all other montane evergreen forest areas, or perhaps African Tailorbird *Orthotomus metopias* or Kipengere Seedeater *Serinus*

melanochrous. All of the Mwanihana Forest is included in the Udzungwa Mountains National Park.

Rank 4 (area 2) Udzungwa Scarp south area
Thirteen restricted-range species have been recorded in the southern Udzungwa Scarp, which has been surveyed over several months in the dry season by D. Moyer, M. Rahner and F.P. Jensen, with more brief visits in the wet season at Chita, Uhafiwa and Kihansi (Jensen & Brøgger-Jensen, 1992; Moyer, 1993; Rahner, 1994). Five species are categorised as globally threatened. None of the Udzungwa endemics have been recorded. Large populations of Dappled Mountain Robin *Arcanator orosthrutus* are found, with smaller numbers of Swynnerton's Robin *Swynnertonia swynnertoni*. Tanzanian Mountain Weaver *Ploceus nicolli* is rare, as elsewhere in the Udzungwas. This forest adjoins that of the central and northern Udzungwa Scarp.

Rank 5 (areas 8, 4 and 1) Kisinga-Rugaro, Dabaga and Kigogo area
Eight restricted-range species occur in all the three areas. Of these, only the Iringa Akalat is globally threatened; it is fairly common in the western Udzungwa forests including Kisinga-Rugaro. A part of Kisinga-Rugaro was surveyed in three weeks in the wet season by J.O. Svendsen, L. Hansen, T. Lehmberg and L. Dinesen. As is the case for other western forests in the Udzungwas, no Udzungwa endemics are found (see figure 2). Kenrick's Starling *Poeoptera kenricki* also seems absent. Eight restricted-range species occur at Dabaga, including the Iringa Akalat. The composition of the restricted-range species is the same as that for Kisinga-Rugaro (Jensen & Brøgger-Jensen, 1992). Stierling and Loveridge visited Dabaga about 100 years ago (Jensen & Brøgger-Jensen, 1992) but there is no information on more recent surveys. Kigogo has the same number of species as for the two areas above. The globally threatened Iringa Akalat is fairly common (Jensen & Brøgger-Jensen, 1992) in both wet and dry parts of the forest. Sharpe's Akalat *Sheppardia sharpei* is present in both Dabaga and Kisinga-Rugaro but does not occur in Kigogo. The Kigogo forest has been surveyed for two weeks in the dry season (see Jensen & Brøgger-Jensen, 1992 including information from L. Baker), and no further restricted-range species is expected to be found.

Rank 8 (area 6) Matundu area
Of the restricted-range species only Sharpe's Akalat is found in the lowland Matundu Forest (see table 1). Matundu, in common with other lowland Udzungwa forests, lacks any of the restricted-range species of the Kenya-Tanzania coastal forests, although some of the widespread coastal forest species are found. Also, the restricted-range birds known from the montane forests in the Udzungwas are lacking. Unlike the montane evergreen forests, this large lowland forest is groundwater dependent and true evergreen forest aspects are found mainly along major rivers. The Udzungwa Mountains National Park includes all the lowland forest on the eastern side of Ruipa river (Matundu Forest Reserve). The forest west of the river is included in the West Kilombero Scarp Catchment Forest Reserve. Matundu has been surveyed for several months in the dry season by T. Lehmberg, L. Dinesen, M. Rahner, J. Fjeldså and D. Moyer.

Rank 9 (area 11) Image area
Only brief visits have been paid to Image by E. Mlungu, T. Lehmberg and L. Dinesen. A species list has been provided by E. Mlungu via J. Fjeldså. Three restricted-range species

have so far been recorded: Green-throated Greenbul *Andropadus chlorigula*, Fuelleborn's Boubou *Laniarius fuelleborni* and Spot-throat *Modulathrix stictigula*; however, probably a few more restricted-range species will appear during longer surveys. The forest is heavily degraded and most is located above 1,800 meters, due to clear cutting. Further surveys are required to obtain a complete bird list.

