

**AERIAL SURVEY OF THE AREA FROM NEGOMANA TO NUSSONA ON
THE EAST BANK OF THE LUGENDA RIVER, PROVINCES OF CABO
DELGADO & NIASSA, DONE ON BEHALF OF MADAL MOÇAMBIQUE**

**RECOMMENDATIONS FOR THE ESTABLISHMENT OF AN INTEGRATED
CONSERVATION DEVELOPMENT PROJECT (ICDP)**

by

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&

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* Cover picture: Satellite image of Lugenda/Rovuma area,
Mocambique, by MIKOTEK, CSIR, Pretoria, R.S.A.

Deep magenta shows high planaltic semi-deciduous miombo
Light green shows deciduous miombo and drier savanna grasslands
Dark green shows extent of burning in the winter 1991.

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1. INTRODUCTION:

The Niassa Game Reserve situated between the Rovuma and Lugenda Rivers in northern Moçambique is regarded as one of the finest wildlife and scenically spectacular areas in the country (Tello & Dutton 1979). Consequently, in 1979, the reserve was recommended for up-grading to National Park status (ibid.). The value of the area was confirmed again this year when the World Bank Global Environmental Facility (GEF) for Moçambique, with its emphasis on rehabilitating areas of greatest biodiversity, rated it highly for receiving funding (FSG report, 1992).

A similarly spectacular buffer zone, about 40kms wide, extending east of the confluence of the Rovuma River from Negomana to Mussoma (FIGURE 1) carries a diverse fauna in pristine habitats. This area has considerable potential for development as a Multiple Resource Use Area (MRUA), a management approach where the natural resources are used on a basis of long-term sustainability.

The proposed MRUA was surveyed by a team of technicians and advisers from the Direcção Nacional de Florestas e Fauna Bravia, Ministério da Agricultura during the period 15 and 16 August 1992.

As a consequence of the survey, this report proposes that the establishment of the Lugenda/Rovuma MRUA be considered as a pilot scheme for rural development, integrating local community involvement with resource use programmes. This Integrated Conservation Development Project (ICDP) (Wells & Brandon, 1992; Murphrey, 1992) would have the effect of linking the common objective of conserving biological diversity in protected areas with local social and economic development. With this approach local communities would not be passive recipients of benefits from resource use but active partners in all aspects of the project.

The Province of Cabo Delgado although rich in wildland resources does not have any demarcated conservation areas. The establishment of the proposed ICDP in conjunction with the proposed Quirimba Archipelago Marine National Park could form the foundation for a network of conservation areas in this Province.

2. DESCRIPTION OF THE AREA:

The most striking feature of the area is the Inselbergs which rise abruptly from an undulating woodland plain to about 300 meters above sea level (PHOTO 1). These smooth-sided rock formations, some reaching 1500m (eg. Mt. Meeula), were once volcanic gas escape cores which have become exposed by natural erosive processes over millions of years. Evidence of the earlier wetland genesis of the area is the presence of Karroo and post Karroo sediment soil deposits.



PHOTO 1: Inselbergs or volcanic cores in a pristine wilderness setting - favoured habitats for Klipspringer.

The spectacular scenery and pristine habitats of the buffer zone score at least 90% in terms of wilderness quality (Dutton & Dutton 1973). This rating scale considers such characteristics as visual impact, diversity, uniqueness, pristineness, condition of environment and animals, potential for human use.

Most of the soils derive from the existant basaltic geology and are therefore relatively new, unstable in structure and prone to serious sheet erosion. Sandy/clay soils are restricted to the immediate river floodplain terrace.

The two principle rivers, Rovuma and Lugenda, are perennial, intersected by numerous dry river courses (PHOTO 2). The Lugenda in the last 150km before its confluence with the Rovuma River is broad and sandy (PHOTO 3), but its character changes to rapids west of Mecula (PHOTO 4).



PHOTO 2: One of the many dry river courses draining into the Lugenda River

The climate is classified as Tropical Humid with a unimodal rainy season, December to April, averaging 972 mm (Mocimboa da Praia) (Atlas Geographica Vol.1, 1980). The area is influenced by southern Indian ocean monsoons which can bring unseasonal heavy rain. Orographic rain often develops on the isolated Inselbergs.

Even during the extreme drought conditions in August 1992, water emanating from the Inselberg's apron forests was well-distributed throughout the study area (PHOTO 5).



