

Perspective on a five year management strategy for the Mkomazi Game Reserve 2002-2006

*In collaboration with the Project Manager, Mkomazi Game Reserve - July 2001
For the Wildlife Division, Government of Tanzania*

Acknowledgements:

The management plan for the Mkomazi Game Reserve was written up by Dr Malte Sommerlatte (Wildlife Consultant) in July, 2001. The basis for the management plan was the two field trips which he did to the area in May and June, 2001 as well as the preliminary management plan of the Mkomazi game reserve and the publications and reports which exist concerning the ecology of the reserve.

I would like to particularly thank Tony and Lucy Fitzjohn of the Wildlife Preservation Trust Fund (WPTF) for their hospitality during those field trips and the time that they spent going through the initial draft of the management plan. I would also like to thank the Mkomazi Project Manager (PM), Mr Lusasi for his inputs into the management plan and the close cooperation which he extended to me while writing up the plan.

The management plan for the Mkomazi Game Reserve was a collaborative effort between the author, the PM and the Field Director of the WPTF. In that way it is very much their plan and therefore it should have every chance of being implemented.

Executive summary

The management plan for the Mkomazi Game Reserve is for a period of 5 years, starting in 2002 and ending in 2006. The management plan consists of 5 sections, which deal with; the general ecology of the reserve, management goals and objectives, management programmes and activities, revenue and cost schedule and activity schedule. The management plan was written by Dr. Malte Sommerlatte (Wildlife Consultant) in July, 2001 with the cooperation of the Project Manager of the reserve and the field director of the Wildlife Preservation Trust Fund (Tanzania). It is based on a preliminary draft done by the WD as well as numerous publications and reports. It is proposed that the management plan be reviewed in the third year of operation and updated towards the end of the fifth year by an independent team of consultants. The management plan is the basis for the conservation and management of the Mkomazi Game Reserve and is a valuable document for future funding by either the WD and/or donors.

Tanzania's wildlife policy is enshrined by the Arusha Manifesto (1961) and enlarged on by such documents as the Wildlife Policy (1998) and the Wildlife Act (1974 and 1978) which state that Protected Areas have been established to protect species and habitat diversity and to generate income, employment and other benefits to the Government and to neighbouring communities. In order to do this, the Government will seek inputs from the private sector as well as suitable wildlife NGO's. The basis for these activities is a management plan whereby a substantial amount of tourism income will be ploughed back into the management of the Protected Area and the surrounding buffer zones.

The climate of Mkomazi Game Reserve is semi-arid which has a bimodal rainfall of 500mm

p.a. Altitude ranges from 230-800 m.a.s.l but rising to 1,356 m.a.s.l in the west. Mean annual temperatures are 23.1° C. The reserve lies in the southern tip of the Somalia-Masai Regional Centre of Endemism (Acacia-Commiphora savanna) and it is enriched by the Afromontane Centre of Endemism (Eastern Arc Mountains) and the Zanzibar-Inhambane Regional Mosaic (East African Coast). It is part of the greater Tsavo ecosystem which covers 40,000 km². The Mkomazi Game Reserve was gazetted in 1951 and the present size is 3,276 km². With regionalisation in the early seventies, it was split up into the Mkomazi and Uмба Game Reserves. During this period, the reserves became rundown and poaching increased dramatically. Livestock was allowed to enter the reserve. In 1988 the Reserves were amalgamated and the WD took over the management once more. Livestock grazing rights were terminated and this decision was later upheld by the Court of Appeal in 1998. Several reports carried out during that time, recommended that the reserve remain a wildlife sanctuary as the area had no agricultural value.

The Mkomazi Game Reserve has no permanent water except the Uмба River on its eastern boundary. There are several dams which have been built and which together with natural pans provide water during the dry season. The reserve consists of metamorphic rocks, alluvial deposits on Precambrian rocks and some volcanic deposits. Soils vary from red to reddish brown on hill tops, grey brown colluvial soils on hill slopes and black clays in valley bottoms and "mbugas". The vegetation varies according to the soils and topography and is characterised by forests on mountain tops, woodland on hill slopes and a mixture of woodland, savanna woodland and grassland on lower slopes and valleys. There are a few areas with riparian forest and woodland along watercourses and seepage lines. The first game counts were conducted in 1968 and have been continued from time to time ever since. Wildlife numbers have declined somewhat, especially elephants which saw a reduction from 3000 to 346 by 1996. Wildlife biomass is on average 570 kg/km² during the dry season and increasing to 1,925 kg/km² during the wet season. The Mkomazi Game Reserve is a wet season dispersal area with wildlife moving into the reserve from Tsavo National Park in Kenya and moving out again during the dry season as the pans and dams dry up. The reserve is adjacent to the Tsavo National Park (20,000 km²) in the north and in the south is buffered by numerous Forest Reserves situated on the North and South Pare Mountains.

The game reserve lies in Lushoto and Same Districts which have a human population density varying between 39-124 persons/km². There are approximately 48,000 people living directly next to the reserve. Most of the inhabitants practice agriculture (maize, rice etc.) as well as livestock keeping. There are some 87,000 head of livestock in the two Districts.

The Mkomazi Game Reserve is being supported by the WPTF, a wildlife trust, which has financed the rehabilitation of the reserve infrastructure and dams, started a breeding programme for black rhinos and wild dogs and introduced a community outreach programme. The Trust has a 10 year Memorandum of Understanding with the WD which is renewable. The Trust HQ's is a Kisima where there is a workshop, staff housing, vehicle park and aircraft. Up to 2001, the Trust had spent \$ 2.58 mil. on capital expenditure with running costs equalling approximately \$ 194,000 p.a.

The Mkomazi Game Reserve has some exceptional values which the reserve management is set to protect and manage. These are: high species and habitat diversity, part of the Tsavo

ecosystem, conservation of a fragile ecosystem, important area for Palearctic migrants, scenic beauty and wilderness character and threatened and rare species. The reserve is threatened by poaching, uncontrolled fires, livestock encroachment, lack of tourism and income from tourism, run down infrastructure and facilities and insufficient staffing and administration. The management goal is therefore to conserve the biodiversity of the reserve for the enjoyment of visitors and for the benefit of neighbouring communities. The management objectives are: 1) manage and develop habitats, 2) develop tourism, 3) involve communities, 4) improve law enforcement, 5) improve infrastructure and communications, 6) establish management oriented research and monitoring, 7) reintroduce extinct species and 8) increase income. The management plan is based on several zones each with its specific objectives and development plans. There are five zones within the reserve. These are: a) administrative zone (0.06%), b) conservation zone (35%), c) wilderness zone (59%), d) tourism/lodge development zone (0.05%), e) restoration zone (less than 5%).

The chapter on management programmes and activities is the key to the management plan and describes in detail management objectives, current activities, problems and future activities to overcome these problems. The development of tourism is a major objective of the current management plan. At the moment, there are no well developed tourism facilities in the reserve and as a consequence few tourists come to visit the reserve. The road network until recently was poor and because of poaching and bush encroachment little wildlife could be seen. The WD was also ambivalent to tourism development and investors as it preferred safari hunting to non-consumptive tourism. In future, the reserve management will concentrate on attracting investors to build a lodge, rehabilitate the present research site at Ibaya and to promote a wide range of tourist activities which would include the rhino sanctuary when it is deemed feasible. A series of special camp sites have been proposed and it is recommended that guides be trained to take visitors out on foot safaris, bird walks and night drives.

It is realised that much more needs to be done to involve communities living around the reserve in order for them to benefit from the reserve. In 1993 a community outreach programme was initiated by the Trust which has done some substantial work. This work now needs to be coordinated and put on a sound financial footing with long term objectives and a detailed work programme. The problems facing the communities (and indirectly the game reserve) are unsustainable land use practices, few benefits accruing from the reserve and a lack of agricultural and grazing land. The reserve can contribute to improving the living standards of the neighbouring communities as well as increasing public awareness of the reserve and sustainable land use practices by establishing a problem animal unit, employing villagers when building reserve infrastructure, providing limited access to reserve resources, conducting community projects and establishing a forum to discuss mutual problems and issues.

The objective for wildlife and habitat management is to maintain species and habitat diversity. At the moment, the game reserve is facing serious ecological problems brought about by poaching, bush encroachment and uncontrolled fires which have led to the extermination of some species. This is not only the case for wildlife but also for plants. In order to reverse this trend, the management plan envisages a series of activities which will stabilize the situation and then with time will reintroduce extinct or rare species. This

involves the reintroduction of species, control of wild fires, provision of water, control of soil erosion, protection of montane forests and bush control.

Research and ecological monitoring is an important aspect of management so that management practices can be evaluated and if necessary altered. The objective for the research and ecological monitoring programme is therefore to establish a monitoring programme which can be done by the reserve personnel and to establish a management oriented research programme which will help the PM in managing the reserve and its wildlife. A substantial amount of research has been conducted in the reserve but there are still some gaps which need to be filled for management purposes. These include basic information on wildlife and vegetation trends, status of rare and endangered species and the production of maps useful for management. It is proposed that a series of bench mark sites be established in key habitats in order to monitor the development and trend in vegetation and habitats. There is also the need to develop a system of road counts which can be done by the reserve personnel on a regular basis in order to back up the aerial counts done by the TWCM. A review of all research publications needs to be undertaken to include the results in the management plan and to assess gaps in our knowledge of the reserve. If the reserve is to allow limited use of some of its resources then simple but effective survey techniques have to be developed to assess resources and prescribe offtake quotas. In the case of lodge development, Environmental Impact Assessment's need to be done according to the policy laid down by the WD.