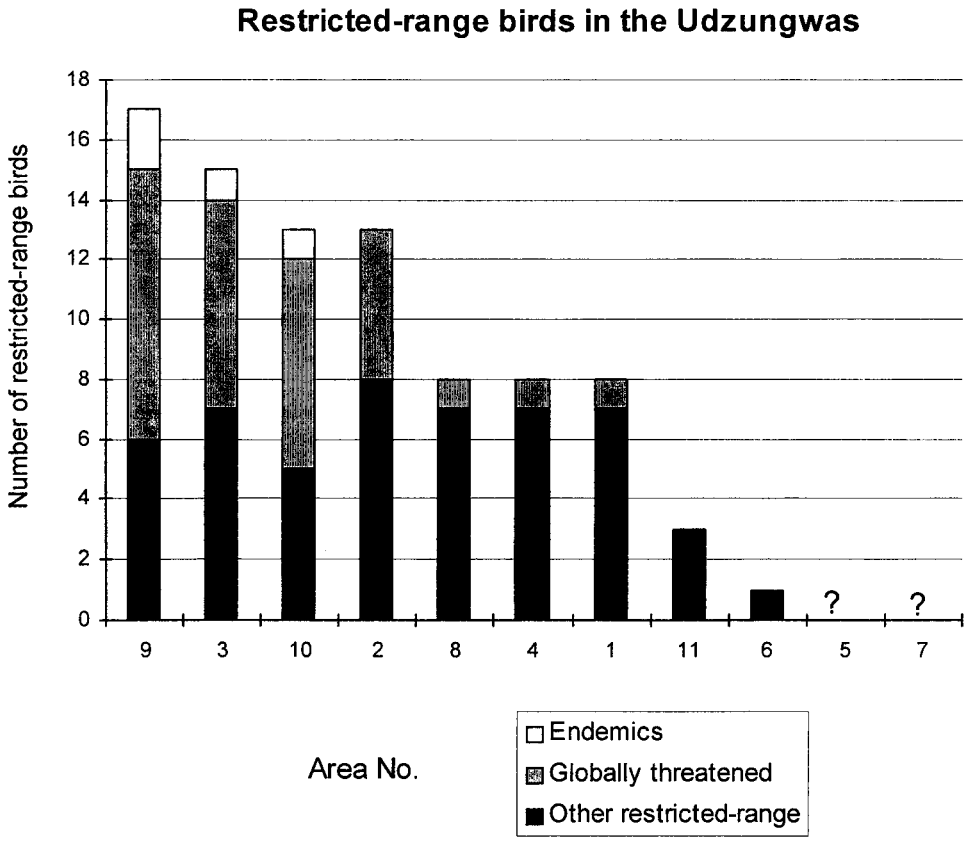

Figure 2. Number of restricted range forest birds in each area of the Udzungwas. See figure 1 and table 1 for location of areas and bird species of concern. RR = Restricted-range species with a distribution of less than 50,000 km^2 (ICBP, 1992). GT = Globally threatened species (Collar et al., *1994).*

No rank (area 7) Nyanganje area

These forest patches, of which the Nyanganje Forest is by far the largest, have not yet been investigated (see figure 1). They may contain a rather similar bird community to Matundu but the forest fragments situated up to 1,350 m between this area and Mwanihana/West Kilombero may hold a larger number of restricted-range species. A part of the forest is within the Udzungwa Mountains National Park. No priority can be given for this area at present.

No rank (area 5) Iyondo area (forest at river Mngeta)

No survey has been carried out yet. The lowland part, which is continuous with Matundu,

probably contains a similar avifauna. However, the relatively large forest fragment of Iyondo contains montane forest up to about 1,800 m and it may contain a number of restricted-range forest species. In a one-day-visit in 1999 by H. Lerdorf and L. Dinesen the presence of the Rufous-winged Sunbird was confirmed. This forest is included in the West Kilombero Scarp Forest Reserve. No priority can currently be given for this area.

Priorities based on opinions of local people

A case study in the village of Udekwa, adjacent to the high conservation priority forests in the Ndundulu and Nyumbanitu Mountains in West Kilombero, showed that the surrounding Miombo woodland is more important than forest for supplying the village with woody products such as firewood, handles, tools, furniture, building poles, fruits and medicine (Dinesen & Lehmberg, 1996). The evergreen forest is avoided by most people, including all women, but was utilised to some degree for collecting medicinal plants and building poles by the men. The evergreen forest was recognised as important for generating rain. The village government has accepted a suggestion to include the evergreen forest in the Udzungwa Mountains National Park. A large part of the continuous forest area is situated outside the Park and is presently classified as water catchment reserve. However, the local people refused a similar suggestion to include a part of the Miombo woodland in the park. Local people were against commercial exploitation of the evergreen forest which occurred in 1993–94, which they did not benefit from. Bushfires, clearing for fields and commercial logging were considered the most serious problems regarding the long-term conservation of the evergreen forests surrounding Udekwa village (Dinesen & Lehmberg, 1996). At the Mwanihana side of the Udzungwas the utilisation patterns are different due to a larger population pressure and limited areas of Miombo (Cunningham, 1993). The villages are situated right up to the edge of the National Park but local people have access to the forest and to some forest products such as honey and firewood (Cunningham, 1993). It was recognised by Kiwasila & Odgård (1992) that the most important issue regarding forest conservation in the Udzungwas was enforcement of the bylaws.