PHOTO 3: Lower section of the Lugenda River



PHOTO 4: Upper section of Lugenda River south of Mecula



PHOTO 5: Apron forest at the base of Inselbergs - important in sustaining flow of perennial rivers.

2.1 DEMOGRAPHY:

The bush war has resulted in settlement and cultivation particularly near the administrative centre at Mecula. Human population density for the region is given as 5-10/km² (Atlas Geographica Vol.1, 1980). However, the population is extremely light in the buffer zone, only two villages of about fifty inhabitants being encountered on the census transects (FIGURE 1.)

2.2 PRINCIPLE HABITATS (Tello & Dutton 1979):

The lower reaches of the Lugenda River are broad and sandy with intact riverine forest dominated by giant Khaya nyasica, Adina microcephala, Syzygium sp. and Trichilia emetica (PHOTO 3). The upper reaches of the river are characterized by rapids and many divided channels and islands with Rauvolfia caffra, and Pandanus livingstonianus (PHOTO 4). The deeper pools have hippopotami and crocodiles.

The contiguous aluvial floodplain resembles open parkland with towering Sterculia appendiculata, Kigellia pinnata, Lonchocarpus capassa and Acacia albida (principle food of the elephant) (PHOTO 6).

There is one major area of open grassland which was once part of the Lugenda River floodplain (PHOTO 7).

Deciduous (PHOTO 8) and semi-deciduous Brachystegia spp. woodland (miombo) (PHOTO 9) is the main habitat covering at least 80% of the study area (Wild & Fernandes, 1967). Associated with the miombo are dambos or internal drainage wetlands with tall grass cover (PHOTO 10).

Acacia nigrescens savanna (PHOTO 11) and dense thickets of Euphorbia and baobab Adansonia digitata (PHOTO 12) feature on the Karroo soil deposits.

Extensive thickets of bamboo Oxytenanthera abyssinica (PHOTO 13) occur on the red soil areas.

True Afromontane forest, comprising Erythroleum guineense, Ekebergia rupeliana, Pachystela brevipes and Mystroxydon aethiopicum, is confined to the upper south-east facing slopes of some of the larger massives and Inselbergs.

Apron forest patches, a feature of the Inselbergs (Tinley 1992), are the source for most of the river systems (PHOTO 5).



PHOTO 6: Aluvial floodplain with towering Sterculia appendiculata, Kigellia pinnata, Lonchocarpus capassa and Acacia albida.



PHOTO 7: Grassland invaded by Acacia spp.



PHOTO 8: Deciduous miombo



PHOTO 9: Semi-deciduous miombo in pre-spring leaf flush



PHOTO 10: Typical wetland (dambo) associated with Brachystegia spp. woodland (miombo) - ideal habitat for Lichtenstein's hartebeest



PHOTO 11: Acacia nigrescens savanna - ideal Kudu habitat



PHOTO 12: Dense thickets of Euphorbia and baobab
Adansonia digitata



PHOTO 13: Extensive thickets of bamboo
Oxytenanthera abyssinica

2.3 FIRES:

It was estimated that about 80% of the area had been burnt since the last wet season. From a habitat management point of view, mosaic pattern type burns are ideal. However the impression obtained during the survey was that the intensity and frequency of the fires in the study area were having negative impacts on the habitats. Evidence of sheet erosion was very noticeable in areas of intense burning. These fires, particularly in winter, affect honey production for which the area was once famous. However, it has been shown in Zambia that control of burning is linked to resource use success (Lewis et al 1990).

3. SURVEY METHOD:

The study area was demarkated on a 1:1 000 000 air map and marked off in parallel flight lines 8km apart (FIGURE 2). Flight direction was changed so that the major feature, the Rio Lugenda was approached at 90°.

A Cessna 210 aircraft, guided by a Pronav GPS, was flown at an altitude of 300 ft above the ground along the previously marked flight lines.

One crew, sitting next to the pilot, acted as navigator/photographer, three as observers, and one as the recorder. Distribution of wildlife, habitat types, people, settlements, fires, foot paths and agriculture was localized by co-ordinates registered on the GPS and then recorded on the map. Whenever necessary the aircraft broke off from the flight track to obtain an accurate count, returning to the flight path according to the last GPS fix.

Lateral visibility was estimated at 0,5km on either side of the aircraft, except for the riverine survey of 128km where the visual field focussed on approximately 0,5km yielding a total area of 640km². Animals encountered on the riverine flight path were considered separately from those encountered in the sample area. Calculated as a percentage of the entire buffer zone, the area covered by the 1 km wide census lines including the river survey, amounted to 15% (TABLE 1). Estimating the riverine habitat to be 5km wide, a 10% sample of wildlife was recorded (TABLE 2). The total estimate for the entire study area is shown in TABLE 3.