The development of the reserve's infrastructure is an important part of the management plan. The objective is to develop the reserve's infrastructure for tourism and the proper administration of the reserve. At the moment the development of the Mkomazi Game Reserve is constrained by a lack of roads, radio communications and airstrips which are essential for administrative purposes and anti-poaching efforts. There are not enough buildings and game posts to accommodate personnel. The management plan lists the infrastructure currently existing in the reserve and that which is required for future management and administrative purposes. The chapter concerning transport and field equipment deals with the procurement of vehicles, maintenance of vehicles and the necessary field equipment for game scouts while on patrol. The present situation is characterised by an inadequate number of vehicles and plant many of which are run down and require rehabilitation. It is proposed that the reserve has a workshop situated at Zange to service and maintain vehicles in good working condition. A list of workshop equipment has been made. Administration and law enforcement is an important chapter which analyses the current situation and recommends improvements. The Mkomazi Game Reserve currently has a workforce of 20 of whom 15 are game scouts stationed throughout the reserve. The present number of game scouts is considered too low for effective law enforcement (1 game scout/193 km) and it is recommended that the number be increased to provide a cover of 1 game scout/100 km. The number of wildlife officers should also be increased to include two sector managers, one community and monitoring officer as well as a person in charge of works. Together with the recruitment of new personnel, a training programme needs to be formulated which adequately prepares the new recruits for their jobs. In future, game scouts will be deployed around key dams and waterholes as well as in other areas of game concentration. Game scout patrols will be backed up by an informer network and where possible by a reward incentive. Fines should be reviewed and increased

to reflect the value of the poached animal as well as the seriousness of the offence.

The present status of the Mkomazi Game Reserve qualifies it for category 1V of the IUCN list of Protected Area. The management plan proposes to improve the status of the MGR by integrating it with the surrounding Protected Areas according to current international conservation agreements. This should increase tourism, improve management and provide a bigger area for conservation. It is recommended that the Mkomazi Game Reserve be made into a Biosphere Reserve and incorporated under the UNESCO Man and Biosphere Programme. Secondly, it is recommended that the Mkomazi Game Reserve be made into a Transfrontier Protected Area together with Tsavo West National Park in Kenya. This would create one of the biggest Protected Areas in East Africa.

The chapter on revenue and costs provides a detailed account of income from tourism. At the moment income from tourism is very low as there are no lodges and the only facilities are a few camping sites. The strategy should be to attract investors who are prepared to build a variety of accommodation and provide a range of tourist activities based on a wilderness experience. These would include, lodge concessions, banda rentals, camping sites and a Wildlife Field Centre providing courses in wildlife ecology. In order to stimulate investments, the WD needs to provide financial incentives to investors in the way of long leases, reduced concession fees and other attractive offers. If this is done then it is envisaged that the current annual income of \$ 1,014 will increase to \$ 106,682 over a period of five years. In the fifth year, it is estimated that the lodge would generate \$ 46,500, the Wildlife Field Centre \$ 16,760 and general entrance fees a further \$ 30,947. Capital expenditure has been calculated at \$ 1.03 mil. over the five year period or \$ 206,711 p.a. Of that amount, 34.5% would be spent on buildings and game scout outposts, 25.1% on vehicles and transport and 16.5% on new dams and boreholes. The running costs, amount to \$ 119,491 p.a. of which 29.3% are for vehicle maintenance, 14.9% for building maintenance and 14.1% for plant maintenance. The current budget is \$ 44,444 p.a. and therefore does not cover the proposed running costs. If a retention scheme were to be initiated then a substantial part of the proposed running costs would be covered. It is therefore recommended that a retention scheme be introduced for the Mkomazi Game Reserve whereby the development of tourism facilities and infrastructure be of utmost importance.

The management plan finishes with a chapter on implementation which provides a list of activities for each management programme, a set of indicators and designates the person (s) responsible for implementation. This implementation programme will then form the basis for future evaluations.

1. Introduction to the Management Plan

This 5 year management plan for the Mkomazi Game Reserve (MGR) starts in 2002 and ends in 2006. The management plan consists of several management objectives and a set of activities which are required to achieve those objectives. It is primarily a guide for the Project Manager (PM) whose responsibility it is to implement the management programmes and allocate scarce resources and budgets according to management priorities. The other reason for having a management plan is to establish a general line of direction and to

provide consistency whenever a PM is transferred. This is important as one of the reasons for the decline of the MGR has been a lack of direction and consensus in how to manage and develop the reserve.

The management plan comes at a particularly important time for the MGR which in the past has suffered from rampant poaching, encroachment by pastoralists and severe financial constraints but which is now receiving more attention and funding from the Wildlife Division (WD) and the Wildlife Preservation Trust Fund (Tanzania). The WPTF has been established to assist in the rehabilitation of the reserve and one of the objectives of the current management plan is to integrate the work of the Trust into the general management activities of the MGR.

Equally important is that the production of a realistic management plan is now often the basis for donor support and without it aid agencies are often reluctant to become involved in the conservation and management of Protected Areas. While it is one of the objectives of the management plan to encourage tourism and generate more income from tourism, the availability of capital funds to develop the reserve will still be a problem for many years to come. The management plan therefore solicits support from the WPTF as well as other wildlife NGO's and aid agencies for some of the proposed developments.

While this management plan provides the framework for the long-term management of the MGR, it should remain flexible and open to new ideas and changes in management perspectives. This means that the management plan requires regular reviews, updating and corrections.

1.1 Structure

The management plan has been divided into 5 sections:

Part 1 describes the general ecology of the MGR, the wildlife policies pertaining to wildlife conservation and Protected Area management and the activities of the WPTF.

Part 2 explains the goals and objectives of the management plan as well as the zoning of the MGR for management purposes.

Part 3 sets out all the management programmes and activities. This is the backbone of the management plan because it describes how to manage the reserve during the next 5 years.

Part 4 is the revenue and costs schedule which explains how income will be generated from tourism and what capital costs are required to develop the reserve.

Part 5 is the activity schedules which summarises who will do what and when.

1.2 Development of the Management Plan

A draft management plan for the MGR was completed around 1997 (no date given) but it has never been officially approved by the Minister for Natural Resources and Tourism or by the Director of Wildlife. The draft was incomplete and several important sections were left out such as a chapter on revenue and costs, a chapter on management programmes and a

chapter on the activities of the WPTF who is after all a major player in the rehabilitation of the MGR. These omissions made the management plan unacceptable and impracticable. The draft management plan also advocated the reintroduction of safari hunting which is inconsistent with the present management objectives of the reserve (which is to develop non-consumptive tourism) as well as the recommendations made by Parliament and the WD itself.

Therefore, at a meeting in the MGR in 2001 of the current PM, the field director of the WPTF and the present Director of the WD, it was decided that the draft management plan be rewritten and that a new management plan be submitted to the WD at the earliest date possible.

1.3 Monitoring and Evaluation

The implementation of the management programmes should be evaluated after 3 years and then at the end of the 5th year when the life of the old management plan has come to an end. The evaluation should be done by a team consisting of an independent wildlife consultant, a member of the WD Planning Unit, the MGR Project Manager and the Field Director of the Trust.

1.4 Updating

The management plan should be updated at regular 5 yearly intervals. At the end of the fifth year, management objectives need to be reassessed and if necessary revised and a new set of management programmes and budgets incorporated into the next 5 year management plan.

2. Wildlife Policies

Tanzania's wildlife policy was initially stated in the Arusha Manifesto of 1961 but since then such documents as The Wildlife Policy of Tanzania (1998) have enlarged on it incorporating new ideas and trends .

2.1 Arusha Manifesto

In 1961 President Mwalimu Julius Nyerere gave a speech in Arusha on wildlife conservation which is generally regarded as the cornerstone for wildlife conservation in Tanzania. It states:

The survival of our wildlife is a matter of grave concern to all of us in Africa. These wild creatures amid the wild places they inhabit are not only important as a source of wonder and inspiration but an integral part of our natural resources and our future livelihood and well being.

In accepting the trusteeship of our wildlife we solemnly declare that we will do everything in our power to make sure that our children's grand-children will be able to enjoy this rich and precious inheritance.

The conservation of wildlife and wild places calls for specialist knowledge, trained manpower, and money, and we look to other nations to co-operate with us in this important task-the success or failure of which not only affects the continent of Africa but the rest of the

world as well.

2.2 The Wildlife Policy of Tanzania

The Wildlife Policy of Tanzania has four main objectives:

- 1) To promote the establishment of Protected Areas for the conservation of biodiversity and to create Wildlife Management Areas in buffer zones for the benefit of local communities.
- 2) To promote the sustainable use of wildlife and to provide revenue to the Government and income, employment and food to Tanzanians.
- 3) To manage and develop Protected Areas and to retain sufficient revenue from wildlife for management and development purposes.
- 4) To encourage the involvement of donors and other conservation agencies and to cooperate with other countries through international conventions and transfrontier conservation projects.

In order to achieve the objectives of the wildlife policy, a number of strategies have been developed. These are too numerous to elaborate here but the ones most pertinent to the present management of the Mkomazi Game Reserve are:

- ✘ Conservation areas in Tanzania have been set aside for their biological diversity and should include representative samples of important habitats and species.
- ✘ Management objectives will therefore concentrate on protecting rare and endemic species and their habitats as well as maintaining biological diversity. If necessary habitats will be rehabilitated and species will be re-introduced which once occurred in the P.A.
- ✘ The enforcement of wildlife laws and regulations is still seen as the most important part of any successful wildlife conservation effort. It can be achieved by having well trained and equipped game scouts backed up in some instances by village wildlife scouts and a network of informers.
- ✘ The conservation and development of Protected Areas will be based on a management plan. The P.A.'s areas will be zoned with each zone having different management objectives. The management plan will have specific objectives and consist of a series of management programmes and activities in order to achieve those objectives.
- ✘ Local communities will be involved in the conservation and management of wildlife in buffer zones and specially designated Wildlife Management Areas. In these areas responsibility for wildlife management will be devolved to the village level so that villagers and especially women can benefit from the use of their resources. In some cases, communities will be allowed to make use of resources within Game Reserves providing use is well managed and sustainable and does not conflict with the primary aims of the reserve.
- ✘ Wildlife human conflicts are inevitable in wildlife areas and in areas surrounding Protected Areas. There will be no compensation for wildlife damage but instead the policy encourages the involvement of the community in wildlife management and the sharing of benefits from wildlife.
- ✘ In order to develop Protected Areas, the private sector will be encouraged to invest in the wildlife sector and to participate in the development of community based conservation programmes. The Government will provide appropriate concession periods, favourable working conditions and set aside viable wildlife areas for development.