DISCUSSION

In conclusion, the most important forests for restricted-range birds are the West Kilombero forests (area 9 on figure 1), the central and northern Udzungwa Scarp forests (area 3), Mwanihana forest (area 10) and the southern Udzungwa Scarp (area 2). These areas contain the highest number of restricted-range birds and endemics in the Udzungwas (in the sequence mentioned) and together they hold all forest birds of concern. Kisinga-Rugaro (area 8) and other western forests have at least five restricted-range birds less than e.g. the southern Udzungwa Scarp forest or Mwanihana (see figure 2). These plateau forests are in general drier than the escarpment forests and most are probably of secondary nature, however, still of major conservation importance. Further analysis of the underlying causes of the priority patterns is needed; however, some obvious factors should be mentioned here. Clearly, the size of the evergreen forest fragment and the distance to other fragments is important. The most important forest areas are all large in area and some important smaller fragments such as Ukami in West Kilombero (about 7 km^2) are situated adjacent to larger forest areas.

Secondly, the most important areas are also the wet eastern facing escarpments, which receive most of the precipitation. These areas are most probably also the climatically most stable and should possibly be regarded as survival areas for certain species during periods of

unfavourable dry climatic conditions. Also these sites have a rather undisturbed forest structure and have escaped large-scale disturbance by *e.g.* shifting cultivation and logging.

Although further avifaunal surveys will create some changes in the demarcations of areas and are needed (see below), it is believed that the priorities given here are consistent (expect for the unsurveyed forests) because many areas in the Udzungwas now are rather well surveyed for birds. Hunting plays a minor role for the composition of the bird fauna contrary to *e.g.* the larger species of mammals.

As it is suggested in this paper a strategy for conservation of biodiversity should pay attention to areas with species and genotypes that are unique. Birds are in some cases good indicators of overall biodiversity values and for centres of evolution (ICBP, 1992; Fjeldså & Lovett, 1997), which seems to be the case in the Udzungwas (Dinesen *et al.*, in prep.). This implies protection of evergreen forests and implementation of management plans for the utilisation of adjacent woodland resources. Possibilities of alternative tree and protein resources in villages situated in proximity to the evergreen forests should be found if needed. The evergreen forests in the Udzungwas should in general be conserved without major utilisation due to their exceptionally high biodiversity value. However, access to the forests by local people and tourists should be carefully considered. The biological significance of these old Eastern Arc montane evergreen forests is high and the areas of forest are critical for long-term survival of restricted-range birds and mammals (see also Fjeldså & Rabøl, 1995). The local benefit from the forests includes vital long-term values such as securing rainfall and drinking water, improved soil fertility and prevention of erosion and silting of watercourses.

Large areas of Miombo woodland still exist in some areas of the Udzungwas, with scattered villages. Extensive areas of cultivation are also found, especially to the north and west. A management strategy for Miombo should be based on utilisation in a sustainable manner fulfilling local needs of forest and wood products. Protection of local water sources should be considered through enforcement and revision of the bylaws. The Miombo woodland is of high importance for wood products and fruits etc., but in terms of biological diversity, the Miombo contains widespread and robust species that are not dependent on specific sites, and thus they are not at all as vulnerable to human exploitation as the evergreen forests. Simple monitoring programmes should be implemented to evaluate the effect and success of the implementation of any environmental projects. Such programmes need to consider both qualitative and quantitative parameters, including *e.g.* measures of rates of change in the extent of forest, population sizes of selected species and the level of environmental awareness among local people.

It is an advantage in many parts in the Udzungwas, when compared to *e.g.* the Usambaras and the Ulugurus that no people are living in or between the evergreen forest fragments. Thus, forest regeneration will be possible. However, the human population in the Udzungwas is increasing and the population pressure is already high in some parts, *e.g.* along the foothills of the eastern escarpment and in the Kihansi area. A thoroughly implemented forest management plan will limit conflicts between people, forest and wildlife, a conflict that is far more advanced in many other Eastern Arc forests such as the Usambaras and the Ulugurus. The possibility of an extension of the National Park to include adjacent high priority biodiversity areas should be carefully considered. So far the western and southern Park borders have been selected arbitrary without considering ecological or biological data and evidence, which were lacking when the borders were pointed out. Establishment of zones between the evergreen forest patches is an important tool for forest regeneration and should include swamp and grassland areas formerly covered by forest. The

extensive bushfires in the Udzungwas are a major problem. Fires prevent forest regeneration and penetrate the forests in the dry season and destroy parts of it and overall the forest area continues to shrink due to the regular fires.

Further surveys for birds are needed in the Nyanganje and Iyondo areas to assess their conservation priority. The forest fragment of Iyondo may contain several restricted-range species due to the altitude of the forest. However, it is also important to assess the biodiversity values of areas such as the Luhombero Forest in West Kilombero and the Gologolo Mountains in the high parts of Mwanihana *e.g.* by searching for restricted-range birds. Also further surveys in the central Udzungwa Scarp and Image are recommended. Many species are elusive and hard to detect and in several cases a species has been recorded only once during month-long surveys. Further studies on other biological organisms will clarify how consistent the patterns shown by the birds are.

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