4. WILDLIFE RESOURCE:

4.1 MAMMALS:

A total of 65 mammal species has previously been recorded for the study area (Smithers & Tello 1976) (APPENDIX A).

Predators such as lion, leopard, hyena, jackal, though not seen, are all represented in the MRUA (APPENDIX A).

The area probably carries some of the last black rhino in Mozambique, although none were encountered during the present survey. Other rare species in the area are Johnson's Impala and Wildebeest and a geographic variation of waterbuck.

4.1.1 WILDLIFE POPULATION ESTIMATES:
(refer METHODOLOGY and FIGURES 3 & 4):-

TABLE 1: Survey estimate of wildlife populations in the study area (7 064km²), excluding the riverine flight.

Species	Numbers observed	Numbers estimated
Elephant <u>Loxodonto africana</u>	70	500
Buffalo <u>Syncerus caffra</u>	0	-
Hippopotami <u>Hippopotamus amphibius</u>	0	-
Eland <u>Taurotragus oryx</u>	6	43
Sable <u>Hippotragus niger</u>	29	207
Zebra <u>Equus burchelli</u>	16	114
Wildebeest <u>Connochaetes taurinus</u>	36	257
Waterbuck <u>Kobus ellipsiprymnus</u> var <u>kondensis</u>	0	-
Impala <u>Aepyceros melampus</u> var <u>johnstoni</u>	22	157
Bushbuck <u>Tragelaphus scriptus</u>	0	-
Grey duiker <u>Sylvicapra grimmia</u>	21	150
Red duiker <u>Cephalophus natalensis</u>	1	7
Reedbuck <u>Redunca arundinum</u>	1	7
Kudu <u>Tragelaphus strepsiceros</u>	3	21
Warthog <u>Phacochoerus aethiopicus</u>	14	100
Yellow baboon <u>Papio cynocephalus</u>	1 troop	7 troops

TABLE 2: Survey estimate of wildlife populations along the Lugenda River transect (64km²).

Species	Numbers observed	Numbers estimated
Elephant <u>Loxodonto africana</u>	28	280
Buffalo <u>Syncerus caffra</u>	60	600
Hippopotami <u>Hippopotamus amphibius</u>	15	50
Eland <u>Taurotragus oryx</u>	0	-
Sable <u>Hippotragus niger</u>	13	130
Zebra <u>Equus burchelli</u>	0	-
Wildebeest <u>Connochaetes taurinus</u>	0	-
Waterbuck <u>Kobus ellipsiprymnus</u> var <u>kondensis</u>	27	270
Impala <u>Aepyceros melampus</u> var <u>johnstoni</u>	168	1680
Bushbuck <u>Tragelaphus scriptus</u>	1	10
Grey duiker <u>Sylvicapra grimmia</u>	0	-
Red duiker <u>Cephalophus natalensis</u>	1	10
Reedbuck <u>Redunca arundinum</u>	0	-
Kudu <u>Tragelaphus strepsiceros</u>	4	40
Warthog <u>Phacochoerus aethiopicus</u>	1	10
Yellow baboon <u>Papio cynocephalus</u>	2 troops	20 troops
Crocodile <u>Crocodilus niloticus</u>		numerous

FIGURE 3

LEGEND

- Elephant
- Buffalo
- ◇ Wildebeest
- △ Zebra
- ▽ Hippotamus
- ▷ Warthog
- ◁ Red duiker
- Baboon troop
- Crocodile

