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World Wide Fund For Nature-Tanzania Programme Office (WWF-TPO)

**Ecological Baseline Survey Report and Monitoring Plan
for the Vidunda Water Catchment Area and East side
of the Udzungwa Mountains National Park**



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Executive summary

The Vidunda Catchment Area and Eastern side of the Udzungwa Mountains National Park form a significant area of Tanzania for conservation of biodiversity and water catchment values. Part of a biodiversity hotspot, the highland forests in this region are rich in endangered and endemic species, and as catchment forests are critical to the livelihoods of hundreds of thousands of people. Yet the area has been under severe pressure for several decades from a rapidly increasing human population, and the Uvidunda Mountains in particular are highly degraded.

As part of a new conservation project for the area being implemented by WWF, this study was commissioned with the aims of reviewing and assessing baseline ecological information on the area, and recommending a sustainable long-term ecological monitoring plan for the area. Methods employed included field and GIS-based assessment of ecological conditions, review of known biodiversity and past monitoring activities, preliminary questionnaire-based sampling of community knowledge, consultations with key stakeholders, and evaluation of afforestation activities.

The results of several interviews with households of eight villages of the Vidunda Catchment Area are presented, providing a preliminary sketch of an area which currently lacks the natural resources to support the large local human population. The interviews also testify to dramatic losses of animal populations in this area in recent decades.

Consultations with stakeholders and community leaders reveal that an encouragingly large programme of growing and planting seedlings is under way in the area. However, there is room for improvement and observations and recommendations are offered regarding the need for more strategic planning and enhanced agroforestry practices.

The Iyunji Forest is identified as a key site for the ecological restoration of the Vidunda Catchment Area. It is the only remaining moist forest in the Uvidunda Mountains, and has been reduced in size by a quarter over the last 31 years. The biodiversity of the forest is here reviewed and evaluated, gaps in knowledge are identified, and surveys to fill these gaps recommended as a matter of priority. It is also recommended that a community-based ecological monitoring programme involving the communities of Chonwe, Udunghu and Vidunda villages be initiated, and a strategy for implementation is suggested.

Along the Eastern side of the Udzungwa Mountains National Park, there is also an opportunity for a community-based ecological monitoring programme of Mwanihana Forest, building on a recent study of the effects of human activities on the ecology of the forest. It is also important that more technical long-term research by national and international researchers be continued.

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Abbreviations and Acronyms

CABS	Centre for Applied Biodiversity Science (CI)
CCS	Community Conservation Service (TANAPA)
CI	Conservation International
CMEAMF	Conservation and Management of the Eastern Arc Mountain Forests Project
FBD	Forestry and Beekeeping Division
IRA	Institute of Resource Assessment
NGO	Non-governmental Organisation
NORAD	Norwegian Agency for Development Cooperation
PFM	Participatory Forest Management
RFCO	Regional Forestry Catchment Officer
TANESCO	Tanzania Electric Supply Company Limited
TANAPA	Tanzania National Parks
UDSM	University of Dar Es Salaam
UEMC	Udzungwa Ecological Monitoring Centre
UMNP	Udzungwa Mountains National Park
VCC	Village Conservation Committee
VNRC	Village Natural Resources Committee
WD	Wildlife Division
WWF	World Wide Fund for Nature

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1. Introduction

1.1 Importance of the Uvidunda Mountains: an overview

The ‘Eastern Arc Mountains’ are an archipelago of biogeographically linked mountain ranges in Tanzania and southern Kenya recognised to be of global importance for their unique habitats, high levels of biodiversity and endemism, and water catchment value for millions of local people (Burgess *et al.*, in press). The Uvidunda Mountains (or ‘Uvidundas’) of south-central Tanzania are rightly included amongst these uplands since their values, both extrinsic and intrinsic, are exceptional.

The Uvidundas are divided from the Udzungwa Mountains (or ‘Udzungwas’) by the Great Ruaha River, as it heads east to join the Rufiji River and eventually the Indian Ocean. In spite of the Ruaha’s potential role as a geographical barrier for some taxa (Fjeldså *et al.*, in prep), the Uvidundas share its habitat types and many of its biological values with the Udzungwas, which are internationally renowned for their extraordinary species richness (Doody, 2005). Although for at least 70 years the Uvidundas have had a very small area of sub-montane forest compared with the much larger tracts of forest in the Udzungwas (Fuggles-Couchman, 1939), we should expect several of the rare and locally endemic species characteristic of this habitat in the Udzungwas to be present. Moreover, in common with most other Eastern Arc mountains it is reasonable to expect the Uvidundas to contain one or more strictly endemic species; however a lack of biodiversity research in the area means this has not yet been confirmed.

Together the Udzungwa and Uvidunda Mountains are of hugely significant water catchment value for the wider ecology of southern Tanzania, for the livelihoods of millions of people, and for the Tanzanian economy, providing one-third of the nation’s electricity through hydroelectric power generation. The Uvidundas contribute to the catchment of the Great Ruaha River and TANESCO’s Kidatu Dam hydroelectric power station. In addition, several other rivers and streams rising in the Uvidundas support the 9 villages of the area and the vast fertile plain of the northern end of the Kilombero Valley, where several thousand tonnes of sugar and other crops are harvested each year (e.g. in 1999: 50,000 tons of sugar; 40,000 tons of rice; 34,000 tons of bananas and cassava; IRA, 2000).

However, in contrast to the neighbouring Udzungwa Mountains, where the Udzungwa Mountains National Park covers one-fifth of the total area (UMNP: 1990km², gazetted in 1992), and most of the forests and some of the woodland outside of the UMNP have either Catchment Forest Reserve, Village Forest Reserve or PFM status, the Iyunji Forest and surrounding woodland and bush of the Uvidunda Mountains have until now had *no legal protective status*. Moreover, the Uvidundas and the communities dependent on these mountains have until quite recently received little attention from the national and international development and conservation agencies and NGOs with interests in other areas of the Eastern Arc.

1.2 Background to the study

In 2006 the World Wide Fund for Nature Tanzania Programme began a 3-year project, funded by the Norwegian Agency for Development Corporation (NORAD) and WWF-Norway. The stated **goal** of the project is:

“The integrity of the Udzungwa Mountains Catchment is conserved so that it continues to provide vital sustainable goods and services at local, national and international levels”

More specifically, the **purpose** of the project is:

“to ensure reduced pressure and improved utilization of forests, water and land resources on the eastern side of the Udzungwa Mountains National Park by end of 2008”

Several activities under the project have already been initiated and are ongoing, including:

- Extensive consultations with local communities and stakeholders
- Facilitation of Mapping of Iyunji Forest with technical support from FBD
- Facilitation of Drafting of Participatory Forest Management Plan and By-laws
- Collaborative land use planning by district council and communities with assistance from WWF
- Socio-economic baseline study in villages adjacent to the Udzungwa Mountains National Park and the Vidunda Catchment.

To assist in the planning phase of this project, and complementary to these activities, this short study was commissioned to research and summarise baseline ecological information on the area, and develop the framework for a sustainable ecological monitoring plan for the area, to be implemented during the course of the broader 3-year project, and beyond.

1.3. Objectives

There were two central objectives of this study:

- a) To carry out a preliminary field and GIS-based assessment of the current ecological conditions in the Vidunda catchment area.
- b) To design and develop an ecological monitoring programme for the Vidunda catchment forest and 9 villages around Vidunda catchment area in Kilosa District, and the highly populated narrow belt of land stretching for 105 km along the park boundary in Kilombero District.

A further objective relating to the training of local staff to carry out ecological monitoring is addressed in the proposed training recommendations and plan, Sections 8-11.

2. Study Area and Methods

The location of the Uvidundas in south-central Tanzania is shown in fig. 1 below. The Uvidunda Mountains comprise the high ground sometimes called the Bismarck Mountains, which are sandwiched between the Udzungwa Mountains to the south, and the town of Mikumi to the north. To the northwest are the Rubeho Mountains, and to the east lie the heavily cultivated Kilombero Valley and the hills at the southern end of Mikumi National Park. In fact, on some older maps 'Uvidunda' is shown as the Bismarck Mountains plus an area extending into these eastern hills which are now in Mikumi NP; however the latter area is not included within the geographical definition of the Uvidunda Mountains – or 'Uvidunda catchment area' – either for the purposes of this study, or the longer-term WWF-TZ project.

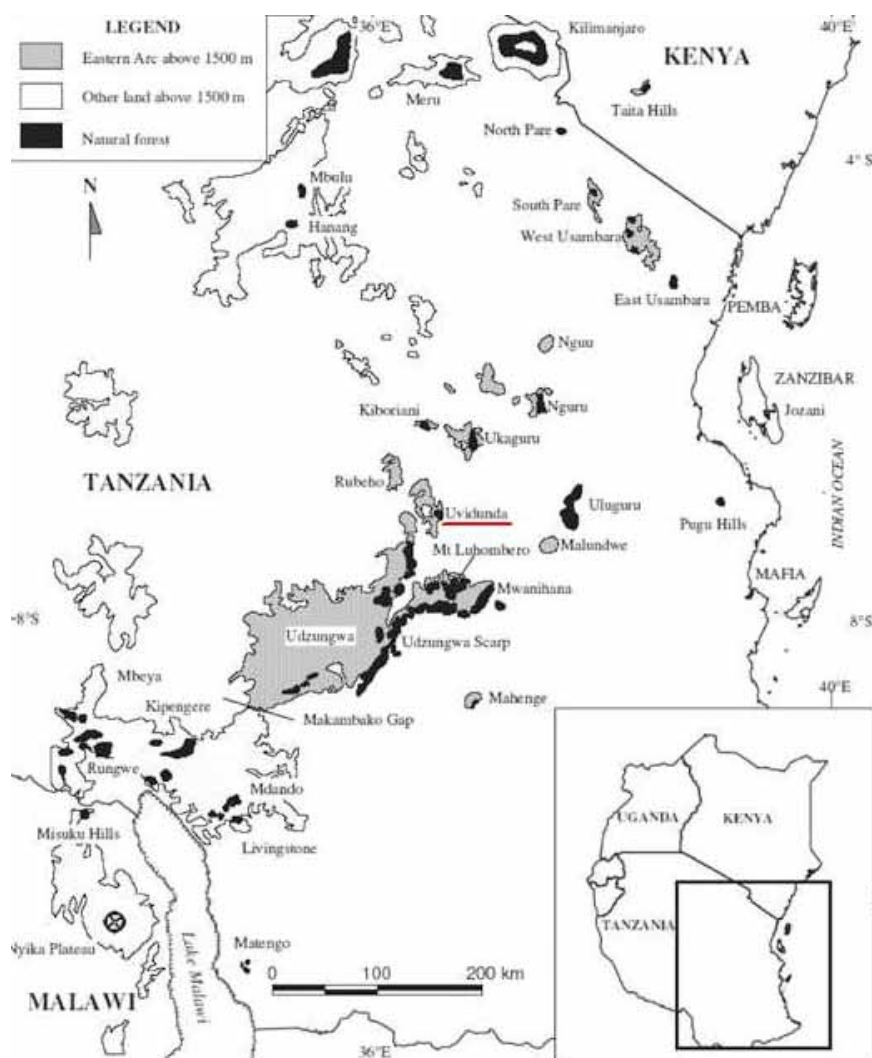


Fig. 1. Map of the highlands of Tanzania, showing the location of the Uvidunda Mountains.