- ✘ In order to conserve Protected Areas on a long-term basis and to put them on a sound financial basis, the policy advocates the retention of sufficient revenue from wildlife for development and management purposes.
- ✘ The role of management oriented wildlife research and monitoring is recognised by the policy paper which is regarded as essential for wildlife management purposes and the protection of habitats and species.
- ✘ Wildlife conservation awareness and publicity is seen as an important ingredient of future conservation efforts.
- ✘ The policy paper welcomes the support of wildlife NGO's, donor agencies and any other organisations concerned with wildlife conservation and the protection of rare and endangered species.
- ✘ The policy paper encourages the improved management of P.A.'s and upgrading of P.A.'s through such devices as Memorandums of Understanding (MoU's), establishment of Transfrontier Protected Areas and by joint agreements between various agencies gazetting or upgrading P.A.'s.
- ✘ Mining activities are prohibited in Game Reserves in order to preserve biological diversity.

2.3 National Tourism Policy

The National Tourism Policy (1991) takes cognisance of the role played by Game Reserves in furthering safari hunting and game viewing tourism in Tanzania. It identifies the need to develop local tourism and to improve publicity of the lesser known wildlife areas in Tanzania. Emphasis is placed on developing a wide range of tourist areas and attractions which apart from wildlife viewing will include areas of cultural, marine and scenic value.

2.4 Tanzanian Wildlife Laws

The primary legislation for the establishment and management of Game Reserves is the Wildlife Conservation Act, No.12 of 1974 as amended in 1978. The majority of Game Reserves have now been upgraded to "National Project" status and some of them have introduced a retention scheme whereby up to 50% of income generated by the reserve is retained for management purposes.

3. Area description

3.1 Biogeographical Significance

The Mkomazi Game Reserve contains elements of two important biogeographic zones which explains its species richness and makes the area of such great scientific and conservation value. Firstly, the Mkomazi Game Reserve lies in the southern tip of the Somalia-Masai Regional Centre of Endemism an area of some 1.87 million km² extending from north-eastern Somalia to north-eastern Tanzania and including much of Kenya, south-eastern Sudan, parts of Ethiopia and north-eastern Uganda. This area is characterised by Acacia-Commiphora savannas which are adapted to semi-arid conditions.

Secondly, the local flora and fauna of the MGR is enriched by the presence of the Afromontane Centre of Endemism which is characterised by isolated areas of equatorial highlands which support a highly characteristic flora and fauna and contain many endemic species. The Mkomazi Game Reserve is located on the edge of the North and South Pare Mountains and the Usambara Mountains which rise respectively to 2,111 m. (Kindoroko),

2,463 m. (Shangema) and 2,304 m. (Chambolo) above sea level. These mountains are part of the Eastern Arc Mountains and because of their great age and relative isolation have a great number of endemic animal and plant species.

Thirdly, the eastern boundary of the MGR is on the edge of the Zanzibar-Inhambane Regional Mosaic which stretches along the East African coast from southern Somalia to southern Mozambique. The eastern part of the reserve is only 43 km from the Indian Ocean.

3.2 Historical Background

The Mkomazi Game Reserve was gazetted in 1951 under Government Notice No.265/275. The MGR was established following the degazettement of the Ruvu Game Reserve which had been established as early as 1904 by the German administration. With time, the Ruvu Game Reserve became severely degraded and overgrazed by livestock and therefore it was no longer considered a viable wildlife sanctuary. The wildlife authorities at the time then decided to substitute the Ruvu Game Reserve by creating the MGR north of the Pare Mountains. After two years of negotiations, the local authorities agreed to the establishment of the MGR provided that the Ruvu Game Reserve was degazetted. In 1951, David Anstey became the first warden of the MGR. After conducting extensive safaris, Anstey excised approximately 89 square miles from the reserve in 1957 (around Maore) so that people living outside the reserve would have enough land for salt production and grazing. In 1965, an area around Igoma was excised from the reserve to provide more land for agriculture and grazing and at the same time some land around the Pangaro Valley was added to the reserve which is an important dry season grazing area for wildlife (for further details see Anstey's: A Brief History of Mkomazi Game Reserve).

At the time of regionalisation in the early 1970's the reserve which lies in two districts was divided into: a) the Mkomazi Game Reserve (Same District) and b) the Uмба Game Reserve (in Lushoto District). The management of these two reserves then came under the jurisdiction of the respective regional authorities. Regionalisation did not have the desired positive effect on wildlife conservation, instead the two game reserves became quickly rundown because of poor management and a lack of financial support. This coincided with the upsurge of elephant poaching in the 1970's when 95% of the Mkomazi's elephants were obliterated. Another factor which upset the ecological balance of the reserve was the incursion of Losogonoi Maasai from the Ruvu area into the land north of the Usambara Mountains and east of the Pare Mountains which upset the traditional grazing system of the people living in those areas. The encroachment by livestock owners and the destruction of grazing land was so severe that the Government in 1988 took over the two game reserves and amalgamated them into the Mkomazi/Uмба Game Reserve for better management purposes.

For many years it has been debated whether or not the wildlife and aesthetic values of the MGR warrants preservation. Other human interests in the reserve have been high and it has been frequently suggested that the agricultural value may exceed the conservation value of the reserve. This suggestion has been refuted by Anderson (1967) after he conducted an intensive study of the soils and the agricultural potential of the reserve. On the basis of his study, he considered the MGR unsuitable for agriculture and recommended that it should remain under wildlife and that it should keep its present boundaries. Furthermore, he

recommended that all livestock be removed from the reserve. On the basis of this recommendation, the Director of Wildlife in 1987 terminated all grazing permits issued to people in the past and ordered their removal. This action was unsuccessfully appealed against by a group of Maasai with The Court of Appeal (1998) stating amongst other things that " no individual person or group of persons can have rights in land which are superior to the public title". Therefore the rights of the MGR are above those of private persons or groups of people.

3.3 Location, Boundaries and Size

The MGR has an area of 3,276 km² although some of the boundaries remain uncertain. It lies along the Kenya-Tanzania border in the north eastern part of Tanzania and within the districts of Same and Lushoto. The MGR forms a common border with the adjacent Tsavo National Park (21,000 km²) in Kenya and is part of the greater Tsavo ecosystem estimated to cover about 40,000 km². The MGR is situated between latitude 3° 47' to 4° 33' south and longitude 37° 45' to 38° 45' east. It has a maximum width of 41 km and a maximum length of 130 km (Fig. 1).

3.4 Climate

The climate of the MGR is characterised as semi-arid with evapo-transpiration rates being much higher than rainfall for most of the year. This has a severe effect on the water available to plants and animals alike. Rainfall, therefore has a critical influence on the distribution of wildlife and vegetation communities alike. For example, plant productivity and hence animal biomass has been closely correlated to rainfall in semi-arid areas. Temperature on the other hand does not play such a significant role in Mkomazi.

The MGR has a bimodal rainfall distribution with the long rains occurring between February and May (with a peak in March) and the short rains from late September through December (with a peak in October). The mean annual rainfall for MGR is 500 mm. There is a rainfall gradient running west to east in the reserve with the western part receiving the highest amount of rain between 550-650 mm, the central part of the reserve 400-500 mm and the eastern part around 400-450 mm. This together with the generally shallower soils (and less water holding capacity), greater air movement and less cloud cover make the central and eastern part much more arid than the western section. These ecological differences have a profound effect on animal and plant productivity, distribution and density patterns.

Fig. 1 The Mkomazi Game Reserve

Some 48% of the rains fall in the long rains between March and May and 27% in the short rains between October and November. The remaining amount usually occurs between January and February. The rains falling in the long rainy season is less variable than the rains falling in the short rains. By July, the savanna grassland dry out quickly as the winds increase and the humidity drops. A period of intense desiccation follows throughout August and September when ambient temperature rises, daily sunshine hours are at their longest and the wind velocity reaches its maximum. This is the time when uncontrolled fires sweep through the reserve and many areas are completely burnt. By mid October, the Mkomazi Game Reserve experiences its first showers and thunderstorms and it is then that the soils are most susceptible to erosion because of the lack of vegetation cover.

The mean annual temperature is 23.1° C with a mean annual minimum of 17.5° C and maximum of 29.0° C. July and August are the coolest month and the hottest are December through February. The mean monthly range is 17° C. Mean annual temperatures change with altitude approximately 6° C for every 1000 m. This means that the western section of the reserve because of its higher elevation has lower annual temperatures and is therefore cooler than the eastern part of the reserve.

3.5 Physiography, Geology and Soils

The Mkomazi Game Reserve stretches in a north west to south east direction along the Kenya Tanzania border. In the north west, the reserve rises up to a series of hills and ridges which at Maji Kununua (1,620 m.) and Kinondo (1,594 m.) form the highest part of the reserve. These hills are an outlier of the North Pare Mountains. The area covered by these hills and ridges cover approximately 130 km² or about 4% of the reserve. From the north west the reserve slopes gently towards the south east and the Umba plains at an altitude of 230 m. The centre of the reserve is broken up by a series of isolated hills and ridges between 800 and 1,356 m. which in total cover approximately 200 km² or about 6% of the reserve. The slightly sloping plains of the reserve are dissected at regular intervals by drainage lines ("mbugas") which give these otherwise featureless plains a distinctive characteristic. These drainage ways are directed south eastwards and are covered by grasslands or tree grasslands which during the rainy season become waterlogged. The "mbugas" are important grazing areas for wildlife but they are being invaded at the moment by Acacia sps. which is detrimental to the grazers using the grasslands.