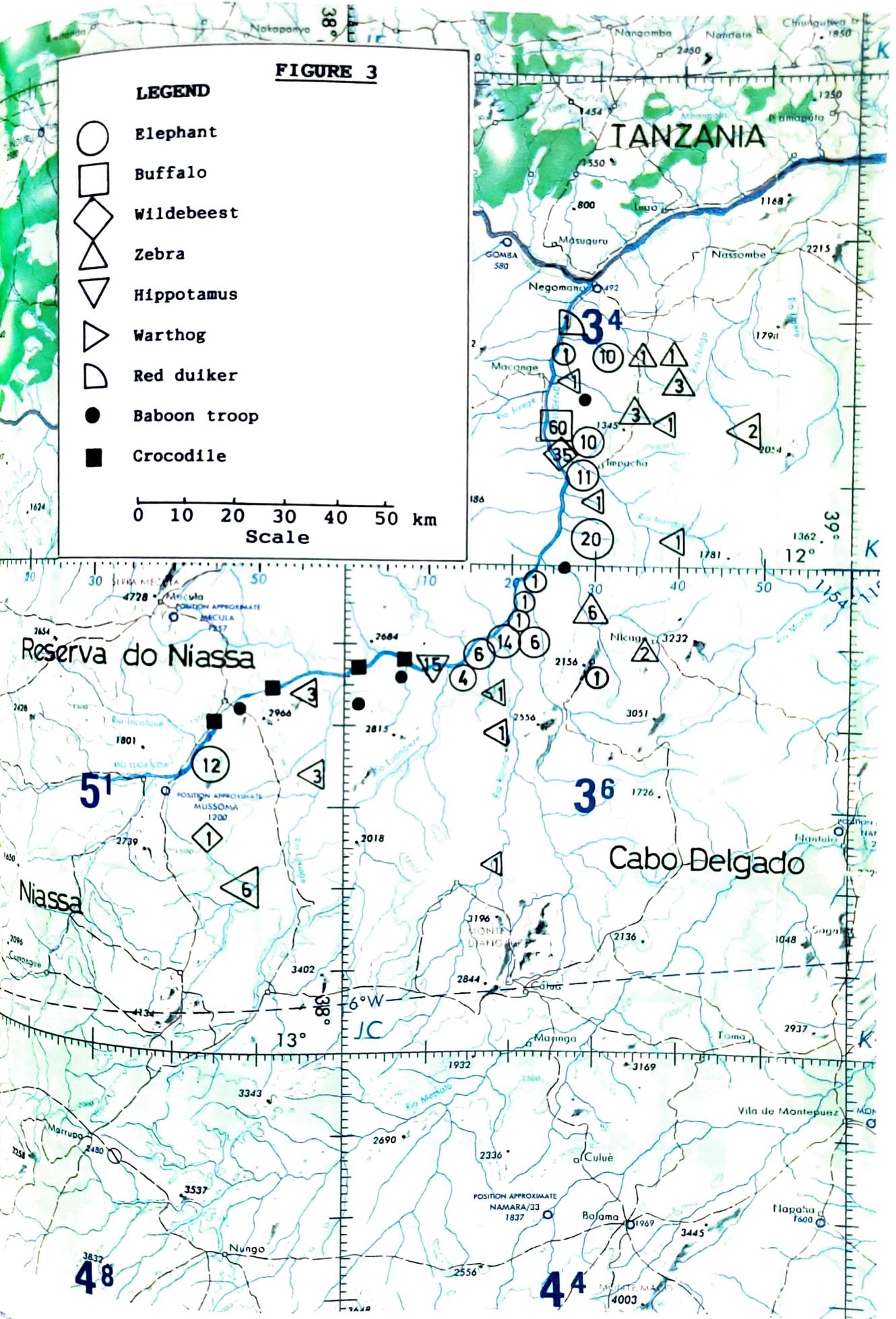
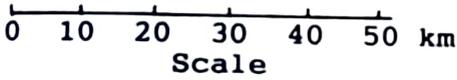