The 'Vidunda catchment area' (estimated area 9,608 hectares) therefore refers to the Bismarck Mountains, including the small Iyunji Forest, the 3 villages in the mountains (Vidunda, Chonwe, Uduhhu), and the 6 villages along the road and extending up the lower slopes of the eastern edge of the mountains (Tundu, Kifinga, Iwembe, Msowero, Lumango, Ruaha).

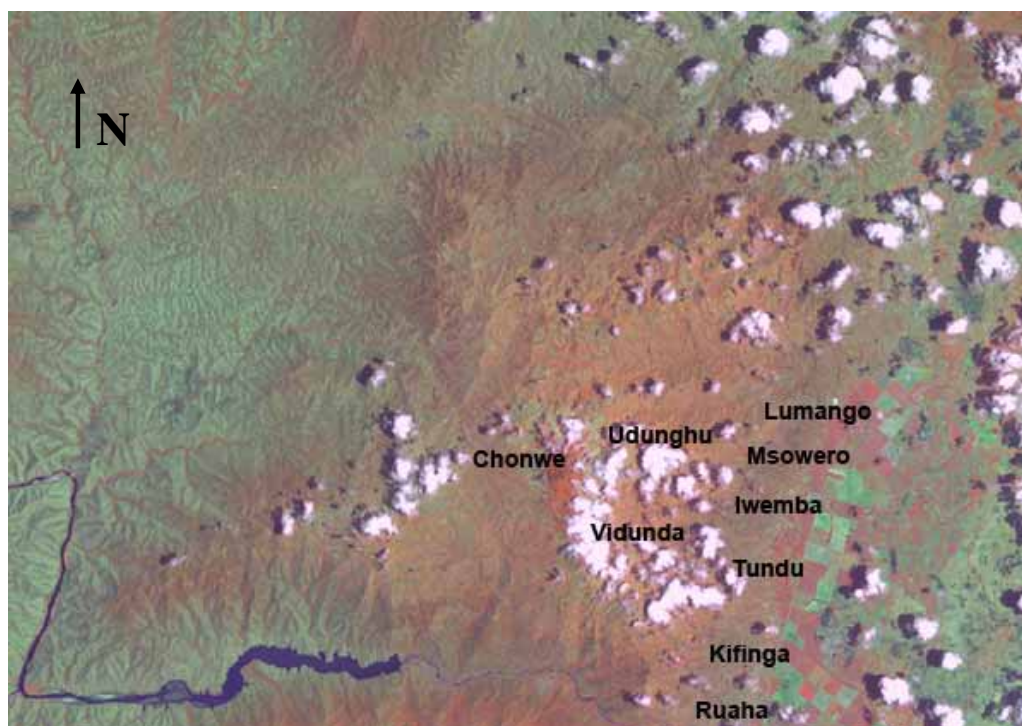
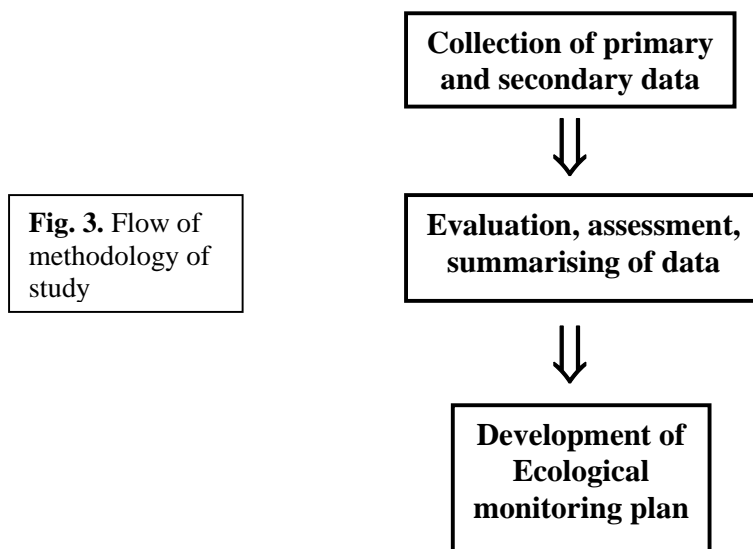


Fig. 2. Satellite image of the Vidunda Catchment Area, showing focal villages of study.

A second area with which this study is concerned comprises the twenty villages along the eastern side of the UMNP, i.e. south of the bridge at Kidatu across the Great Ruaha River. These villages have been the subject of conservation efforts since 1992 by WWF-TZ and the Community Conservation Service of the UMNP, and a number of reports have been written on this subject. All these villages neighbour Mwanihana Forest on which a fair amount of ecological research has been carried out, and the biological values of this forest are also fairly well understood.

In general, given the time constraints of the study, it was therefore decided to focus fieldwork and ecological assessment on the Vidunda catchment area, though recommendations are also given on ecological monitoring for the area of Mwanihana Forest bordering the 20 villages. Wherever appropriate, reference is made to the relevant existing literature on this area.

The approach to the study broadly followed three logical stages:



Methods employed therefore comprised a combination of:

- Search and review of existing ecological and biodiversity literature, supplemented by personal communication with researchers
- GIS-based assessment of existing land cover maps
- Interviews with several key village, ward, district, regional and commercial stakeholders and officials
- Rapid field assessment of Vidunda Catchment Area environment
- Development and sampling of questionnaire in eight villages of the Vidunda Catchment area
- Evaluation of all available information and development of appropriate ecological monitoring plan

Note: A more detailed methodology and timeframe of the study is given in [Appendix 1](#).

3. Vegetation cover and forest loss

A rapid general assessment of vegetation cover and land use of the Vidunda Catchment Area was made using aerial photographs, the Mikumi land cover and land use map (IRA, Sheet SB-37-13), FBD maps of Iyunji Forest, and a site visit to the Iyunji Forest area. This assessment confirmed that large areas of the uplands in the Iyunji Forest area are either currently used for agriculture, or have been previously cleared for agriculture (fig. 3). Apart from the small Iyunji Forest, the remaining land on the steep slopes of the mountains is drier open woodland and bush with scattered trees, much of which is degraded, i.e. many trees have been removed. However, over the whole Vidunda Catchment Area, in particular in the western portion of the mountains, there remain some fairly extensive areas of fairly intact open woodland and bush.

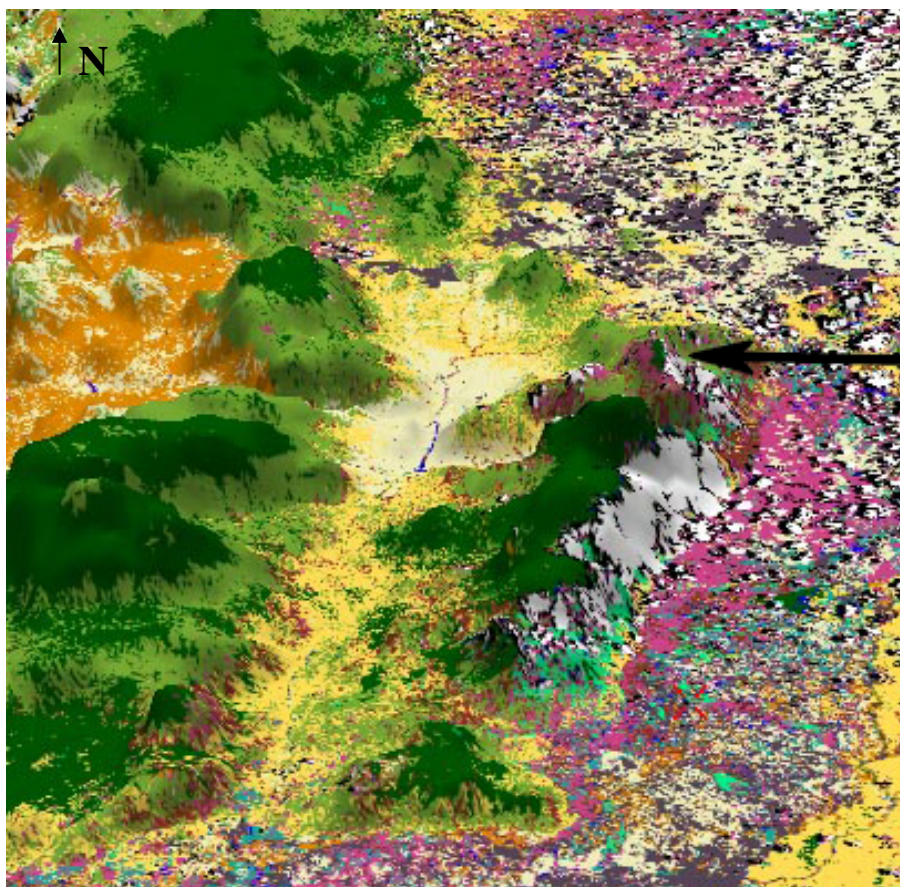


Fig. 4. Topographical vegetation map of the Uvidunda and northern Udzungwa Mountains (produced by CABS, CI, 2000). Dark green indicates moist forest; light green is open woodland or bush with scattered trees; pink indicates land cleared for agriculture. The large arrow is pointed at Iyunji Forest.