The reserve is drained in the north west towards Lake Jipe while the rest of the watershed flows towards the Umba river in the south east and the rather ill defined Kisiwani river in the south west which dries up during the dry season. The MGR has no sources of permanent water other than the Umba river which forms the south eastern border of the reserve for some 38 km. However several dams have been constructed in the past at Dindira, Ngurunga and Kavateta (being rehabilitated at the moment) which hold water throughout the year. There are also a series of pans which are strung along the border with Tsavo and which hold water for part of the dry season.

The MGR is surrounded by a series of mountain peaks and ridges which give it some of the most dramatic topography found anywhere in East Africa. Only 15 km south of the reserve, the Usambara Mountains abruptly rise out of the plains to a height of nearly 2,500 m. while Africa's highest mountain Mt. Kilimanjaro which is only 98 km away from the northern boundary culminates in a snow capped peak at 5,896 m.

The geology of the reserve is characterised by metamorphic rock which make up the North Pare Mountains and its outliers and which were created some 2000-3000 million years ago during the Middle Precambrian period (Usagaran System or Basement Complex) under high pressure and temperatures. The metamorphic rock types are granulites and gneisses These rocks are composed for the most part of hornblende, pyroxene, quartz-feldspar and calsilicate. During the Middle Precambrian period a considerable amount of faulting took place mainly along a north east axis but also along a north west direction. The Pangaro valley is an example of such faulting. The undulating plains of the MGR are underlain by Precambrian rocks which are covered superficially by alluvial deposits and in some areas by

calcerous tuffaceous materials which are volcanic deposits from Kilimanjaro. Where areas have been extensively eroded or where sedimentary rocks have been thrust up, ancient gneisses, schists and crystalline limestones come to the surface.

The soils of the MGR are classified according to their colour and location along a catena. The main soil types occurring in the MGR are:

1. Red and Reddish Brown Soils on Hilltops and Upper Slopes

For the most part, Mkomazi Game Reserve is made up of medium textured red and reddish brown soils (aridisols) ranging from heavy sandy clays to lighter textured sandy and silty loams. They occur on hilltops and the upper slopes of hills and are freely draining with considerable surface run off. They are rather poor because of leaching and have a low percentage of organic matter. They are predominantly red or reddish brown in colour because of their iron oxide content. In less freely drained areas the iron oxide becomes unstable and is lost. In particularly dry areas as in the eastern part of the reserve, the red colouring stands out even more. These soils are shallow on the ridge tops and upper slopes but become deeper and finer textured with more organic matter lower down. The clay content of the soils on the upper slopes of the hills are rather low because of eluviation but as one proceeds down the slope the clay content increases. With the increase in clay content and of organic matter, soils become darker in colour at the lower end of the upper slope. These soils are covered mainly by Commiphora bushland and bushed grassland vegetation types which are well adapted to poor and freely drained soils. Grass cover is poor with numerous bare patches and as the soils are easily disturbed by overgrazing any marked reduction in plant cover leads to severe soil erosion.

2. Reddish Brown and Gray Brown Colluvial Soils on Middle to Lower Slopes

Proceeding down the upper slope of the catena, soils become darker in colour and are generally of a reddish brown and gray brown colour. These colluvial soils lie between the red eluvials of the upper slope and the heavy black clays of the valley bottoms. This transitional band of soils might be of considerable extent or it might be quite negligible in width. The soils in this intermediate area consist of fairly heavy textured loams and clay loams. The soils are less freely drained than the soils of the upper slopes and their clay and organic matter content is usually higher as well. Water seepage and run off from the upper slopes means that they support a slightly better grown stand of bushland trees. But because they are still on hill slopes, the soils are sufficiently free draining to escape waterlogging during the rainy season. Although these soils cover only a small area of the reserve, they are of particular importance because of the "edge-effect" of high mineral reserves and favourable structural and textural characteristics. Although these soils generally occur on middle slopes, they can at times cover ridges and slopes of hills where they blend with red soils. In some areas, these soils are underlain by an extremely deep light gray alluvium which has a high content of sodium salts causing flocculation and soil erosion. The vegetation types to be found on these soils are mainly Commiphora bushland and bushed grassland, Acacia-Commiphora bushland and bushed grassland.

3. Heavy Black Clays of the Valley Bottoms and Drainageways

These soils are commonly known as "black cotton soils" (vertisols) and occur in drainage ways and valley bottoms. They have a high clay content which expands when wet making

the soils impassable for vehicles and wildlife alike. When the soils dry out they crack and become rock hard. During the rainy season, the soils swell and become compact and nearly impermeable so that water runs off to form areas of standing water. Although these soils retain much water, the amount of water that is available to plants is limited because of the retention capacity of the montmorillonitic clays. Even though these soils are usually quite rich in mineral elements as well as organic matter they are unsuitable for many tree species and plants because of their salinity and alkalinity. These soils are characterised by a variety of grass species depending on their salinity and water holding capacities. .

4. Ferruginous Soils or Ferrisols on Hilltops

These deep red soils occur on mountain slopes with high rainfall and relatively low temperatures. The vegetation has been greatly altered through periodic burning. The main vegetation types include fire induced *Chloris* grasslands and *Commiphora-Combretum* wooded grasslands and *Brachylaena-Calodendron* dry forests.

3.6 Vegetation Communities

The vegetation communities of the MGR are influenced primarily by changes in rainfall and altitude. In the past these communities have been greatly influenced by the impact of man, wildlife, livestock and fires (see fig.2). The vegetation communities are described on the one hand by altitude (position on the hill slope) but also by their structure and characteristic tree/grass species. There are considerable differences in the classification of the Mkomazi vegetation by Harris (1972) and Anderson (1967) on the one hand and Coe et al. (1999) on the other which makes it difficult to produce a coherent picture for management purposes. Unfortunately, there is no data on forest/woodland regeneration and only Harris (1972) produced data on grassland trends which can be used for management purposes. In future, less emphasis should be placed on botanical collections and more on the collection of data useful for management and conservation measures. This means measuring such parameters as a) tree height, density and basal area with which to calculate volume and stand regeneration and b) grass basal cover and species composition which are used to determine range condition and trends. In future this will become important for fire and herbivore management.

Upland Forest/Woodland

These are forests and woodlands located above 1000 m. The forests are 15 to 20 m. high and have a closed canopy. Although usually closed, they occasionally have open glades and less densely crowned areas. Rainfall is in the region of 650 mm and at certain times of the year cloud cover is quite dense and provides additional moisture. The forests have been greatly altered and reduced in extent by fires and in some cases by pole cutting and firewood extraction (charcoal burners). The forests grow on dark brown loam soils with shallow litter, fine grained with little gravel. Where fires have destroyed the forest canopy, grasslands or wooded grasslands occur on deep red earths.

1) Apodytes-Heywoodia Forests/Woodland

These forests occur above 1,200 m. with a canopy cover in excess of 75% with abundant lianes and epiphytes. Early- morning mists provide additional precipitation. Coe et al. names them hill summit forest or "mist forests". These evergreen forests still survive on the summits of Ibaya-Igire, Kinondo and Maji Kununua and are of very high conservation value

and the reserve management needs to implement conservation measures if they are not to disappear within the next few years. The forest is dominated by *Apodytes dimidiata* and *Heywoodia lucens*. Much of this forest type has been degraded by fires in recent years and where fire has burnt down the forest (as on the Vitewini ridge), the remaining flora consists of open Combretum bushland with occasional relicts of *Albizia petersiana*, *Brachylaena huillensis* and *Cassipourea celastroides*. On rocky hilltops and steeper slopes semi-evergreen thickets have survived composed of *Abrus schimperi*, *Croton dochogamus*, *Dombeya kirkii*, *Erythrina burtii* and *Grewia mollis* just to mention a few.

2) *Brachylaena-Spirostachys* Forests/Woodland

This type of vegetation community has adapted to some extent to fires and it is quite different to the hill summit forest. It occurs below the ridge above Ibaya, in the Mbono Valley and in the Igire Forest which lies to the south of the ridge. It is also found on the upper slopes of the Mzara Hills and in fire protected pockets and shallow gullies on Vitewini. Conservation measures need to be put in place to protect these species rich forests. The forests are dominated by *Brachylaena huillensis* and *Spirostachys africana*. This forest is of considerable importance to local people who collect natural products from it. Also in this range are areas of *Dombeya rotundifolia* woodland which occur on rocky ridges and which are maintained by annual fires.

3) Chloris Grassland

This association was formerly forest or woodland but due to frequent fires it has been reduced to grassland and wooded grassland. The main species of grass are: *Chloris roxburghiana*, *Panicum maximum*, *Cynodon dactylon* and *Themeda triandra*.

Middle Hill Slope Woodland

This zone occurs between the Upper Hill Slope and the Lower Hill Slope forests and woodlands. It contains, however a quite distinct vegetation community.

1) Combretum Woodland/Scrub

This vegetation type consists mostly of *Combretum exalatum*, *Combretum fragrans* and *Combretum molle*.

Lower Hill Slope Woodland

This is a common vegetation type occurring throughout most of the hilly sections above 850 m and in the central and western section of the MGR. It has been greatly modified by fire at the bottom of the hill slopes. It occurs on gray brown soils. In a relatively stable state it is a habitat of great plant diversity.

1) Combretum Woodland/Bushland

Originally this vegetation type consisted of *Commiphora holtziana* and *Commiphora campestris* woodland but it has been severely degraded by fire so that what is left is usually an open Combretum bushland. The main tree species in the Combretum woodland are *Combretum aculeatum* and *Combretum fragrans* with some *Commiphora holtziana* and *Commiphora campestris* and a variety of other trees such as *Acacia* sps, *Azelia quanzensis*, *Boscia salicifoliola*, *Dalbergia melanoxylon*, *Melia volkensii* and *Terminalia brownii*.