FIGURE 4

LEGEND

- △ Sable
- ◇ Eland
- ▽ Kudu
- ◐ Bushbuck
- ◑ Waterbuck
- Impala
- Grey duiker

0 10 20 30 40 50 km
Scale

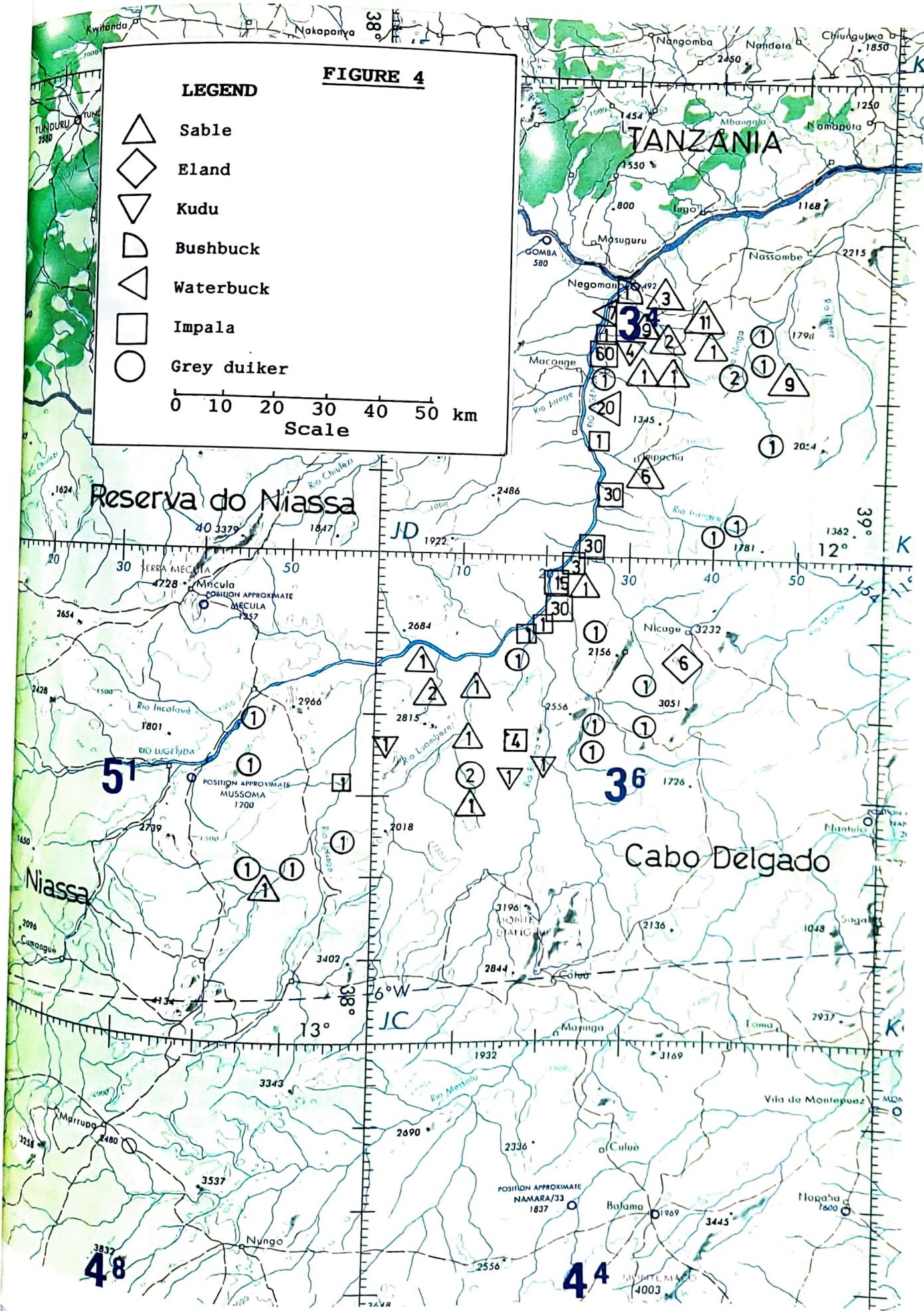


TABLE 3: Survey estimate of the total population of wildlife in the entire study area (7 128km²).
 * Under estimate because of type of habits in which they occur.

Species	Numbers observed	Numbers estimated
Elephant <u>Loxodonta africana</u>	98	780
Buffalo <u>Syncerus caffra</u>	60	600
Hippopotami <u>Hippopotamus amphibius</u>	15	50 *
Eland <u>Taurotragus oryx</u>	6	43
Sable <u>Hippotragus niger</u>	42	337
Zebra <u>Equus burchelli</u>	16	114
Wilbebest <u>Connochaetes taurinus</u>	36	257
Waterbuck <u>Kobus ellipsiprymnus</u> var <u>kondensis</u>	27	270
Impala <u>Aepyceros melampus</u> var <u>johnstoni</u>	190	1837
Bushbuck <u>Tragelaphus scriptus</u>	1	10 *
Grey duiker <u>Sylvicapra grimmia</u>	21	150
Red duiker <u>Cephalophus natalensis</u>	2	17 *
Reedbuck <u>Redunca arundinum</u>	1	7
Kudu <u>Tragelaphus strepsiceros</u>	7	61
Warthog <u>Phacochoerus aethiopicus</u>	15	110
Yellow baboon <u>Papio cynocephalus</u>	3 troops	27 troops
Crocodile <u>Crocodilus niloticus</u>		numerous

4.2 BIRDS:

Although no serious work has been done on bird recording, at least 371 species are likely to occur in the region (Mackworth-Praid & Grant 1957).