3.1 Iyunji Forest: habitat loss and destruction

Loss of forest at the Iyunji forest site for the period from 1975-2000 was analysed by the Conservation and Management of the Eastern Arc Mountain Forests Project (CMEAMF) using maps and satellite images. They calculated that during this 25-year period the forest area was reduced from 471.3 ha in 1975 to 418.1 ha in 2000, representing a loss of 11.3% of the forest cover (as shown in fig. 5). However, recent surveys show this to be an underestimate. An FBD ground mapping survey in 1999 found the forest cover to be 392 ha. The most up-to-date mapping and marking of the forest by the FBD in 2006, using hand-held GPS units, found that the current extent of forest cover is 356 ha (FBD map Jb2509 October 2006). If we assume the figure for 1975 of 471.3 ha to be correct, this means that there has been a reduction in forest cover of 115.3 ha - or one quarter of the forest (24.5%) - over the last 31 years. Moreover, the destruction is continuing unabated: 36 ha of forest (9.2% of the remaining forest) have been lost from 1999-2006.

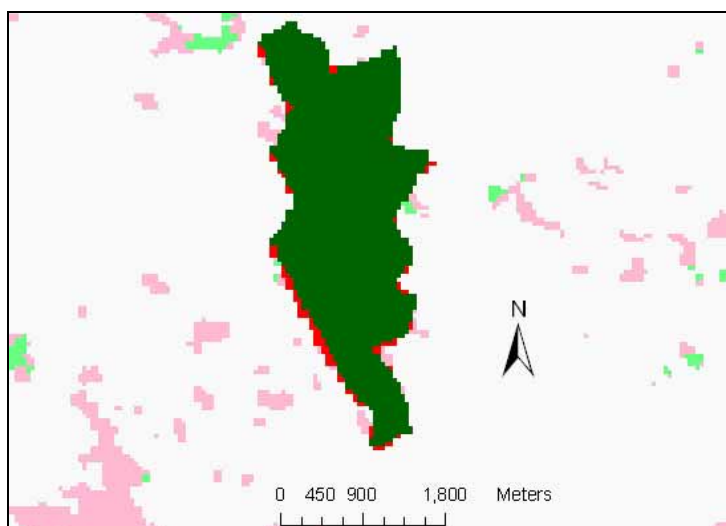


Fig. 5. Iyunji Forest habitat loss 1975-2000, taken from satellite images and maps. Green is remaining forest in 2000, red represents former forest. Adapted from Forest Change maps, CMEAMF, 2006.

Moreover, even a rapid inspection of the forest near Chonwe village reveals that the remaining area of forest is under severe pressure. Most of what remains is already secondary forest with a broken canopy (fig. 5), a clear result of a long history of cutting of large trees for timber. There is farming up to the very edge of the forest and ongoing encroachment, with some edges of the forest clearly recently cut back for agriculture. Burning of shambas is also an evident problem; signs of fires reaching the edge of the forest, and therefore preventing any regeneration, were observed during the site visit. There are several well-worn and busy human trails crossing the forest. Nevertheless, many mature trees to 30m remain, and the forest retains a moist and cool microclimate.



Fig. 6. Secondary forest of Iyunji

4. Biodiversity of Iyunji Forest

4.1 Birds of Iyunji Forest

The following provisional bird list for Iyunji Forest is restricted to forest-dependent species, since these contain the restricted-range species which are of the highest conservation concern, and is a compilation of ornithological records cross-verified from the following sources: Jones (personal observations, October 2006); Fjeldså *et al.*, in prep (with permission); David Moyer & Elia Mulungu, 1997 (pers. comm.); Fuggles-Couchman (1939, 1986).

Table 1. A provisional list of highland birds reported from Iyunji Forest and surrounding area.

Common name	Species name
Scaly francolin	<i>Francolinus squamatus</i>
Moustached green tinkerbird	<i>Pogoniulus leucomystax</i>
Yellow-rumped tinkerbird	<i>Pogoniulus bilineatus</i>
Green barbet	<i>Stactolaema olivacea</i>
Cardinal woodpecker	<i>Dendropicos fuscescens</i>
Olive woodpecker	<i>Dendropicos griseocephalus</i>
Bar-tailed trogon	<i>Apaloderma vittatum</i>
Silvery-cheeked hornbill	<i>Ceratogymna brevis</i>
Crowned hornbill	<i>Tockus alboterminatus</i>
Klaas's cuckoo	<i>Chrysococcyx klaas</i>
Red-chested cuckoo	<i>Cuculus solitarius</i>
Barred long-tailed cuckoo	<i>Cercococcyx montanus</i>
White-browed coucal	<i>Centropus superciliosus</i>
Schalow's turaco	<i>Tauraco schalowi</i>
Livingstone's turaco	<i>Tauraco livingstonii</i>
African wood owl	<i>Strix woodfordi</i>
Scarce swift	<i>Schoutedenapus myoptilus</i>
African goshawk	<i>Accipiter tachiro</i>
Mountain buzzard	<i>Buteo oreophilus</i>
African crowned eagle	<i>Stephanoaetus coronatus</i>
Buff-spotted flufftail	<i>Sarothura elegans</i>
Eastern bronze-naped pigeon	<i>Columba delegorguei</i>
Olive pigeon	<i>Columba arquatrix</i>
African green-pigeon	<i>Treron calva</i>
Tambourine dove	<i>Turtur tympanistra</i>
Square-tailed drongo	<i>Dicrurus ludwigii</i>
African paradise-flycatcher	<i>Tersiphone viridis</i>

White-tailed crested-flycatcher	<i>Elminia albonotata</i>
Black-backed puffback	<i>Dryoscopus cubla</i>
Black-fronted bush-shrike	<i>Telophorus nigrifrons</i>
Tropical boubou	<i>Laniarius aethiopicus</i>
Fulleborn's black boubou	<i>Laniarius fuelleborni</i>
Forest batis	<i>Batis crypta</i>
Spot-throat	<i>Modulatrix stictigula</i>
Olive thrush	<i>Turdus olivaceus</i>
Orange ground-thrush	<i>Zoothera gurneyi</i>
White-chested alethe	<i>Alethe fuelleborni</i>
Dusky flycatcher	<i>Muscicapa adusta</i>
White-starred robin	<i>Pogonocichla stellata</i>
Cape robin-chat	<i>Cossypha caffra</i>
Red-capped robin-chat	<i>Cossypha natalensis</i>
Red-winged starling	<i>Onychognathus morio</i>
Black saw-wing	<i>Psalidoprocne holomelas</i>
Green-throated greenbul	<i>Andropadus chlorigula</i>
Stripe-cheeked greenbul	<i>Andropadus olivaceiceps</i>
Shelley's greenbul	<i>Andropadus masukuensis</i>
Little greenbul	<i>Andropadus virens</i>
Yellow-vented bulbul	<i>Pycnonotus barbatus</i>
Cabanis's greenbul	<i>Phyllastrephus placidus</i>
Grey-backed camaroptera	<i>Camaroptera brachyura</i>
Bar-throated apalis	<i>Apalis thoracica</i>
Chapin's apalis	<i>Apalis chapini</i>
Yellow white-eye	<i>Zosterops senegalensis</i>
Mountain yellow warbler	<i>Chloropeta similis</i>
African tailorbird	<i>Orthotomus metopias</i>
Evergreen forest warbler	<i>Bradypterus mariae</i>
Cinnamon bracken warbler	<i>Bradypterus cinnamomeus</i>
Yellow-throated warbler	<i>Phylloscopus ruficapillus</i>
African hill-babbler	<i>Pseudalcippe abyssinica</i>
Collared sunbird	<i>Anthreptes collaris</i>
Variable sunbird	<i>Nectarinia venusta</i>
Moreau's sunbird	<i>Nectarinia moreaui</i>
Olive sunbird	<i>Nectarinia olivacea</i>
Bronze sunbird	<i>Nectarinia kilimensis</i>
Dark-backed weaver	<i>Ploceus bicolor</i>
Red-faced crimsonwing	<i>Cryptospiza reichenovii</i>
Green-backed twinspot	<i>Mandingoa nitidula</i>
Yellow-bellied waxbill	<i>Estrilda quartinia</i>
Yellow-browed seedeater	<i>Serinus whytii</i>
Kipengere seedeater	<i>Serinus melanochrous</i>
Oriole-finch	<i>Linurgus olivaceus</i>

4.2 Mammals of Iyunji Forest

Table 2. Incomplete list of extant and recently extirpated mammals of Iyunji Forest

Common name	Scientific name	Notes
Udzungwa red colobus	<i>Procolobus gordonorum</i>	EXTIRPATED
Black-and-white colobus	<i>Colobus angolensis ssp.</i>	Few still present
Sykes monkey	<i>Cercopithecus mitis</i>	Present
Vervet monkey monkey	<i>C. aethiops</i>	Present
Small-eared galago	<i>Otolemur garnettii</i>	Present; only known from one site in the Udzungwas
Tree hyrax	<i>Dendrohyrax sp.</i>	Extirpated?
Abbott's duiker	<i>Cephalophus spadix</i>	EXTIRPATED
Red duiker	<i>C. harveyi</i>	Extirpated?
Blue duiker	<i>C. monticola</i>	Extirpated?
Bushbuck	<i>Tragelaphus scriptus</i>	Extirpated?
Bushpig	<i>Potamochoerus larvatus</i>	Extirpated?
Buffalo	<i>Syncerus caffer</i>	Extirpated?