Also in this area, where there are gullies which provide protection from fires a semi-evergreen thicket develops which contains *Blepharispermum zanguebaricum*, *Cissus quadrangularis* and *Combretum padoides*, *Croton dichogamus*, *Newtonia hildebrandtii* and *Sterculia rhyngocarpa* just to mention some.

2) Commiphora Woodland

On steep slopes with shallow stony soils and in the absence of fires, *Commiphora holtziana* woodland develops with a mixture of *Adansonia digitata*, *Delonix elata* and in some areas the green stemmed *Sterculia appendiculata*. These woodlands occur on north facing hill slopes because they provide a certain amount of protection from fire (shallow soils and less wind). Examples of this vegetation type can be found on the north side of Vitawini ridge and on some of the isolated hills in the reserve.

Lowland Woodland and Bushland

This vegetation type occurs mainly below 850 m. and is the characteristic plant community for much of the MGR. It has been drastically influenced by fires. In 1972, Harris considered that it covered approximately 70% of the MGR. Two vegetation types can be differentiated.

1) Acacia-Commiphora Woodland/Bushland

This vegetation type occurs in the west of the reserve and consists of *Acacia etbaica*, *Acacia mellifera*, *Commiphora africana*, *Commiphora schimperi*, *Delonix elata*, *Adansonia digitata* and *Melia volkensii*. The soils are reddish and contain a lot of quartz gravel.

2) Commiphora Bushland/Scrub

This vegetation type occurs in the east of the reserve where rainfall is less than in the west and where bushland and scrub habitats predominate. The soils are reasonably well drained gray and black clay soils. The dominant species are: *Commiphora campestris*, *Cordia rothii*, *Cordia ovalis*, *Cassia abbreviata* and *Grewia* sps.

Grassland

This vegetation type usually occurs in lowland areas on heavy gray clays characteristic of drainage ways or "mbugas" or on better drained soils occurring on hill slopes and foothill fan slopes. The "mbuga" grasslands are an important feature of the western and central part of the MGR but peter out towards the east.

1) Pennisetum-Dicanthium Grassland

This grassland vegetation type occurs in topographic depressions which become waterlogged during the rainy season. The dominant grass species are: *Pennisetum mezianum*, *Dicanthium papillosum*, *Dactyloctenium aegyptium*, *Chloris roxburghiana* and *Sporobolus helvolvus*. Because of waterlogging they are usually free of tree growth but where there are elevated areas of ground *Acacia drepanolobium* occurs.

2) Themeda-Pennisetum Grassland

These grasslands are better drained than the *Pennisetum-Dicanthium* grasslands and consist of *Themeda triandra*, *Pennisetum mezianum*, *Bothriochloa radicans* and *Cenchrus ciliaris*

3) Cenchrus-Themeda Grassland

These grasslands occur on slopes bordering the “mbugas” and so are reasonably well drained. *Cenchrus ciliaris* is the most common species with *Themeda triandra* occurring in areas which have a high rainfall (western part of the reserve). Other common species are: *Pennisetum mezianum*, *Cynodon dactylon*, *Panicum maximum* and *Chloris roxburghiana*.

4) Enteropogon-Digitaria Grassland

These grasslands are of limited distribution and occur on basin sites where the drainage is poor. The basins usually become flooded during the rainy season. Besides *Enteropogon macrostachyus* and *Digitaria* sps, they contain *Cynodon dactylon* and *Sporobolus* sps.

Riparian and Ground Water Forest/Woodland

This vegetation type occurs along rivers and areas where there is sufficient ground water throughout the dry season to maintain a forest/woodland association.

1) Tamarindus Woodland/Forest

This is a very localised vegetation association which occurs at the foot of permanent or seasonal waterseepages. These sources of water are important for large game (especially elephant and buffalo) during the dry season. They occur at the bottom of Ibaya, Kisima, Kinondo, Maji Kununua and Tussa. The dominant trees are: *Tamarindus indica*, *Newtonia hildebrandtii*, *Albizia harveyi* and *Albizia petersi*.

2) Riparian Woodland

This vegetation association occurs along the Uмба river but no species lists are given by any of the authors consulted.

Fig. 2 Floodplains or Mbugas with *Acacia/Commiphora* Woodland and Bushland in the Background

3.7 Wildlife

The wildlife population of MGR has been recorded since 1968 when Watson, Parker and Allan (1969) did the first aerial count of the MGR and adjacent areas. Ever since several aerial and ground counts have been done, the last of which was conducted in 1996 by Eltringham et al. (1999). Unfortunately, the authors always used different game counting techniques which make comparisons difficult and therefore the same applies as to what was said in the vegetation section of the management plan. In future, it is important to decide on one technique and to stick to it. Only then can one compare species numbers and trends over a certain period of time.

Numbers

The base line figures for MGR are provided by Harris (1972) which he deduced from aerial surveys, ground surveys and opportunistic recordings taken during his studies. This data is then compared to the estimates derived from aerial counts done in 1994 (Inamdar, 1994) and in 1996 (TWCM, 1996). For further information on numbers, biomass and the distribution of individual species see Harris (1972), Eltringham et al. (1999), McWilliam (1997) and McWilliam and Packer, M.J (1998).

Table 1: The Number of Large Mammals in the MGR Based on Aerial and Ground Counts

Species	1960's (Wet)	1994 (Wet)	1996 (Wet)
Buffalo	750	1,858	1,552
Eland	500	(?)2,421	343
Elephant	3,000	477	346
Gerenuk	250	17	43
Giraffe	250	545	691
Grant's gazelle	-	-	597
Impala	600	801	1,006
Kongoni	1,000	511	408
Lesser Kudu	250	426	546
Oryx	400	102	794
Waterbuck	150	17	59
Zebra	400	460	2,731

The nature of the counts make it difficult to interpret the population estimates and to give some comment on population trends. This is because over time counting techniques, season and personnel varied. But apart from that, wildlife counts are notoriously erratic and this is especially so in the case of Mkomazi because much of the wildlife has a clumped distribution and because of the thick bush and cryptic nature of some of the species wildlife is difficult to see (for example: lesser kudu, gerenuk). On the whole, however it can be said that there has been little change in numbers since the 1960's except with elephants which declined from an estimated population of 3,000 in the 1960's to 346 in 1996. But some of the larger species such as buffalo, giraffe and zebra seem to have increased. The huge increase in eland in 1994 is most probably due to counting errors rather than a natural increase. Although not shown, black rhino have been exterminated in the MGR. Eltringham et al. (1999) came up with the following estimates based on ground counts which are substantially higher than the estimates derived from the 1996 aerial count.

Table 2: The Number of Large Mammals in the MGR Based on Ground Counts

Species	1996	Comments
Buffalo	2,000	Wet season total
Eland	500	
Elephant	300/1,000	Dry/wet season totals
Gerenuk	1,000	Imprecise total
Giraffe	1,000	
Grant's gazelle	200	
Impala	5,000	Conservative estimate
Kongoni	1,000	
Lesser kudu	6,000	
Zebra	2,500	

Biomass patterns change with population numbers especially during the dry season when the reserve has its lowest population numbers. In the 1960's the reserve had a dry season biomass of 570 kg/km² with the western part a biomass of nearly 13,000 kg/km². This is explained by the availability of food and water in the western part of the reserve and the lack of food in the eastern part. During the rainy season the mean biomass for the entire reserve increases to 1,925 kg/km² with very little differences in biomass between the eastern and western parts of the reserve. Elephants contribute substantially to the differences in biomass during the seasons with elephants moving into the reserve during the wet season and then congregating around the western part of the reserve during the dry season.

For management purposes, authors like Glover (1963), Bourliere (1965) and Laws (1969) estimate that 0.4 elephants/km² is approximately the carrying capacity of a semi-arid bushland. At the moment, there are 0.1 elephants/km² in the MGR which is well below the carrying capacity. The same can be said of all other wildlife. In fact, one of the problems facing the MGR is that there are not enough browsers like elephants, black rhino and giraffe to open up the bushland and scrubland areas of the reserve and that there are insufficient bulk grazers such as buffalo and zebra to graze the "mbugas" and to keep them in a healthy condition.

Movement

Movement of animals is characterised by a strong north south movement across the Kenya border and an equally strong east west movement within the reserve (see figs 3-6). While the north south movement accounts for much of the overall changes in population numbers, the east west movements greatly influence seasonal distribution patterns. The highest number of animals seen in the MGR is during the rainy season when there is an influx of elephants and to a lesser extent zebra, oryx and Grant's gazelle. During the dry season when the MGR dries out and there is little available food, there is a reverse movement when elephants migrate north. During this time of the year wildlife numbers are also very low in the eastern part of the reserve. The western part of the reserve does not experience such great fluctuations as the eastern part since it is better watered and the higher rainfall produces more herbage. Elephants cross the border at any points whereas other migratory species such as oryx, zebra and Grant's gazelle are confined to migratory routes made up of open grasslands. During the dry season, those animals which remain in the MGR congregate around the Dindira dam area and other sources of permanent water. When the rains break, there is a movement back towards the central and eastern part of the reserve. The MGR is different to other African game reserves in that the total number of animals and biomass in the reserve are greater during the wet season than during the dry season. In that sense, the MGR is a wet season dispersal area for wildlife from Tsavo National Park in Kenya.

Fig. 3 Distribution of Buffalo, Dikdik and Eland (after Eltringham et. al 1999)

Fig. 4 Distribution of Elephant, Gerenuk and Giraffe (after Eltringham et. al 1999)

Fig. 5 Distribution of Grant's gazelle, Impala and Kongoni (after Eltringham et.al 1999)

Fig. 6 Distribution of Lesser Kudu, Oryx and Zebra (after Eltringham et.al,1999)

Another point to remember is that although the reserve has a permanent source of water in the eastern sector, there are very few animals here during the dry season. The reason for this is the heavy usage of this area by livestock (Harris in 1972 stated that about 40% of the eastern area is heavily overgrazed) and poachers. Therefore, if the reserve is to increase its wildlife populations and if wildlife is to have access to all parts of the reserve these two problems have to be solved.