The Inselbergs offer ideal sites for raptors judging by the frequency of faecal whitened nesting ledges. Bateleur eagles, now regarded as a threatened species in most of its southern African range due to pesticide poisoning, were frequently encountered during the survey flight. Several white-backed vultures were also seen nesting in tall trees near the Lugenda river.

4.3 FISH:

Recorded species are those which are commercialized from catches taken on the Rovuma and Lugenda rivers (Tello & Dutton 1979) (APPENDIX B). The study area has the advantage of having river systems rich in fish which provide the local people with additional sources of protein. Apart from their protein value, some of the species recorded are highly suitable for sport fishing. No doubt there are other lesser known species to be recorded in these and the smaller river systems and pans.

5. MANAGEMENT OPTIONS:

It is evident from the results of the aerial survey that the Lugenda/Rovuma area has great potential for development as a Multiple Resource Use Area (MRUA) where resources such as water, timber, wildlife, and the various habitats can be used on a sustainable basis. There are two broad options for managing the area:-

1. A preservationist approach requiring fences, fines and militaristic defence strategy which in the end alienates and heightens conflict in rural communities (Machlis & Tichnell, 1985).

OR

2. The Integrated Conservation Development Project (ICDP) approach which involves participation by the rural people who live closest to the natural resources.

The latter option empowers the local people so that they are able to mobilize their own capacities in managing the resources, making decisions, and controlling the activities that affect their lives (Cernea, 1985). This form of resource use, orientated to supporting socio-economic activities, can at the same time achieve conservation objectives (IUCN 1985). Furthermore, ICDPs act as a catalyst to stimulate self-reliance amongst the poor and underprivileged (Wells & Brandon 1992). This form of resource use should be guided by a bottom up approach, involving the local communities in all stages of the project development. The emphasis is on building slowly on a small scale, with flexible and adaptive management strategies, in other words, learning by doing (Wells & Brandon, 1992).

The World Bank GEF Biodiversity programme, which rates the Niassa Game Reserve high in the process of rehabilitation in Moçambique, also recognizes the importance of linking wildland management to rural development projects whereby the local people participate in the planning and management of resources. This approach can stop encroachment on valuable habitats such as riverine forest and water catchment areas (Ledec & Goodland, 1988).

The cause of the indiscriminate destruction of the wildlife resource throughout Africa has been traced back to when colonial Governments undermined the customary laws and authority of traditional African leaders by removing the natural resources from their ownership (Lewis et al, 1990). The subsequent transfer of resource ownership to centralized governments led to what is known as the tragedy of the commons where a resource belongs to no one in particular so everyone exploits it (Murphree, 1991).

In the Lupande area in Zambia, for example, where the State claimed ownership of wildlife resources, people no longer had a stake in preserving wildlife and poaching escalated. However, with the recent implementation of an ICDP, poaching levels decreased 90% in three years, wildlife increased, while local residents benefitted from access to game and wildlife related employment. The Government now divides revenue from licence fees with the community, whereas in the past the total amount was paid to the treasury. In one year \$US230 000 was returned to the local community for development projects. The Government's portion pays for park management and the tourist board (Lewis et al, 1990).

For ICDPs to be successful it is imperative that a percentage of the revenue derived from resource utilization goes directly to the local community (Child, 1991). It has also been found that prospects for success are limited without active Government participation in establishing policy and legislation supportive of ICDPs (Wells & Brandon, 1992). For example, the Parks and Wildlife Act, in Zimbabwe, which gives land owners a high level of control and use, if not ownership, of wildlife on their land, has led to the growth of lucrative wildlife utilization programmes (Bell, 1987). A similar emphasis on Government involvement is reflected in Tinley's FAO report to the Mozambique Government in which he recommends a complete revision of the Fauna legislation and regulations to accommodate restoring ownership and management of natural resources to the hereditary rural chiefs, as well as developing a partnership between rural owners, Government and concessionaires (Tinley, 1991).

A major problem is that the full market value of the natural resources has not been fully realized by rural communities and Governments. Consequently wastage occurs, and the products are sold or exchanged far below their actual value. For example, illegal poaching for ivory in Malawi brought in US\$10/kg while the world price was US\$50/kg (Bell, 1987). In the Marromeu delta area Sable antelope, presently valued at \$US8 000 (Brian Courtney in correspondence, 1992), are hunted for meat rations at 50 US cents/kg. Likewise valuable hardwood species such as Mbila, Pangapanga and Chanfute are burnt for cultivation because the local communities do not realize their long-term value.