Sources: D. Moyer, pers. comm.
 J. Fjeldsa, pers. comm.
 This study (questionnaire results)

4.3 Trees of Iyunji Forest

Table 3. Native Trees of Iyunji Forest

Abutiloum manitianum
Acacia polycantha
Acacia rubosta
Albizia adianthifolia
Albizia versicolor
Annona senegalensis
Anthocleista grandiflora
Begonia meyeri-johannis
Biophytun abyssinicum
Bridelia micrantha
Brillantansia sp.
Cassia abbreviata
Catareguna spinosa
Clutia abyssinica
Cussonia spicata
Dombeya cincinnata

Dracaena usambariensis
Erthrina abyssinica
Ficus exasperata
Ficus mucosa
Ficus thonningii
Ficus vallis-choudae
Flacurtia indica
Gardenia jovis-tonantis
Harungana madascariensis
Hibiscus palmatus
Holarrhea pubescens
Hoslundia opposita
Indigofera emarginella
Indigofera rhynchocarpa
Khaya anthotheca
Landolphia kirkii
Lonchocarpus capassa
Macaranga sp.
Maesa lanceolata
Markhamia obtusifolia
Millettia usambariensis
Millicia excelsa
Monotes elegans
Myanthus arboreus
Myrica salicifolia
Ochria holstii
Olea europea
Pandanus rabaiensis
Pavetta crassipes
Persea americana
Phoenix reclinata
Piper capensis
Polygala macrostigana
Psidium guajara
Psorospermum febrifugun
Pteris catoptora
Rhus natalensis
Sapium ellipticum
Sorindeia madascariensis
Sparmannia mombasiana
Steganotaenis araliacea
Stereospermum kunthianum
Terminalia fatraea
Tithonia diversifolia
Uapara nitida
Vangueria madascariensis
Vitex doniana

Sources: Peter Steven Mwakanembo, researcher, Vidunda;
J. Massao, Iringa RFCO, FBD

5. Results of Village Interviews

The following information summarises the results of interviews undertaken in eight villages in the Vidunda Catchment Area between 3rd – 11th October 2006, using a structured questionnaire developed for the purposes of this study. The questionnaire used is shown in Appendix 2.

The results are divided into two sections:

- i) results from a general interview with a village chairman or a member of the Village Natural Resources Committee (VNRC) of each village sampled
- ii) results from interviews with a minimum of 10 individuals picked at random from each village

5.1 . INTERVIEWS WITH VILLAGE CHAIRMEN/VNRC MEMBER

Table 4. General information on the 8 villages sampled (plus Udunghu).

	Occupation	Popn	Males	Females	Dist from forest	Tribe(s)	Energy	Building materials	Water supply
Kifinga	Agr, bus	4680	2370	2310	1.5km	Wavidunda	Firewood	Bricks	River, 2 pumping wells
Tundu	Agr	3437	1200	1200	>1km	Wavidunda	Firewood, Charcoal	Bricks	River, springs, wells
Iwemba	Agr	2700			500m	Wavidunda	Firewood, Charcoal	Bricks	River, 2 pumping wells
Ruaha	Agr, wor	22,700	5675	17,025	>1.5km	Wavidunda Wapogoro, Wasagara, Wahehe, Wanyakyusa	Charcoal	Bricks	Tap water, pumping wells
Lumango	Agr, bus	1320	678	644	>1km	Wavidunda	Firewood	Trees	River, springs
Msowero	Agr	1811	876	945	>100m	Wavidunda Wasagara	Firewood, Charcoal	Bricks	River, wells
Vidunda	Agr, past	3062	724	709	5km	Wavidunda	Firewood	Bricks	River, springs
Chonwe	Agr	2726	603	615	<100m	Wavidunda	Firewood	Bricks	Springs
Udunghu	Agr	4412			3km	Wavidunda	Firewood	Bricks	Springs

Note: Agr =agriculture; bus =business; wor =workers; past =pastoralist

Table 5. Perceptions in each village of main problems and main attributing factors to each problem.

	Water	Education	Health	Poverty	Development projects	Village land
Kifinga	Not safe	Few school buildings	More centres needed	Not enough land to cultivate	4 villages water project	Under Illovo Sugar ^a
Tundu	Not safe	Few school buildings	No centre	Bad weather	-	Under Illovo Sugar ^a
Iwemba	Not safe	-	No centre	Not enough land to cultivate	Secondary School building	Residence
Ruaha	Seasonal not safe	-	No centre	-	-	Under Illovo Sugar ^a
Lumango	Not safe	-	No centre	No land	TTCL Machinery Protection	Residence
Msowero	Not safe	Not enough teachers	No centre	No land to cultivate	Mining of Gravel sand	Under Illovo Sugar ^a
Vidunda	Not safe	No rooms	No centre	No reliable road	-	Farms
Chonwe	-	Not enough buildings	No centre	No reliable road	Construction of MO house, school buildings renovation	Farms, residence
Udunghu	Not safe	Not enough buildings or teachers	No centre	No reliable road	MKUKUTA and TASAF school building projects	Residence

^aIn these villages respondents reported most of the land in Kilombero Valley to the east of the main road dissecting each village is owned by the Illovo Sugar Company, while the land on the mountainside to the west of the road remains village land.

Problems highlighted by villagers during our small survey include unsafe water, a lack of schools and health centres, and lack of available land for agriculture. These issues are dealt with in more depth in a forthcoming WWF-commissioned report on socioeconomic issues in the Vidunda Catchment Area by Mr. Paul Harrison.

Table 6. Answers to questions on afforestation activities

	Species planted	Seedlings obtained from?	Who pays?
Kifinga	-	-	-
Tundu	Teak, eucalyptus, Senna siamea	Gathering	Nobody
Iwemba	No	No	No
Ruaha	Eucalyptus, Syzigium, Teak, Senna siamea	Illovo	Illovo
Lumango	-	-	-
Msowero	-	-	-
Vidunda	Graveria, Cidelea, teak, mkangazi	Illovo	Illovo
Chonwe	Graveria, Cidelea, avacado, Myrica, eucalyptus	Illovo	Illovo
Udunghu	Graveria, Teak, Cidellea	Illovo	Illovo

In this area WWF have supported establishment of more than 20 tree nurseries and supplied these nurseries with supplies. Training was also given to school teachers on how to establish tree nurseries (Z. Aloyce, pers. comm.). Yet the people we interviewed were not aware of these WWF activities. However our sample size of people interviewed is very small and cannot be considered representative of the community as a whole.

Table 7. Main crops grown and farming practices in each village

	Main crops	Shifting cultivation	Crops changed annually	Use fertilizer?
Kifinga	Cane sugar, maize, rice	Yes	No	No
Tundu	Cane sugar, rice	No	No	Urea
Iwemba	Cane sugar, Rice	No	No	Urea
Ruaha	Cane sugar, maize, rice, potatoes	Yes	No	Urea
Lumango	Maize, millet, simsim	Yes	No	No
Msowero	Maize, millet, rice, simsim, cane sugar	No	No	Yes
Vidunda	Maize, Beans, vegetables	Yes	No	Intercropping
Chonwe	Maize, beans, vegetables	Yes	No	Intercropping
Udunghu	Beans, maize, groundnuts	No	No	Intercropping

At the bottom of the Mountains in the Kilombero Valley, the main crop grown is sugar – for sale to the Illovo Sugar Company. In the three more remote villages at higher altitude in the mountains – Vidunda, Chonwe and Udunghu – subsistence farming is practised more, with maize being the staple crop grown the most.

II. INTERVIEWS WITH VILLAGERS

NOTE: BECAUSE OF THE TIME CONSTRAINTS ON THIS SHORT STUDY, THE NUMBER OF HOUSEHOLDS SAMPLED IN EACH VILLAGE IS SMALL (n = 10-13). THEREFORE, THOUGH INTERESTING, NONE OF THE RESULTS PRESENTED HERE CAN BE VIEWED AS CONCLUSIVE OVERVIEWS OF EACH VILLAGE. NEVERTHELESS SOME TENTATIVE PRELIMINARY INTERPRETATION OF RESULTS IS PROVIDED.

Table 8. Summary of individual interviewees

	Total Interviewees		Household range	Residence age range	Interviewee age range	Occupation		
	Male	Female				Farmer	Jobless	Business
Kifinga	10	3	2-7	1.5-65	19-65	11	1	1
Tundu	9	3	3-9	8-66	34-66	12	0	0
Iwemba	7	4	2-6	8-46	30-69	8	2	1
Ruaha	6	4	2-19	5-45	22-60	7	2	1
Lumango	5	5	1-9	4-40	23-77	8	0	2
Msowero	5	6	2-8	6-57	18-57	9	1	1
Vidunda	6	6	2-9	15-47	28-52	11	0	1
Chonwe	6	6	2-11	21-60	21-65	12	0	0

Table 9. Summary of respondents' answers on: wild animals found in the area; source of firewood; source of water for cooking

	Do you know any wild animals present?		Species named	Firewood for cooking				Water for cooking
	Yes	No		Forest	Bought	Bush and /or farm	Do not use it	
Kifinga	7	6	Bushpig, reedbuck, bushbuck, baboon, Vervet monkey	2	7	0	4	River and pumping well
Tundu	11	1	Vervet monkey, baboon, reedbuck, bushpig, bushbuck, antelope, Sykes's monkeys, dik-dik, black and white colobus	6	0	4	2	River, spring and pumping wells
Iwemba	11	0	Vervet monkey, baboon, bushbuck, dik-dik, reedbuck	7	3	0	1	River and pumping wells
Ruaha	7	3	Vervet monkey, baboon, Sykes's monkey	0	2	3	5	Tap water
Lumango	10	0	Vervet monkey, baboon, Sykes's monkey, black and white colobus, bushpig	5	0	4	1	River
Msowero	11	0	Vervet monkey, baboon, Sykes's monkey, dik-dik, rabbit, bushpig, black and white colobus, bushbuck	8	2	1	0	River and well
Vidunda	9	2	Vervet monkey, baboon, Sykes's monkey dik-dik, rabbit, bushpig, black and white colobus, waterbuck, antelope, bushbuck, civet, jackal	5	0	7	0	River and springs
Chonwe	12	0	Vervet monkey, baboon, Sykes's monkey, hyrax, black and white colobus, waterbuck	5	0	7	0	Spring

Vervet monkey and baboon are the faunal species reported most commonly across the area. These are common animals of Tanzania which are usually the last to disappear from an overexploited area (see also Table 14), and they become pests especially when their natural habitat is degraded (Table 12). It is encouraging however that black and white colobus and Sykes's monkey are still found close to Tundu, Lumango, Msowero and Vidunda.