3.8 Land Use of Adjacent Areas

The MGR is surrounded by 5 major ethnic tribes, the Pare, Sambaa, Maasai, Chagga and the Gogo. The Maasai dominate the western portion of the reserve while the Pare and Sambaa are important in the south and south east of the reserve respectively. The Sambaa, Chagga and Gogo are mostly crop cultivators, the Maasai are nomadic pastoralists and the Pare are agro-pastoralists (see fig.7).

Fig. 7 Agricultural Land Use in Adjacent Areas

Lushoto District

The MGR lies in 2 districts, Same and Lushoto. Lushoto district is 3,500 km² and is divided into 8 divisions of which 2 (Mnazi and Lunguza) border the MGR. There are two wards which have 5 villages bordering the reserve (Lunguza, Mkundi, Langoni, Kwedikwazu and Kivingo). The district currently has an estimated population in 1997 of 434,886 which gives it a population density of 124.3 persons/km². About 80% of the district's inhabitants are farmers who cultivate an average holding of 3 ha. Only 510 km² or 14.6% of the district is suitable for agriculture. The main crops are: rice, maize, cocoyam, sweet potatoes with some cash crops such as cotton, sisal and sugar cane. Irrigation agriculture is important. Pastoralism is practised on the plains, where soils are unsuitable for agriculture and where there is little water for irrigation. In 1984, the district had 48, 233 cattle. During the dry season, there is an acute shortage of water and grazing. The wards adjacent to the MGR are dependent on water from the Usambara Mountains and several streams drain into the Uмба river which forms the eastern boundary of the reserve. With increasing use and human population pressure, the water draining into the Uмба river will get less and less.

Same District

Same district has an area of 5,152 km² with a population in 1995 of 200,394 people and a density of 38.9 people/km². Villages bordering the MGR include Vumari, Kizungo, Kisiwani, Mkonga, Ijinyu, Gonja, Maore, Ndungu, Kalemawe, Karamba and Makokawe. These villages have a population of approximately 39,367 people. About 75% of Same district's population depend on agriculture. The arable land is estimated at 430 km² or 8.3% of the district. In spite of the lack of agricultural land, the district earns substantial amount of money from rice and cotton. About 15 % of the district's population are pastoralists who owned approximately 39,977 cattle in 1984.

Resource Issues

Before the MGR was gazetted, pastoralists made use of the grazing in the reserve during the wet season and then as the dry season progressed moved back towards the Pare and Usambara Mountains where there is permanent water. Even though the area was declared a game reserve, a certain number of Parakuyo and Maasai pastoralists were allowed access

to the MGR and herds rapidly built up in the 1960's and early 1970's. This came to a halt in 1988 when all pastoralists and their cattle were evicted from the reserve. Any pastoralists and their livestock who are now in the reserve are there illegally. Before the eviction of pastoralists out of the reserve, livestock populations had built up to 88,210 cattle in 1984 from 67,758 in 1978. With the exclusion of livestock from the reserve, herders had to either find other suitable areas for grazing or they had to reduce and sell off their herds. This triggered off a sharp decline in cattle numbers and the number of cattle currently existing in the vicinity of the reserve is therefore much less than it was in the late 1980's. This has greatly influenced the economy of the area and the livelihood of many pastoralist families. Any future conservation strategies will have to take the legitimate needs of pastoralists into consideration.

The human population around the borders of the MGR increased by 13% from 1978 to 1988 and it is now estimated that approximately 48,000 people live up against the border of the Mkomazi Game Reserve. There is no buffer zone to speak of and pressures are bound to increase as time goes on. This scenario, however is not unusual in Africa and wildlife authorities have come to terms with it and have developed innovative management strategies which take these developments into account (like game proof fencing and intensive habitat management, something which was already being done in the Kruger National Park in the early sixties).

While the MGR does not have any suitable arable land, it does have other resources which have in the past been used by farmers such as the gathering of wild foods and medicines, placing of beehives, collecting fuelwood and the use of ritual groves and ceremonial sites (Kiwasila, 1996). The two main uses of wild resources are fuelwood and wild vegetables (Kiwasila and Homewood, 1999). The two most used fuelwood trees are *Acacia mellifera* and *Acacia bussei* both of which occur extensively in the MGR. In the case of wild foods, such weed species as *Solanum* sps, *Celosia trigyna* and *Amaranthus* sps. are widely used as was *Zanthoxylum (Fagara) holtziana* a thorny bush/tree which grows in the MGR. The propagation of *Zanthoxylum* on farm land would be a useful contribution to the conservation of this species as well as the economy of women and children who are particularly dependent on selling its products.

Most villagers experience a shortage of land for cultivation but it is the lack of land for grazing that is particularly acute in areas around the MGR. In Kisiwani, the majority of villagers wanted to retain the MGR, but they suggested that the community should be allowed to have some input to decision making and management of the reserve and that in order to reduce wildlife conflicts, water should be supplied to wildlife in the reserve (Kiwasila and Homewood, 1999). These suggestions are reasonable and constructive and will be taken up and discussed in the section on management programmes.

3.9 Neighbouring Protected Areas

The MGR is an ecological continuation of Tsavo West National Park (8,000 km²) in Kenya with a common boundary of approximately 114 km. Tsavo West acts as a buffer zone for the MGR but it is also an important source of wildlife (especially elephants which move into the MGR during the long rains) from which the MGR can be restocked. Another P.A. which is of importance to the MGR is the Chambogo Forest Reserve which lies immediately adjacent to

Zange HQ's and partially covers the northern tip of the North Pare Mountains at an altitude of 1,946 m. The Chambogo Forest Reserve is part of a chain of Forest Reserves which extend over the North and South Pare Mountains protecting important watersheds and afro-montane vegetation communities. Apart from protecting important plant and wildlife communities, the Chambogo Forest Reserve provides an interesting tourist attraction with its montane forests and grasslands and an area for field studies.

4. The Wildlife Preservation Trust Fund (Tanzania)

4.1 The Role of the WPTF

The Wildlife Preservation Trust Fund has been established to support the rehabilitation of the Mkomazi Game Reserve which is being carried out by the WD and the Project Manager of the MGR. This is in accordance to "The Wildlife Policy of Tanzania" which encourages the involvement of wildlife NGO's, aid agencies and any other organisations in helping Tanzania's conservation efforts. In 1995 The Wildlife Preservation Trust Fund signed a Memorandum of Understanding (MoU) with the Government of Tanzania defining its role in the rehabilitation of the MGR. the MoU is for an initial 10 year period with an option of renewal if both parties agree.

The Trust aims not only to hold the line of conservation in Mkomazi but to go one step forward and reverse the decline of wildlife and deteriorating reserve infrastructure, something which has been going on since the late 1970's. The objectives of the Trust in Mkomazi can be summarized as: a) rehabilitate the reserve's infrastructure, b) establish facilities and breeding programmes for the conservation and reintroduction of rare and endangered species, c) promote outreach programmes to the surrounding communities to increase public awareness of the MGR and to finance community based projects and d) carry out ecological studies and initiate wildlife conservation projects whenever necessary. By signing this MoU with the Trust, the Government of Tanzania has introduced an innovative approach to conservation activities which in future can be replicated in other Protected Areas.

The Trust is a non-profit organisation which receives financial and technical support from the USA, the United Kingdom, Germany and the Netherlands. It has a Field Director who is stationed in the MGR at Kisima and is responsible for all the Trust's field activities and programmes. At the Kisima HQ's of the Trust there is an office, workshop, stores and staff accommodation. The Trust HQ's are linked by radio with the reserve HQ's at Zange as well as the rhino sanctuary and some of the reserve guard outposts. The Trust has a fleet of vehicles, bulldozers and graders with which to do its work. There is an airstrip near the Kisima HQ's with a hangar to accommodate the Trust's aeroplane. The airstrip can also be used by large transport planes bringing in black rhino from South Africa.

The Trust specialises on "management oriented conservation projects" and most of the money which is donated by the Trust is actually used in field projects rather than administrative and office work. The Trust is backed up by some well-known and experienced wildlife scientists and wildlife managers who are involved in the breeding and re-introduction of endangered species.

The Trust is therefore very much part and parcel of the MGR and as such has been incorporated into the administrative structure of the reserve (see organogramme) reporting directly to the PM. There are regular meetings of the Field Director and the PM in order to discuss areas of mutual interest and to plan future development priorities.

4.2 Trust Activities

Trust activities are described in detail under the respective chapters on "Community Conservation", "Habitat and Wildlife Management" and "Park Infrastructure". Here it is sufficient to just mention the priority areas which the Trust has focused on since it began its work in the MGR.

1. Rehabilitation of Reserve Infrastructure and Communications

The main thrust of its activities has been to open up the reserve for tourists and to support the PM in anti-poaching operations and general reserve management. In order to do this, the Trust has done a substantial amount of work rehabilitating such reserve infrastructure as dams, boundaries, airstrips, firebreaks and roads as well as constructing new infrastructure and completing the demarcation of the MGR boundaries (see fig.8). In addition, the Zange HQ's has been rehabilitated and regular aerial patrols of the reserve are being conducted.

Fig.8 Staff of the WPTF with some of their Equipment

2. Community Development Projects

The aim of the Trust is to create an awareness of wildlife (and reserve) values amongst villagers living around the MGR so that the village communities will in future support the activities of the reserve in wildlife conservation and management. Therefore, the work of the Trust has focused primarily on building or rehabilitating village schools and creating an awareness of wildlife conservation and reserve values amongst communities living around the MGR by means of discussions and meetings. The activities of the Trust has centred on the Kisiwani area (see fig.9)

Fig. 9 Community Development Projects at Kisiwani Secondary School

3. Captive Breeding and Reintroduction of Endangered and Rare Species

The third priority for the Trust is to breed rare or endangered species and reintroduce into the MGR or other suitable wildlife areas. This is considered an important contribution to the conservation of species as well as to the maintenance of biodiversity of the MGR. In order to do this the Trust has established a rhino sanctuary for Black Rhino as well as a breeding station for the African Wild Dog (see fig. 10).