If the Lugenda/Rovuma Multiple Resource-Use Area (MRUA) can be developed as an ICDP it will form a pilot project whereby the resident communities, the Government and a private concessionaire enter into a joint venture to manage the area. Its success can influence its neighbours to establish similar ICDPs and guide policy at national level.

5.1 CONSUMPTIVE FORMS OF RESOURCE USE:

* Low volume high priced Safari hunting

The monetary value of wildlife species can be judged from the current prices that are being paid for trophy animals in Zimbabwe and South Africa:-

	\$US	2 000
Buffalo	\$US	4 000
Sable	\$US	1 300
Eland	\$US	1 300
Waterbuck	\$US	490
Reedbuck		

For breeding animals the prices are even higher (Courtney, in correspondence, 1992)

* Limited cropping operations

It might be necessary in future to crop wildlife populations responding to conservation management strategies. Meat as a by-product of cropping and Safari hunting can be commercialized locally at subsidized prices, providing another direct benefit to the local people.

* Wildlife capture and translocation

Once the wildlife responds to conservation measures, capture-and-translocation, like cropping, is another lucrative option.

* Game fishing in the Lugenda

There are at least three species of freshwater fish suitable for sport fishing, the best known being the tiger fish Hydrocynus vittatus.

5.2 NON-CONSUMPTIVE USE INCLUDING ECOTOURISM:

* Wilderness trails on foot or in locally constructed dug-out canoes

The value of wilderness areas where tourists are not encumbered by unnecessary artifacts is gaining popularity worldwide. It is apparent that wilderness trails conducted in pristine environments provide a psychologically healing experience for people (Ramsay 1989). The fact that it is difficult to get a booking on well-known wilderness trails in South Africa is an indicator of people's desire to get away from materialistic urban environments. The study area has all the qualities of wilderness (PHOTO 14) and in no way should this be diminished by inappropriate forms of development.



PHOTO 14: Area endowed with outstanding wilderness quality

* Biological tours such as visits by ornithologists and botanists

Biological tours, guided by experienced naturalists for which local people are well qualified to act as guides, offer visitors an ecologically orientated form of bush experience. They also offer a participatory involvement whereby visitors contribute to the formulation of bird and botanical checklists, etc.

* Environmental education and extension

An important aspect of a MRUA is to provide in situ environmental education and extension at local and national level eg. schools, students, tourists, visitors, government officials, etc.

5.3 PROJECT'S PHYSICAL DESIGN:

The whole ICDP should be guided by a management strategy which emphasizes minimal impact on the natural environment. This is particularly critical during the early stages of project development. Special care should be taken regarding:-

- location of rustic camp and the use of only local building materials in its construction.
- location of landing strip
- establishment of roads which avoid following ecotones (i.e. edge between two distinct habitats) especially along the banks of the major river systems.
- use of solar power for all energy needs
- establishment of proper facilities for staff including a small school, clinic and maize meal grinder.

6. PROPOSED ICDP CONCESSION AREA:

The area proposed as a Multiple Resource Use Area, based upon the concept of an Integrated Conservation Development Project covers approximately 9 750km². The limits are shown in FIGURE 1, following, wherever possible, natural features such as Inselbergs and watersheds. This might appear to be a large tract of land, but to be viable it has to have sound ecological boundaries to accommodate migration patterns during the various seasons and to protect important riverine habitats and water catchments.

7. CONCLUSIONS:

The buffer zone around the proposed Parque Nacional do Niassa has a varied and rich resource base upon which to develop an Integrated Conservation Development Project.

The Government's programme of rural development will be seeking forms of land use that will support populations once peace allows refugees to return to their traditional areas.

The area in question has limited potential for extensive forms of agriculture due to various ecological constraints. Alluvial soils are confined to a narrow strip along the Lugenda River. The presence of Glossina spp. (mosca tse tse) precludes the farming of domestic livestock. The wildlife resource, however, if used on a sustainable basis can be source of red meat protein for local consumption and support a multiple use safari operation with considerable foreign currency earning potential.

The Government is therefore confronted with two scenarios:

1. Slash-and-burn agriculture which will destroy the riverine habitats of the Lugenda River. Uncontrolled destruction of the wildlife resource that is valuable as a red meat protein source and for multiple use safari operations

OR

2. Ensure that the area is managed for long term benefits for the local people and the nation as a whole. The local people, as custodians and beneficiaries of the wildlife and timber resource, will make sure that their socio-economic base is not destroyed by outsiders.