With the exception of Ruaha, all villages contain people still collecting firewood from local forest. The proportion of people not using firewood at all is low (with the

exceptions of Kifinga and Ruaha), suggesting that collective efforts need to be increased (by the communities and their partners) to increase use of alternative energy sources. The area is still well endowed in water resources in spite of the environmental degradation that has occurred.

Table 10. Summary of villagers' perceptions on status and trend of important natural resources from the natural forest.

	Kifinga	Tundu	Iwemba	Ruaha	Lumango	Msowero	Vidunda	Chonwe
Firewood	Scarce Decreasing	Scarce Decreasing	Scarce Decreasing	Not used	Scarce Decreasing	Scarce Decreasing	Scarce Increasing/ Decreasing	Sufficient Decreasing
Charcoal	Scarce Decreasing	Scarce Decreasing	Scarce Decreasing (rarely used)	Scarce Decreasing	Scarce Decreasing	Scarce Decreasing	Scarce Decreasing	Scarce Decreasing (rarely used)
Timber	Not used	Scarce Decreasing	Scarce Decreasing (rarely used)	Scarce Decreasing (rarely used)	Scarce Decreasing (rarely used)	Scarce Decreasing	Scarce Decreasing	Not used
Building material	Not used	Scarce Decreasing	Scarce Decreasing	Scarce Decreasing (rarely used)	Scarce Decreasing	Scarce Decreasing	Abundant/ scarce Increasing	Scarce Decreasing
Medicinal plants	Not used	Rarely used	Scarce Decreasing (rarely used)	Not used	Sufficient Decreasing	Sufficient Decreasing	Sufficient Increasing/ decreasing	Abundant Increasing
Grass for thatching	Rarely used	Rarely used	Rarely used Decreasing	Not used	Abundant Decreasing	Abundant Increasing/ decreasing	Abundant Increasing	Abundant Increasing
Others (fruits)	Not used	Rarely used	Not used	Not used	Not used	Rarely used	Scarce Decreasing	Not used

Key results suggested by these preliminary data are as follows:

- The amount of firewood, charcoal, timber and building material available to communities, in all villages surveyed, is perceived to have decreased, and these resources are now scarce.
- The main reasons given for these trends were extensive tree cutting and denied access to forests through forest protection.
- In contrast, medicinal plants and grass for thatching are still available in sufficient quantities across the area – due to these resources being used by fewer people.

In Udunghu (not included in these data), villagers were generally of the view that their environment has been the same, i.e. deforested, for a very long time. However, they also say that they are reaching a crisis point with fuelwood, and that they remember the area had more woodland when they were young (P. Harrison, pers. comm.).

It seems clear that the extensive deforestation that has taken place in the Uvidunda Mountains has had, and continues to have, a direct impact on the local communities' livelihoods.

Table 11. Important Natural Resources for the Household.

Scores equal number of respondents who said the resource was important (n=10-13).

	Firewood	Building materials	Medicinal plants	Water	Timber	Charcoal
Kifinga	6			9		3
Tundu	7	3		2		5
Iwemba	10		1	2	4	5
Ruaha	5			1		7
Lumango	9	1				2
Msowero	11	2	2	2		3
Vidunda	9	1	2	4	3	
Chonwe	10		2	1	2	

Some of the interviewees mentioned more than one natural resource. The reasons given for the importance of resources were because they are for daily use, and because they form the only source of energy.

Firewood is still perceived to be the most important resource – and this is an issue that must be addressed through further promotion of alternatives. Building materials, medicinal plants and timber all scored low.

Table 12. Problem animals

	Presence of wild animals		Species named	Trend			Crops destroyed
	Yes	No		Ab	Su	Sc	
Kifinga	6	7	Baboon, Vervet monkey, elephant	I		D	Maize, rice, cassava, millet, mango, sorghum
Tundu	12	0	Vervet monkey, baboon, bushpig, Sykes's monkey	I			Maize, rice, potatoes, legumes, mango, cassava, millet, sorghum, groundnuts, banana, fruits
Iwemba	10	1	Vervet monkey, baboon, bushpig, Sykes's monkey, cane rat	I		D	Maize, rice, cane sugar, legumes, mango, cassava, millet, banana
Ruaha	3	7	Vervet monkey, baboon, bushpig, elephant	I		D	Maize, rice, potatoes, banana
Lumango	10	0	Vervet monkey, baboon, bushpig	I	D		Maize, rice, potatoes, legumes, mango, cassava, millet, cane sugar, banana
Msowero	11	0	Vervet monkey, baboon, Sykes's monkey, bushpig,	I			Maize, rice, potatoes, legumes, cassava, millet, groundnuts, banana, beans
Vidunda	12	0	Vervet monkey, baboon, rabbit, bushpig, bushbuck, jackal	I		D	Maize, rice, tomatoes, cassava, millet, banana, beans
Chonwe	12	0	Vervet monkey, baboon, bushpig (squirrel)	I		D	Maize, rice, potatoes, tomato, cassava, millet, cabbage, banana, beans, coffee

Ab=abundant; Su=sufficient; Sc=scarce

The presence of wild animals remaining in the local area was confirmed at each of the villages surveyed. However those species remaining are the most common medium-sized mammals (see also Table 14).

Vervet monkey, baboon and bushpig figure prominently across the region as problem animals destroying crops. All of these species would be crop-raiding to a lesser degree if more natural forest and woodland remained in the area.

All those who reported problem animals said that they control them by chasing them with dogs, and by shouting at them; others said they just leave them.

Table 13. Use of wild animals for food or ritual

	Use wild animals for food or ritual?		Species named
	Yes	No	
Kifinga	1	11	Bushpig
Tundu	3	9	Bushpig
Iwemba	3	8	Dik-dik, bushpig
Ruaha	0	10	-
Lumango	1	9	Antelope
Msowero	2	9	Antelope, dik-dik
Vidunda	4	8	Bushpig, bushbuck, antelope, dik-dik
Chonwe	0	12	-

A very small proportion of respondents are still using wild animals for food or ritual, most likely reflecting local extirpations of most medium to large mammals through overexploitation (see also Table 14 and section 4.2).

Table 14. Wild animals which have disappeared in living memory

	Any disappeared wild animals?		Species named	How long ago?
	Yes	No		
Kifinga	9	3	Leopard, elephant, buffalo, lion, bushpig	All < 30 years
Tundu	10	2	Buffalo, bushbuck, cane rat, dik-dik, antelope, elephants	Years
Iwemba	8	3	Buffalo, bushbuck, cane rat, dik-dik, antelope, elephants, hippo, black and white colobus, lion, bushpig	Over 20 years
Ruaha	4	6	Velvet, baboon, bushbuck, elephant, reedbuck, hyrax, leopard, cane rat	Do not remember
Lumango	4	6	Bushbuck (3 yrs),dik-dik, buffalo, zebra, elephant, lion, antelope, cane rat	Years
Msowero	6	5	Buffalo, bushbuck, cane rat, dik-dik, genet, rabbit, elephant, rhino, black and white colobus, lion, bushpig	Over 30 years, since Illovo intervention
Vidunda	10	2	Buffalo, bushbuck, cane rat, Sykes's monkeys, dik-dik, Abbott's duiker, black and white colobus, bushpig	6 to many years
Chonwe	2	10	Buffalo (20yrs), bushpig, bushbuck, warthog, dik-dik	Years

The large list of medium to large mammals disappeared from the Uvidunda area reflects a widespread ecological collapse of the local faunal communities, precipitated by overexploitation of the local natural resources, in particular through tree cutting and overhunting. Among this list are IUCN red-listed vulnerable or endangered species: elephant, lion and the Tanzanian-endemic Abbott's duiker, which used to be present in Iyunji Forest.

Table 15. Tree planting activities.

	Do you plant trees?		Species named	Total trees planted	Tree planting			
	Yes	No			Where	Exotic/Invasive	Who provides seedlings	Who pays for it?
Kifinga	6	7	Coconut, orange, stafeli, teak, Senna siamea, eucalyptus	78	Around houses	Exotic	Gathering	Nobody
Tundu	11	1	Sambati, mlama, coconut, mango, Ficus, Bridelia, mgulu, mzazawi, red mahogany, mvule, jackfruit, lemon, avocado, Syzgium, neem, teak, Graveria, eucalyptus, mjoholo	2615	Around houses, on hill	Mostly exotic	Gathering and Illovo	Illovo
Iwemba	5	6	Senna, teak, ashok, Luciena, umbrella tree, jackfruit, stafeli, shelisheli, mango, eucalyptus, red mahogany, mvule	73	House, farm	Mostly exotic	Mama Mwakata-ja, gathering	Themselves
Ruaha	1	9	Eucalyptus	5	Farm	Exotic	Illovo	Illovo
Lumango	2	6	Lucena, Senna, Msegese, Mlama mgumu, mzazawi	55	Around houses, Farm	Exotic	Government, gathering	Nobody
Msowero	5	6	Neem, lucina, senna, red mahogany	67	Around houses, hills, Farm	Exotic	School, Mama Mwakataja	Themselves (Mwakataja)
Vidunda	12	0	Bridelia, Ficus, Graveria, Senna, eucalyptus, msabelele, Cidelea, teak, Khaya, stafeli, orange, Mkola	1355	Farms, Houses	Exotic & indigen-ous	Illovo, Private nursery	Illovo
Chonwe	12	0	Graveria, Syzgium, avocado, Cedelea, teak, msagati, myriad, Bridelia, Ficus, guava	771	Farms, around houses	Exotic & Indigen-ous	Illovo, school	Illovo

The most striking and ecologically significant results from these data concern the high proportion of exotic trees planted compared with indigenous species. In order to restore ecological balance in the area, it is important that a much higher proportion of indigenous species are planted, even in the vicinity of houses and especially out among the farms.