Fig 10 Captive Breeding of Black Rhino

4.3 Capital Costs and Recurrent Annual Expenditure

From 1994 until 2001, the Trust had spent approximately \$ 2.58 mil. on capital costs. This does not include running costs which in 1989 were \$ 75,000 and in 2001 \$ 300,000 (the annual average during this period is approximately \$ 194,000). Roughly 46.5% of capital costs was spent on the rhino sanctuary (\$ 1.2 mil.), 3.9% on the Wild Dog breeding

programme (\$ 100,000), 19.4% on assistance to the MGR management (\$ 500,000), 6.8% on community projects (\$175,000) and 23.3% on the construction and equipping of the Kisima HQ's and workshop (\$600,000). In actual fact, the financial input of the Trust is much higher than the above figures indicate because for example the Field Director does not earn a salary and much of the equipment which is used by the Trust has been donated.

Part 2 - Management objectives

5. Management Goals and Objectives

Game reserves in Tanzania have been created to protect areas of wildlife which will generate income from tourism and safari hunting and act as reservoirs for wildlife. The concept of community involvement in management or benefits accruing to villagers from wildlife was not entertained at the time of gazettement and has only evolved recently. Since those early days, perceptions have changed considerably in accordance to new ideas and technologies. Today, game reserves and other Protected Areas are valued more for their conservation of biodiversity than for their conservation of big game species. When Mkomazi Game Reserve was created in the early fifties, there was no mention of why it was created or what the goal of the game reserve should be. It is, however Government policy and that of the WD to create a network of Protected Areas which contain representative samples of all the different habitats and their characteristic species for the benefit of the nation now and in the future.

5.1 Exceptional Resource Values

Before one can exactly define the goals of the Mkomazi Game Reserve, it is important to have an idea of what exceptional resource values the Mkomazi Game Reserve incorporates and is trying to protect. These exceptional resource values are:

1) High species and habitat diversity

The Mkomazi Game Reserve is at the meeting point of several different centres of endemism which explains its great plant and animal diversity for such a relatively small and dry area. The reserve protects species which are characteristic of the Acacia-Commiphora savanna as well as species which occur in montane and sub-montane forests and woodlands.

2) Integral part of the Tsavo ecosystem

The Mkomazi Game Reserve is an extension of the 21,000 km² Tsavo National Park in Kenya and as such it is an important refuge at certain times of the year for such species as elephant which require large ecosystems to survive. An additional value is that Mkomazi provides a "buffer zone" between human populations in the south and Tsavo National Park in the north while in Tsavo relatively stable animal populations act as a "source" to repopulate wildlife areas in Mkomazi. This makes the MGR an important conservation area for both Tanzania and Kenya. The proximity of the two Protected Areas also creates an opportunity of establishing a Transfrontier Protected Area and a model for collaborative management.

3) Protection of a fragile semi-arid ecosystem

The Mkomazi Game Reserve falls within the ecological/climatic zone IV which is classified as a semi-arid ecosystem. Rainfall is scarce and erratic and therefore water is a limiting factor for wildlife as well as plants. Soils are poor and the vegetation cover is sparse. It is a fragile ecosystem which can easily be degraded by poor management and over-grazing. If agriculture or livestock grazing were permitted to any great extent this would lead to a gradual and irreversible decline of the ecological carrying capacity of the reserve as well as a reduction in species diversity and habitats.

4) Important area for Palaearctic bird migrants

The MGR is an important resting and feeding area for Palaearctic migrants which are mainly insectivorous species. However, more studies have to be done to quantify and qualify this statement.

5) Scenic beauty and wilderness character of the reserve

The MGR is an area of great scenic beauty and as it is relatively untouched it has the additional value of being a wilderness area. This attribute is fast disappearing in other Protected Areas. The altitudinal range within the reserve is from 230 to 1,620 m. making for a great variety of landscapes and landforms each with their characteristic vegetation types. It is surrounded by the Pare and Usambara Mountains which rise to an altitude of 2,463 m. and 2,304 m. respectively. In the distance can be seen Mt. Kilimanjaro which at 5,896 m. is Africa's highest peak.

6) Threatened and endangered wildlife populations

The Mkomazi Game Reserve contains a number of species which appear on the IUCN Red Data List of endangered and threatened species. This includes such species as the African Hunting Dog, the African Elephant, the Cheetah and the Black Rhinoceros all of which used to be prolific in the reserve and because of commercial poaching, disease and habitat deterioration have either declined considerably or have become extinct during the last 20 years. It is one of the objectives of this management plan to reintroduce the black rhinoceros to its former range in the MGR.

5.2 Threats and Other Management Issues

This section broadly describes the threats and issues that the MGR is facing. The objective of the management plan is to contain these threats and to alleviate the management issues.

1) Poaching

There has been a considerable amount of commercial poaching of elephants and plains game in the past. Because of poaching, several species are now extinct or have been drastically reduced in numbers.

2) Fires

Fires started by neighbouring villagers or livestock owners in the early dry season encourage bush encroachment of important habitats such as "mbuga" grasslands. Fires also are a threat to montane and riverine forests which are important habitats of the MGR.

3) Livestock and Water

Illegal livestock grazing in the reserve leads to overgrazing, soil erosion and the depletion of

important water reserves essential if wildlife is to remain in the reserve throughout the year. The development of water reserves for wildlife is considered an important component of future management activities.

4) Bush encroachment

The collapse of elephant numbers has led to the regeneration of large areas of even aged stands of Acacias and Commiphoras. These stands are monotonous and because they are young and shady very little grass grows underneath the crown cover. This is detrimental to grazers. Also the thickening of the vegetation makes game viewing difficult.

5) Tourism

The MGR is relatively unknown amongst tour operators and tourists alike. It has no lodge or any other visitor accommodation to speak of. Therefore, visitors are few and the income from tourism is minimal. It is essential to develop tourism and to make it contribute to the present tight budget.

6) Community relations

The MGR has the usual problems with neighbouring communities that are characteristic of most Protected Areas in Tanzania. The communities regard the reserve as a source of grazing, fuelwood and bush meat and they are unaware of the conservation values of the reserve. In future, communities will be exerting more pressure on the reserve and this needs to be carefully considered and managed.

7) Administration and staffing

The reserve lacks manpower and an adequate command structure in order to control operations and to substantially reduce poaching. This needs strengthening and additional staff should be recruited. In order to improve anti-poaching success a system of informers and rewards for game scouts should be introduced.

8) Infrastructure and communications

In the past few years, reserve infrastructure and communications has improved substantially but there are some important additions to be made as far as staff housing, transport, water and power are concerned.

9) Research and Monitoring

The monitoring of management activities as well as the monitoring of wildlife populations and habitats are essential to good management. Simple and effective monitoring activities need to be incorporated into the management plan which can be undertaken by reserve personnel.

5.3 Management Goals and Objectives

Given the factors considered above, the management goal for Mkomazi Game Reserve has been identified as:

To conserve the biodiversity of Mkomazi Game Reserve for the enjoyment of visitors and the benefit of neighbouring communities

In order to achieve the overall goal, this management plan has the following objectives and strategies:

1) Controlled Burning Programme and Management of Key Vegetation Types

The MGR is under threat from uncontrolled fires started in the early dry season which lead to bush encroachment, degradation of grasslands and the destruction of important montane and riverine forests. A fire management plan will be introduced which will minimize the risk of fires destroying forests, improve grassland quality and reduce bush encroachment.

2) Development of Tourism and Reserve Facilities

Considerable effort will be made to increase tourism to the reserve and to develop different tourism products and services. Underpinning this development is the willingness of tour operators to invest in lodge and camping facilities. Investors will be encouraged to invest in Mkomazi by providing incentives.

3) Involvement of Communities in Mkomazi Management Programmes

It is realised that in future local communities must be involved in some aspects of reserve management and to benefit from the reserve if Mkomazi is to be successfully protected and managed. This is a long-term issue which needs to be carefully considered and implemented.

4) Increased Management Presence and Anti-poaching Patrols

To ensure that measures in the plan are implemented successfully, reserve management will be improved through additional appointments, training and a streamlined command structure. Fundamental to effective conservation and management measures is that the reserve management needs to be in full control of the reserve.

5) Improvements in Reserve Infrastructure and Communications

To support the strategies listed here, reserve management will improve reserve infrastructure. This includes accommodation, office space, communications, transport and roads. The objective is to access all areas of the reserve for management purposes and to develop the means of managing the reserve successfully.

6) Research and Monitoring to Support Reserve Management

Data on the effectiveness of management measures need to be collected at regular intervals as well as species distribution and trends. Wildlife populations will be monitored to assess the effectiveness of anti-poaching activities. Rhino populations will be studied to monitor the effectiveness of re-introduction programmes. Tourists will be surveyed to assist in management decisions and local communities on their views of the reserve.

7) Increase Income from Tourism

The implementation of many of the strategies outlined in the management plan depend to a great extent on whether tourism income increases and the budget allocation from HQ's is increased to cover costs. At the moment the Mkomazi budget does not cover costs and income from tourism is minimal. Once tourism improves and receipts increase, a retention scheme will be instituted to retain 50% of all income for management purposes.

8) Supply of Water for Wildlife

The objectives of the management plan is to supply water throughout the year for wildlife in certain strategic localities so as to attract wildlife and allow it to remain in the reserve for longer periods of time. In order to do this, the present number of dams and pans will be rehabilitated and additional ones created if necessary. Dams and pans will be regularly patrolled so that there is no livestock encroachment and poaching activities.