8. RECOMMENDATIONS:

1. MADAL make an urgent application to the Direcção Provincial de Florestas e Fauna Bravia, Cabo Delgado, through the Direcção Nacional de Florestas e Fauna Bravia for a long-term lease of the area described in this report.
2. MADAL work in close collaboration with the Direcção Nacional Desenvolvimento Rural (DNDR)/Planiamento Físico in formulating a policy which will establish a partnership with the rural communities presently living in the proposed MRUA. Local communities must be part of the management decision-making process and share revenue derived from the various safari operations, consumptive and non-consumptive.
3. MADAL demonstrate its commitment to training nationals by involving a counterpart from DNFFB as from the inception of the project.
4. MADAL, once it has established its bona fides in the MRUA, apply for the tourism management rights of the proposed Parque Nacional do Niassa in partnership with the Departamento da Fauna Bravia.

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11. APPENDICES:

APPENDIX A: MAMMALS (Smithers & Tello 1976, Tello & Dutton 1979)
* not confirmed

Chequered elephant shrew Rhynchocyon cirnei
Fourtoed elephant shrew Petrodromus tetradactylus
Lesser red musk shrew Crocidura hirta
Fruit bat Epomophorus sp.
Little freetailed bat Tadarida pumila
T. sp.
Schreiber's longfingered bat Miniopterus schreibersi
Banana bat Pipistrellus nanus
Yellow house bat Scotophilus nigrita
Bushbaby Galago crassicaudatus
Nightape G. senegalensis
Yellow baboon Papio cynocephalus
Samango monkey Cercopithecus alboquularis
Vervet monkey C. pygerynthrus
Pangolin Manis temmincki
Spotted hyaena Crocuta crocuta
Cheetah Acinonyx jabatus
Leopard Panthera pardus
Lion P. leo
Serval Felis serval
Wildcat F. libica
Hunting dog Lycaon pictus
Sidestriped jackal Canis adustus
Clawless otter Aonyx capensis
Honey badger Mellivora capensis
Tree civet Nandinia binotata
Civet Viverra civetta
Largespotted genet Genetta tigrina
Slender mongoose Herpestes sanguineus
Water mongoose Atilax paludinosus
Banded mongoose Mungos mungo
Antbear Orycteropus afer
Elephant Loxodonta africana
Tree hyrax Dendrohyrax arboreus
Yellowspotted dassie Heterohyrax brucei
Burchell's zebra Equus burchelli
Black rhino Diceros bicornis
Bushpig Potamochoerus porcus
Warthog P. aethiopicus
Hippopotamus Hippopotamus amphibius
Klipspringer Oreotragus oreotragus
Grey duiker Sylvicapra grimmia
Red duiker Cephalophus natalensis
Suni Neotragus moschatus *
Oribi Ourebia ourebi *
Steenbuck Raphicerus campestris *
Kudu Tragelaphus strepsiceros
Bushbuck Tragelaphus scriptus
Johnston's impala Aepyceros melampus johnstoni
Reedbuck Redunca arundinum
Waterbuck Kobus ellipsiprymnus kondensis

Sable Hippotragus niger
Eland Taurotragus oryx
Buffalo Syncerus caffer
Johnston's wildebeest Connochaetes taurinus johnstoni
Lichtenstein's hartebeest Alcelaphus lichtensteini
Scrub hare Lepus saxatilis
Flying squirrel Anomalurus derbianus
Porcupine Hystrix africae australis
Rock dormouse Graphiurus platyops
Red squirrel Paraxerus palliatus
Cane rat Thryonomys swinderianus
Spiny mouse Acomys spinosissimus

APPENDIX B: FISH (Commercialized species)

Mormyrops deliciosus
Hydrocynus vittatus
Alestes sp.
Barbus spp.
Labeo rubropunctatus
L. spp.
Clarius spp.
Tilapia mossambica
T. melanopleura
Eutropius depressirostris
Synodontis sp.
Anquilla sp.
Megalops cybrinoides

**AERIAL SURVEY OF THE AREA FROM NEGOMANA TO MUSSOMA ON
THE EAST BANK OF THE LUGENDA RIVER, PROVINCES OF CABO
DELGADO & NIASA, DONE ON BEHALF OF MADAL MOÇAMBIQUE**



**RECOMMENDATIONS FOR THE ESTABLISHMENT OF AN INTEGRATED
CONSERVATION DEVELOPMENT PROJECT (ICDP)**