6. Findings from Stakeholder Consultations

The following Government/Parastatal Natural Resource Managers and Commercial Stakeholders were interviewed and/or consulted:

- Mr. William Mgao, Mikumi Division Forestry Officer
- Mr. John Massao, Iringa Regional Catchment Forests Officer (responsible for drafting Iyunji Forest PFM agreement and by-laws)
- Mr. Abraham Mdeme, Kilosa District Natural Resources Officer
- Mr. Edward Mkumbo, Kilosa District PFM Officer
- Mr. Ibrahim Namungu, Vidunda Ward Executive Officer
- Mrs. Marieta Paulo Maxe (M. Mazingira), Vidunda village
- Mr. Peter Steven Mkwanembo, Vidunda village
- Mr. Longini Msagaya, Vidunda village
- Mr. Adriani Chiligwa, Vidunda village
- Mr. Paul Mbanga, Ecologist, UMNP
- Antipoaching Department, UMNP
- Mr. Joseph Lyaruu, Acting Manager, TANESCO Kidatu Hydrogeneration Plant
- Mr. A. Sapi (Agriculture Admission Manager- K1), Illovo

Key findings are presented below.

6.1. History of Iyunji Forest

The Iyunji Forest was formerly known as the Chonwe Forest Reserve, but it has never before been officially gazetted as an area of any protective status. It is a natural forest that previously contained a great diversity of indigenous tree species. However there is a long history of logging of the forest for timber, and most examples of good timber species, e.g. *Khaya*, *Milicia excelsa* and mahogany have been removed from the forest. Much of the removal of timber occurred in the 1950s and 1960s, when the Illovo Sugar Company was constructing a large number of buildings in the Kilombero Valley.

No ecological monitoring of the forest has ever been undertaken.

In the past, management of the forest was in the hands of the local chiefs of Vidunda Ward. In 1997-8, the FBD mapped and beacons the forest (measuring its area at 392.05 hectares), and it was decided that the forest should belong to the three most local villages of Chonwe, Udunghu and Vidunda. In 2006, the process of formally drawing up the PFM agreement for this forest was initiated by the communities, Kilosa District Council, WWF-TZ, and the FBD. It is now planned that the forest will be a Village Forest Reserve, jointly managed by the three villages, but with overseeing roles for the Kilosa District Council and the FBD.

6.2. Tree nurseries

Vidunda Village Nursery

The village of Vidunda has its own nursery, established in the last two years, separate from the Illovo Nursery in the same village (see below). WWF facilitated the establishment of this nursery (as well as facilitating the establishment of a village school), and provided the village with seeds, equipment and training. No precise data were available for this nursery, though it was stated by villagers that the aim is to plant 40,000 trees per year from this nursery: to plant species such as Mzambarau (which is native to the area and provides edible fruits) and Msusu along the boundary of Iyunji forest, and even inside the forest; and to plant species such as teak (an exotic), Graveria and Sedaria in and around the village. However, villagers complained of a lack of polythene cups.

Iwemba Village Nursery

The “VI.KI.RU” nursery (for Vidunda, Kidodi, Ruembe) at Iwemba village is reported to have 7000 seedlings of species useful for timber, edible fruits and firewood.

6.3. Mikumi Division Forestry Department Activities

In addition, FBD officials of Mikumi Division are engaged in the following activities:

- Establishment of tree nurseries in collaboration with NGOs, institutions and private people
- Tree planting in schools and villages
- Revenue collection
- Environment and shifting cultivation education to villagers
- Establishment of village environmental committees
- Establishment and enforcement of environmental by-laws
- Dry season wildfire protection campaign

The Division reports that in total, with the support of WWF, they have established nurseries in a total of 11 schools within the two wards of the Vidunda Catchment Area (Kidodi and Vidunda).

They were also instrumental in persuading Illovo, following a meeting in 1997 to begin seriously assisting with the afforestation of the Uvidunda Mountains.

6.4. Illovo Sugar Company: Afforestation activities

The following information was obtained during an interview with Mr. A. Sapi, the Agriculture Admission Manager, K1, Illovo Sugar Company, Kilombero.

Kilombero Sugar Company Management made a decision to start tree planting section in 1989 following the advice of the District Forest Officer (DFO), with the following aims:

- To plant trees as fuel for the factories in sugar production
- To improve the environment in the company area and the surrounding villages
- To control soil erosion and prevent water pollution

According to the Company, from 1989-2006 over 1 million trees have been planted. However, the majority of these are exotic tree species including *Senna* sp (yellow cassia), teak, gum trees, red mahogany, African teak, and African blackwood.

Illovo's central nursery is at their lowland headquarters (K1). In 2002, because of unreliable transportation up into the Uvidunda Mountains from the Kilombero Valley, the company decided to establish a new tree nursery at Kikoboga sub-village, Vidunda village (fig. 7), to provide seedlings for Vidunda ward. This ward comprises the villages of Udunghu, Chonwe and Vidunda. The company claims that villagers of this ward showed a keen interest in tree planting.



Fig. 7. Vidunda (Illovo) Nursery

Seeds in the Illovo nursery at Vidunda are planted each July with the aim of planting 50,000 trees every year. So far a total of 238,328 trees have been planted in the ward:

2002/03	59,000
2003/04	69,478
2004/05	59,850
2005/06	50,000
Total	238,328

It is estimated that around two thirds of the seedlings at Vidunda were planted out and survived. The company does not target specific villages, rather it provides seedlings for all the surrounding villages, schools, Army, churches - and anyone else who wants them.

Apart from the surrounding villages, since 1989 more than 1,200,000 seedlings have been taken from the Illovo nurseries and planted by various institutions, as follows:

Kibaha (Coast region)	54,893
Kilosa District	178,600
Kilombero District	560,000
Churches	120,000
Schools	300,000

Seeds are bought from the Kihonda National Tree Seed Company and the type of tree planted most often depends on the wishes of villagers themselves. The tree nursery also contains ornamental plants and flowers, provided free of charge to villages.

The Company has no programme to educate people on tree planting, believing it is the village government's responsibility.

Problems facing Illovo with this programme are identified *by the company* as follows:

- Villagers surrounding the sugar company, especially those along the main road to Ifakara, are not very interested in tree planting
- The programme depends on motivation, and sometimes the demand is bigger than what can be provided
- People may delay to collect the seedlings from the nursery once ready
- Amount of polythene tubing available is insufficient

A further potentially serious problem with this scheme is that it may not be sustainable, because it is dependent on paid Illovo staff to make it work. Currently, all the staff tending the Illovo nursery in Vidunda (pictured in fig. 7 above) are responsible for the seedlings from when they arrive until they are distributed to villagers for planting, after which they return to Illovo Head Quarters in the Kilombero Valley. Thus the villagers have no experience and receive no training in correct planting practices, in caring for the saplings after they are planted out, nor in raising the seedlings in the nursery. It has been observed that, probably largely as a result of this inexperience and lack of training, many trees are dying after being planted out carelessly.

A training programme focused on improving villagers' afforestation practices is one way that WWF could make a positive difference to the ecological restoration of the Vidunda Catchment Area over the course of this project.

6.5. TANESCO: Tree planting and monitoring of catchment water levels

An interview was carried out with Mr. Joseph Lyaruu, the Acting Manager of the TANESCO Kidatu Hydro-electric Power Generation Plant. He explained that for the last 3-4 years the company has been independently planting trees on the sides of the Uvidunda Mountains, in the vicinity of the Kidatu Dam.

The Kidatu Dam has been operating since 1974, and has a total capacity of 127 cubic metres, allowing the generation of 200 megawatts of power continuously for 14 days. The catchment of the Dam, which is fed by the Great Ruaha River, consists of the following main sources:

- Release of water from Mtera Dam
- The Lukosi and Iyovi rivers (feeding into the Ruaha)
- The catchment forests of the Udzungwa and Uvidunda Mountains
- Rainfall

Inflow into the Dam is measured using a floating instrument with counterweight.

However, data on the tree planting scheme and water levels are only available by request from the TANESCO Head Office in Dar es Salaam, and *these data have been formally requested – but not yet received at the time of finalising this report.*

N.B. While consulting communities in Ruaha village on the issue of land use planning, it was claimed that TANESCO would like to manage a section of forest adjacent to Kidatu Dam, if the Village Government and Kilosa District Council would approve this (Z. Aloyce, pers. comm.). However in the course of our interview the Acting Manager of TANESCO Kidatu Hydrogeneration Plant made no reference to these plans, and this possibility should be explored further.

7. Afforestation Activities in the Vidunda Catchment Area: Summary and Recommendation

In general, it was observed during the course of this study that enthusiasm exists among community members in the Vidunda Catchment Area for tree planting. This appears to have increased since the floods of early 2006, which resulted in several mud slides on the Uvidunda Mountains, resulting in some houses being destroyed. At least some people definitely now perceive there to be a link between past deforestation of the hillsides and the current levels of erosion whenever severe rain hits the Uvidundas.

Overall, the numbers of seedlings being produced in the village nurseries and planted are impressive. However, there is still an overemphasis on planting of exotic tree species, which do not always serve well the ecological restoration of these heavily degraded hillsides. There is a need for greater education on the benefit of planting indigenous tree species, especially around the edge of Iyunji Forest in order to reforest the wider area for the sake of biodiversity and enhanced water catchment value.

It was reported and also observed that some trees are dying after being planted, either through being browsed by wild animals or livestock, or through lack of water. Although it was not possible to quantify this problem, there is clearly some unnecessary degree of negligence to adequately protect seedlings after they have been planted out, resulting in wasted time, money and effort.

There is therefore a pressing need in the Uvidundas for greater guidance and training on the correct practices required for effective afforestation in an Afromontane environment. This guidance is required both for the communities and other stakeholders planting out the trees, and for those stakeholders selecting and supplying the tree species in the first place. In addition, a comprehensive strategy for reforesting areas around the Iyunji Forest needs to be formulated. It may be necessary for this technical expertise to come from outside of the area, though of course the trainer(s) will have to work closely with the local Forest Officers, other local government officials, and land use planners in implementing this programme of planning, education and training.

8. Ecological Monitoring Plan for the Vidunda Catchment Area

8.1. Monitoring the Iyunji Forest: Importance and approach to the problem

“Monitoring should be a central and operational component of all conservation management activities, because if we cannot measure and assess what impact we are having on the conservation of biodiversity, we can never adapt our assumptions and management practices and thus improve the effectiveness of our conservation actions. Monitoring should not be considered a dispensable luxury, but an essential tool for adaptively managing conservation actions as conditions change and we learn from our efforts.”

A.Plumtre, Wildlife Conservation Society, 2001
Source: www.carpe.umd.edu

The Iyunji Forest, as the only remaining forest in these highlands, is critical to the ecology, biodiversity and water catchment value of the Vidunda Catchment Area, and it is here that long-term monitoring should be focused. Monitoring should be carried out by the communities, in order to ensure its sustainability in the long-term, beyond the duration of this project. Standard practices and methodologies for monitoring forests are now fairly well developed, and in order to effectively compare efforts and results across site, it is important to rigorously apply these standards.

However, it must first be decided what is to be monitored. The approach adopted here in developing an ecological monitoring plan is as follows. Firstly, gaps in ecological and biodiversity knowledge of the forest are identified, and a plan to fill these knowledge gaps is addressed as a matter of priority. Next, it is considered which characteristics of the forest can be effectively and sustainably monitored by the local communities. The final step is to propose a realistic framework, including the training of the communities in monitoring practices, to facilitate the implementation of the monitoring programme.

8.2. Filling Knowledge Gaps

Although some knowledge of the biodiversity of Iyunji Forest exists, as outlined in the preceding section of this report, it is clear from a review of this information that there are important gaps in this knowledge, and much to be learned.

Surveys of **plants** have been far from exhaustive, and considering the patterns of endemism across the neighbouring Udzungwa forests, it is plausible that further surveys may uncover new records of rare and potentially new and endemic species.

Birds have been surveyed, but for limited field periods, and not since 1997. On the one hand, there are probably species present which are yet to be recorded. On the other hand, the forest is heavily degraded, with the extent of primary forest much reduced over recent decades. In the East Usambaras in northern Tanzania, where similar habitat destruction has occurred, two forest-dependent bird species are believed to have been locally extirpated (Newmark, 2006), and it is feasible that similar processes may be occurring in Iyunji. This needs to be confirmed and documented through new ornithological surveys.

Medium- to large-sized mammals have not to my knowledge been surveyed in Iyunji, except through the use of informal, unstructured interviews in the 1990s (Moyer, Fjeldsa, *in litt.*) and during this study. However this limited information indicates that several local extirpations of mammals have occurred in recent decades, including the endangered Udzungwa red colobus, which is now restricted to the Udzungwas and Magombera Forest in the Kilombero Valley (Struhsaker *et al.*, 2004), and probably Abbott's duiker, which is now restricted to only four or five sites in Tanzania (Rovero *et al.*, *in press*). The status of the remaining mammals in this endangered forest, including the rare galago species present, should be assessed through field surveys as a matter of urgency. As well as using sound recording equipment for galago and hyrax surveying, it would be ideal to employ camera-traps for other nocturnal mammals. However, the high number of people currently entering the forest probably makes their deployment impractical.

Small mammals, amphibians, reptiles and invertebrates are poorly known from this important forest, and should be thoroughly surveyed - for the sake of documenting new and rare species so that plans to save them from extinction (whether local or complete) might be drawn up before they disappear.

Filling the Gaps: Biodiversity surveys

Surveys of all the above taxa should be carried out by experts in each of the target taxa, during the first year of this project, to enhance the existing baseline information on the biodiversity of Iyunji Forest. It should be ensured that well developed standardised methodologies for surveying each taxon in Tanzanian highland forests are employed on each survey. Efforts should also be made to ensure that interested members of the local communities of Vidunda, Chonwe and Udunghu are involved in these surveys, and some training on surveying methodologies and identification of important species is given.

8.3. Community-based monitoring programme

Considering the levels of degradation and disturbance to Iyunji Forest, one of the key priorities of this project must be to dramatically reduce utilisation of the forest, especially the cutting of poles, harvesting of wildlife and the effects of fire, in order to allow the forest's important faunal and floral species to recover. This priority has been recognised by all of the stakeholders of the project, as illustrated by the rapidity of the process of gazetting Iyunji Forest as a PFM. (The Management Plan and by-laws of the PFM are currently being drafted, following positive and productive village meetings).

To monitor the success of the PFM project, ***the key primary indicator should be the levels of disturbance in the forest.*** This is best monitored by trained local fieldworkers regularly walking a series of randomly placed disturbance transects through the forest, recording information on simple data sheets on numbers of poles cut, snares encountered, trees affected by fire, and other signs of disturbance. ***Other information can be simultaneously recorded, such as direct (visual or audio detection) or indirect (spoor) signs of certain faunal species, especially large mammals (monkeys, duikers, bushpig, carnivores).***

It is therefore recommended that disturbance transects be established in Iyunji Forest, and that 4 'Village Scouts' from each of the 3 villages surrounding the forest, i.e. Vidunda, Chonwe and Udunghu, be trained to collect systematic data along these transects once per month. The appropriate scouts could be identified by the VNRCs of each village, or better still, the new 'Village Conservation Committees' (VCCs) that are being established in each village in the area. These data should then be compiled into a monthly report for the Vidunda Ward Executive Officer and a WWF-TZ representative, for analysis of trends in forest utilisation and the ongoing success of the PFM project. If possible, scouts should be encouraged to attend further training in wildlife management and monitoring at one of Tanzania's wildlife colleges.

Summary of recommendations

- **Biodiversity surveys of flora and fauna by taxa experts**
- **Establishment of disturbance transects in Iyunji Forest**
- **Village Scouts from Vidunda, Chonwe, Udunghu trained to monitor transects monthly, reporting to VNRCs/VCCs and WWF-TZ representative**

9. Ecological Monitoring on the East side of the Udzungwa Mountains National Park

9.1. The effects of dead wood collection

Since 1991, much attention has been given by WWF and TANAPA (UMNP, CCS) to the villages which border Mwanihana Forest along the eastern side of the UMNP: Mkamba, Kidatu, Msolwa Ujamaa, Sanje, Msufini, Mkula, Sonjo, Katurukila, Sole, Mang'ula A, Mang'ula B, Mwaya, Mgudeni, Ichonde, Kisawasawa, Kanolo, Mkasu, Kiberege and Sagamaganga. These efforts have included the initiation of tree planting schemes; formation of women's groups; assistance in developing livelihoods alternative to utilisation of the forest such as dairy farming; and encouraging the reduction of firewood use through initiatives such as the use of alternative stoves. The history of these programmes is well covered in a series of reports available in the WWF-TZ Mang'ula Office.

Most recently, a study carried out in 2005 (Nyundo *et al.*, 2006) investigated the effects of deadwood collection, cutting of grass for thatching and the collection of medicinal plants from Mwanihana Forest on the biodiversity and ecology of the forest. The report also contains demographic information and other results of a socioeconomic study of these villages. It was concluded from the ecological study that the three activities mentioned are having an adverse effect on the ecology of the area, and will probably lead to local extinctions of invertebrate species if allowed to continue. There are other potential adverse knock-on effects, e.g. on the bird species which depend on these invertebrate populations. In a Stakeholders Workshop held in March 2006, it was decided to begin phasing out these activities, beginning with a reduction of the number of days allowed for firewood collection from two to one per week, a restriction to women only, and a banning of all other utilisation activities. It is still too early to be sure whether these changes, which came into force in June 2006, have significantly reduced the pressure on Mwanihana Forest (P. Mbanga, UMNP Ecologist, pers. comm.).

The authors of this recent research into the effects of deadwood collection highlighted the need to monitor the speed of recovery of the affected animal populations, and proposed that this could be done employing an adaptation of the methodology used in the original study:

“It is imperative that a monitoring programme specifically tailored to monitor the impact of dead wood collection, cutting of thatching grass and collection of medicinal plants should be put in place. The programme can use a simple protocol similar to the one used in the present study, with some modifications.”

(Nyundo *et al.*, 2006).

This long-term monitoring programme should be initiated, in collaboration with the UMNP Ecologist and the UEMC, building on the data already collected. If possible, the author of the original study could act as Technical Advisor in implementing this programme. As with the monitoring of Iyunji Forest, in order that this monitoring

programme be sustainable, Village Scouts should be selected by the VNRCs of the appropriate villages (those closest to the transects to be monitored), and trained to collect the data on a regular basis. Data should be delivered to and analysed by the Park Ecologist, with assistance from the TA.

In order to monitor other illegal activities such as cutting and snaring, the methodology of this monitoring could be simply adapted to include standard information usually recorded on disturbance transects. These data would have direct benefits for adaptive management of the UMNP, allowing the Ecologist to advise the Anti-poaching Warden on trends in illegal activities at different sites along the Eastern edge of the Park.

9.2. Primate and duiker monitoring

Over the last 7 years monitoring of primate and duiker relative abundance along 4 km-long transects along the Eastern edge of the Park has been carried out by professional research biologists and locally trained fieldworkers. The transects monitored start at the forest edge and head into the interior approximately perpendicular to the road, from close to the villages of Mwaya, Sonjo and Sanje (all monitored 1999-2006), and Msolwa (monitored 1999-2002). The methods employed and results to date are explained in detail in two scientific publications (Rovero *et al.*, 2006; Rovero & Marshall, 2004). In addition, there are several other ongoing studies of primates, duikers and other taxa in Mwanihana Forest (e.g. De Luca & Mpunga, 2005; Jones *et al.*, 2006; Jones & Rovero, in press; Rovero *et al.*, 2005; Struhsaker *et al.*, 2004).

It is important that these monitoring and research efforts continue on the endangered species of this extremely important forest, and that their results continue to be made widely available. It is especially important that the long-term monitoring of the 4-km transects continued – including the resumption of the Msolwa transect - as there now exist the beginnings of an extremely valuable long-term dataset, giving the data power to detect trends in animal populations (Newmark & Senzota, 2003).

A central aim of the new Udzungwa Ecological Monitoring Centre in Mang'ula (opening November 2006) is to increase local monitoring and research capacity, and it will therefore be appropriate and of benefit to involve the Centre and its staff in all of the monitoring recommendations given here.

Summary of recommendations

- **Village Scouts trained to monitor invertebrate and disturbance transects, building on deadwood study**
- **Continuation of long-term monitoring of primate and duiker transects**
- **In collaboration with UMNP Ecologist and Udzungwa Ecological Monitoring Centre**

10. Ecological Monitoring Matrix

Ecological monitoring activity	Location(s)	How often?	Responsibility	Baseline data source	Target for commencing
1. Disturbance / mammal transects	Iyunji Forest	Every month	Village governments of Vidunda, Chonwe, Udunghu WWF-TZ UEMC	None	End 2007
2. Invertebrate monitoring / disturbance transects	3-4 transects along East side of UMNP	Every month	Selected local village governments (e.g. Msolwa) UDSM UMNP Ecologist UEMC	Nyundo <i>et al.</i> , 2006; unpublished data	End 2007
3. Primate and duiker transects	Campsite 3; Sonjo; Sanje; Msolwa	Every month	UEMC	Rovero <i>et al.</i> , 2006; unpublished data	Ongoing

Activity 3 has been ongoing since 1999. For more detailed timeframe for implementing Activities 1 and 2, see section 11. Further ecological indicators as stated in the Project Proposal and Log Frame (including baseline data for each indicator) are given in Appendix 4.

11. Timeframe for Training of Local Staff in Ecological Monitoring Methods

Iyunji Forest disturbance transects		Invertebrate/disturbance monitoring on eastern side of UMNP ¹	
Milestone	Target date	Milestone	Target date
Selection of 4 long-term monitoring scouts from each village by the VNRCs of Vidunda, Chonwe and Udunghu villages	Dec 06	Selection of 2 long-term monitoring scouts from each village by the VNRCs of Kidatu, Msolwa, Mkamba, and Mang'ula villages	Feb 07
Establishment of disturbance transects and training in the field of scouts by monitoring expert	March 07	Establishment of invertebrate / disturbance transects and training in the field of scouts by monitoring expert	July-Dec 07
Scouts monitoring disturbance transects each month, submitting datasheets to VNRC and WWF Udzungwa Project Officer	April 07	Scouts monitoring pitfall traps and transects regularly, delivering specimens to UEMC for shipment to UDSM	End 2007
Scouts to attend Wildlife Management Training College to further monitoring education (in rotation)	June 07 -June 08		
Follow-up field visit and assessment of monitoring performance and quality of data by monitoring expert	Dec 07, Dec 08	Follow-up field visits and assessment of monitoring performance and quality of data by monitoring expert	June 08, Dec 08

¹ While the fieldwork protocols are simple and village scouts can be trained to regularly carry out this work, this monitoring programme will also be dependent on the ongoing specialist involvement of Dr. Nyundo of UDSM (for the identification of the invertebrates and data analysis); thus the suggested target dates are provisional.

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Appendix 1. Methodology and timeframe

The study was carried out from 25th September to 16th October 2006, and was completed via 4 logical stages:

STAGE 1: Data Collection	<p>A. Secondary data</p> <ul style="list-style-type: none"> i. Collect and review existing secondary literature: relevant reports and articles on ecology, biodiversity, land use, agroforestry, previous ecological research and monitoring activities ii. Acquire historical and current landsat images and digital topographical maps <p>B. Primary data</p> <p>Field visits and meetings to collect further information:</p> <ul style="list-style-type: none"> i. Illovo Sugar Company, Kilombero Valley – tree-planting schemes ii. District Wildlife Officer – hydrological information iii. TANESCO, Kidatu Dam – hydrological information including water and siltation trends and current levels iv. UMNP CCS Warden and Ecologist – afforestation activities; forest use activities; ecological monitoring v. Sample at least 8 villages with questionnaire on village land use, afforestation activities, perceived species loss
STAGE 2: Evaluation and Assessment	<ul style="list-style-type: none"> i. Using ArcGIS 8.1, assess and quantify trends in tree cover and land use. Map and quantify existing village forest reserves and other tree cover ii. Assess afforestation activities and achievements iii. Assess available secondary information and questionnaire results on species loss iv. Evaluate past and current ecological monitoring activities
STAGE 3: Develop Ecological Monitoring Plan	<ul style="list-style-type: none"> i. Identify key indicator species for simple community-based ecological monitoring programme ii. Develop training plan with timeframe iii. Identify important areas for further specialist biological surveys and ecological research iv. Develop research plan including methodology and key indicators, with timeframe
STAGE 4: Report Production	<ul style="list-style-type: none"> i. Write draft final report; present to WWF-TPO for comments ii. Complete and present final report to WWF, UMNP and Kilombero/Kilosa District representatives

Appendix 2. Questionnaire employed

The following questionnaire was employed in the villages of Chonwe, Iwemba, Kifunga, Lumango, Msowero, Ruaha, Tundu and Vidunda. Though presented in english here, all interviews were conducted in swahili.

Interview Form: Vidunda Catchment Area Preliminary Ecological Study

Page 1: Village Chairman / Member of VNRC

Village _____ Subvillage _____
 Occupation of villagers ___ Agriculture ___ Natural resource business ___ Pastoralist ___
 Village population:.....
 Number of households:
 Distance of village from forest if any.....
 Tribal composition:

Source of energy.....
 Source of house construction material.....

Water supply (no. of wells/kind/travel time
 etc)
 Is it seasonal or all year round?.....

Overall main problems and needs, related to:
 Water:.....
 Health:
 Education:
 Economic activities.....

Past/on-going development projects.....

Status of village land?.....

Any afforestation activity.....
 If yes how many trees are planted?.....Where?.....Exotic or indigenous?.....
 Which species?.....
 Where do you get the seedlings?.....
 Who pays for them?.....

Which are the major crops grown?
 1.....
 2.....
 3.....

Shifting cultivation?.....
 Are crops changed every year or not?
 Is any practice used to maintain / enrich soil fertility?
 Fertilisers manure intercropping agroforestry other:

Pages 2-3: Individual interviewees

Name.....Age.....

Sex:.....

Size of household.....

Are you a resident of this area?.....

For how long have you been here?.....years

Your occupation.....

Do you know any wild animals present?.....

If yes, what are the animals?.....

Where do you get firewood for cooking?.....

Where do you get water for cooking?.....

What is the villagers' perception of status and trend of some of the important natural resources coming from the natural forest?

Natural resource	Status of resource - Abundant - Sufficient - Scarce	Trend of resource - Increasing - Stable - Decreasing	Main reason for trend
Firewood			
Charcoal			
Timber			
Building materials			
Medicinal plants			
Grass for thatching			
Others:			

Which resources from the natural forest, miombo or grassland is important to your family?	Where can these resource be found today compared to 10 years ago? (Underline answer)
1.	Nearer the household / No change / Further away from the household
2.	Nearer the household / No change / Further away from the household
3.	Nearer the household / No change / Further away from the household

Why are they so important?.....

Which animals are considered a problem to your crops or livestock?	What is the status of these animals? (Underline answer)	What is the trend of these animals? (Underline answer)
1.	Abundant / Sufficient / Scarce	Increasing / Stable / Decreasing
2.	Abundant / Sufficient / Scarce	Increasing / Stable / Decreasing
3.	Abundant / Sufficient / Scarce	Increasing / Stable / Decreasing
4.	Abundant / Sufficient / Scarce	Increasing / Stable / Decreasing
5.	Abundant / Sufficient / Scarce	Increasing / Stable / Decreasing

Which crops do they destroy?.....

What do you do to control the problem animals?.....

Do you use any animal for food..... ritual.....etc

Which animal?.....

Which animals were once present but are no longer present?	When did they disappear (if possible year)
1.	
2.	
3.	
4.	
5.	

Do you plant any tree species?.....

If yes how many?.....where.....are they exotic or indigineous.....

Which species.....

Where do you get the seedlings?.....

Who pays for them?.....

NOTES:

Appendix 3. List of Secondary Information Sources

The following reports and papers are of particular relevance to the geographical area discussed in this report:

- Aloyce Z. (2005) *Workshop on making and disseminating of improved stoves for Kidatu, Sanje, Mang'ula and Kisawasawa Wards, 23rd-24th May 2005, Twiga Hotel, Mang'ula*. Final Report.
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Appendix 4. Project Baseline Indicators

Targets	Indicators	Baseline (October, 2006)
Goal: The integrity of the Udzungwa Mountains Catchment is conserved so that it continues to provide vital sustainable goods and services at local, national and international levels.		
Purpose: Reduced pressure and improved utilization of forests, water and land resources on the eastern side of the Udzungwa Mountains National Park by end of year 2008.	Degraded areas in Vidunda near Kidatu Dam regenerated by 20 % by 2008	100% of area is degraded (personal observations) (Quantitative data on afforestation activities pending from TANESCO HQ, Dar Es Salaam)
	Siltation in the Great Ruaha river reduced by 15% 2008	Data pending from TANESCO HQ, Dar Es Salaam
	Area with tree cover in the village land increased by at least 20% by 2008 compared to the baseline in 2006.	Tree cover: Vidunda 0.5 ha; Udunghu 0.2 ha; Chonwe 0.25 ha All other villages < 0.1 ha
Output 1: Degradation of Vidunda water catchment adjacent to the UMNP reduced through catchment forest protection, management and restoration.	Incidences of illegal logging in adjacent to the park reduced by at least 25% in year 2008	10 year average (1995-2005) of number of poachers arrested on E side of UMNP = 41.7 per year; total May - Oct 2006 = 25
	Village forest reserves established in 3 villages by 2008	None
	At least 10% of degraded forest restored by yr 2008	115.3 ha of forest lost since 1975
	At least 5 village buffer zone woodlots established by 2008	None
	An ecological monitoring plan developed by 2007.	Completed
	Local community representatives are trained on ecological monitoring by 2007	Training plan completed