9) Reintroduction of Extinct Species

Where species have become extinct because of poaching pressures, they will be reintroduced so that the reserve regains its former biodiversity and wildlife attractions. Reintroduction programmes will be carefully devised, implemented and monitored.

10) Improve Conservation Status of the Reserve

The MGR has had a turbulent past and there has been considerable pressures to degazette the reserve. In order to improve the status of the reserve and integrate it on a district/regional level as well as improve its management, various options will be looked at such as the incorporation of Mkomazi with other neighbouring Protected Areas and Biosphere Reserves.

6. Zoning

The Mkomazi Game Reserve has to balance conservation needs with the need to generate income from tourism. The best way to reconcile such objectives is to zone the game reserve and to specify specific management objectives, development activities and budgets to each zone. Zoning therefore becomes a useful management tool which helps the reserve management to manage different areas according to conservation priorities and available funds. It should be pointed out that the initial zoning of the MGR has been done very much on an ad hoc basis because of a lack of biological information. Therefore the proposed zones are fairly arbitrary and need to be refined as time goes on and as more information becomes available. The objective, however is to try and keep administrative and tourism structures as small and inconspicuous as possible and to keep at least 95% of the reserve in a pristine and unaltered condition (Fig.2).

6.1 Administrative Zone

This zone consists of the highly developed areas of the reserve which have been set aside for the administration and management of the reserve. They include the reserve HQ's, game posts and gate posts (for a more detailed description see chapter 13). Structures needed for administrative purposes will be allowed provided that they conform to general aesthetics. The radius for each location should be no more than 250 m. with HQ's taking up a slightly higher area. In total, this zone will take up approximately 2 km² or 0.06 % of the MGR and

include 10 administrative sites. If one includes airstrips, roads and firebreaks as part of the administrative zone then an additional 27.1 km² or 0.8% of the reserve falls under this zone.

6.2 Conservation Zone or Semi-Wilderness Zone

The purpose of the conservation zone is to set aside areas for game viewing and general tourism infrastructure. The zone is generally unaltered and includes all major tourist attractions and scenic areas with prime wildlife. No resource use will be allowed in this zone. Broadly speaking this zone will be situated in the northern part of the reserve starting from the Maore and Tussa hills and going up to the western boundary of the reserve. The zone is approximately 1,147 km²

in size and covers 35% of the MGR. The objective for this zone is to provide visitors an undisturbed and impressionable experience of a variety of savanna and forest mosaics, characteristic wildlife species and as a background some dramatic mountain ranges. Management activities will concentrate on providing a circuit of well maintained roads and tracks which pass along the major vegetation types incorporating areas of wildlife concentrations, scenic attractions and places of interest. Tourist accommodation will be provided in the form of lodges, camping sites and self-service bandas.

6.3 Wilderness Zone

The purpose of the wilderness zone is to set aside areas where there is a minimum of development and where visitors can enjoy unspoilt wilderness. For the most part the zone covers the southern part of the MGR starting from the Tussa and Maore hills and going down to the Uмба river in the east but it also covers some areas in the north such as montane forests. The zone covers approximately 58.5% of the reserve or 1,916 km². It is recommended that no tourism facilities such as lodges be developed in this zone and that tourism use is through wilderness trails and camping. The only development allowed in this zone is a limited number of access roads and game posts to facilitate administration and game patrols. The objective of this zone is to protect pristine habitats with a diversity of species for conservation and research purposes. No resource use will be allowed. Management activities will concentrate on law enforcement and the protection of different habitats and their associated species. Special care will be taken of rare and endangered species and where this is the case the areas concerned should be disturbed as little as possible.

Fig. 8 Mkomazi Game Reserve Management Zones

The map showing the Mkomazi management zones will be completed during the duration of the management plan as and when the boundaries of the zones have been finally established. The reader needs to understand that some boundaries can change in the course of time as well as the area of the zones (as in the case of Limited Access Zones).

6.4 Tourism Zone

The tourism zone includes areas which have been set aside for tourist lodges, camping sites, educational centres and the like. A limited number of accommodation structures will be allowed which need to be aesthetically pleasing and conform to accepted EIA's. The present Ibaya Research Centre would not pass an EIA and therefore it should either be torn down or completely rebuilt as self-catering bandas (see chapter 7). The radius for each lodge location

should be no more than 300 m. with camping sites occupying approximately half this area. In total this zone will take up approximately 1.6 km² or 0.05% of the reserve which would cover 3 lodge/banda sites and 10 camping sites.

6.5 Restoration Zone/Rhino Sanctuary

This zone includes the present rhino sanctuary of 45 km² situated at Kisima as well as the HQ's of the Wildlife Preservation Trust Fund. The present rhino sanctuary has a carrying capacity for 20 black rhino but a recent evaluation by Knight and Morkel (1998) has recommended that the rhino sanctuary be increased to 80 km² (2.4%) in order to hold a minimum of 50 rhino. The rhino sanctuary has as its objectives: 1) the establishment of a breeding herd of black rhino which will be large enough to maintain genetic viability and 2) which will provide enough offspring to reintroduce them back into the MGR as well as other Protected Areas in Tanzania. Management at the moment concentrates on providing suitable habitats, watering points and tsetse free areas for the rhino as well as providing a high level of security within the rhino sanctuary which is surrounded by a well-maintained electric fence. The rhino sanctuary has a network of roads, firebreaks and security installations which are necessary for the protection of the rhino. Even though these installations are important for rhino security, they should conform to the general objectives of the MGR and be as inconspicuous as possible. At some stage, the rhino sanctuary should be opened to tourists and local visitors alike in order to provide an educational venue for rhino conservation and park publicity.

6.6 Limited Access Zone

One of the innovations of this management plan is to establish limited access zones within the MGR where villagers can harvest during certain times of the year such forest products as fuelwood, wild food, honey, medicinal plants and thatching grass. As the communities are empowered within the management of the MGR to take over certain responsibilities, the provision of a Limited Access Zone could be discussed as long as this does not compromise the conservation of the reserve and open a gateway to abusive and unsustainable practices. The Limited Access Zone would include the collection of non-timber forest products but this will need to be closely supervised and regulated by the reserve management. Areas need to be demarcated within the reserve where these activities can be carried out as well as the amount to be harvested. Such a system has to be licensed and contracts need to be made with the respective village resource committee using the area. The objective of this zone is to allow people living on the immediate boundary of the reserve to benefit from the resources of the reserve and to introduce them to aspects of sustainable resource use. Theoretically the argument goes that if villagers have a stake in the resources of the reserve they will be more inclined to protect it. This hypothesis needs to be tested and before any areas are set aside for this purpose, it is proposed that a pilot scheme be started by the reserve management in order to test the feasibility of such limited access zones. This zone is not suitable for tourism and therefore no tourism infrastructure will be developed. Also no permanent structures will be allowed to be built by villagers. The zone still needs to be properly identified and allocated to specific village resource committees. After an inventory of the non-timber forest products a resource plan will provide guidelines for use. The limited access zone should not cover more than 5% of the reserve.

6.7 The Support/Buffer Zone

The support zone is an area as yet undefined which surrounds the MGR to the east, south and west of the reserve. This buffer zone is village land and consists of an accumulation of villages and settlements with a variety of land-uses. The area and human population of this buffer zone still has to be determined as well as the possible interventions. When delineating this zone, it should be kept in mind that development projects have a greater chance of success when located in a relatively small area consisting of a small and highly motivated human population willing to cooperate. In other words the buffer zone needs to be manageable. Furthermore, development projects need to be linked directly with the conservation of the MGR irrespective of whether they are involved with health, education, agriculture, livestock or natural resource use. It is envisaged that these projects will be financed by a variety of donors and conservation NGO's. Once the MGR is earning enough income from tourism then the reserve will also contribute to such projects. In order to establish a dialogue with villagers in the support zone, it is proposed that representatives from village resource committees be represented on the MGR advisory committee (see chapter 8). This advisory committee meets at regular intervals with the PM of the MGR to discuss issues of mutual concern. One of the priorities of this management plan will be to delineate a support zone, set development priorities and where appropriate establish village resource committees.

Part 3 - Management programmes and activities

7. Tourism

The Mkomazi Game Reserve has deteriorated considerably during the last 20 years with a decline in wildlife numbers (especially elephant) and the local extinction of 5 species due to poaching and habitat deterioration. It is only in the last few years that the WD has made a concerted effort together with the help of the WPTF to rehabilitate the reserve and to bring back some of the extinct species. The problem of Mkomazi has been compounded by the ambivalent attitude of the WD to the reserve as to whether it should be a hunting area or a tourism area. This has now been settled in favour of tourism and the development of tourism infrastructure and facilities is going ahead in the reserve. Furthermore settlement claims by some local people of parts of Mkomazi has discouraged any investments by lodge owners and tour operators. The integrity of the reserve has been upheld by the Court of Appeal and the status of the reserve is now not in question. Therefore it is the intention of the WD to develop tourism activities, to encourage tourist investments and to increase tourism income and receipts. In fact the rehabilitation of the reserve is seen as a potential tourist attraction. Ultimately the flow of tourists is seen as a way of putting the reserve on a better financial footing and as a way of providing employment and benefits to adjacent communities.

7.1 Objectives

The tourism objectives are the following:

1. Develop the reserve for low-key, up-market tourism and/or educational groups interested in African wildlife and ecology.
2. Encourage a variety of tourism activities, especially those which have a low

environmental impact and which take into account the wilderness character of the reserve.

3. Generate revenue from tourism for the reserve as well as employment and income for adjacent communities.

4. Promote the reserve as a tourist destination and integrate it into the northern Tanzanian tourist circuit.

5. Maintain the wilderness character of the reserve by having a strict code regulating the construction of tourist facilities and infrastructure.

7.2 Present Tourism Facilities and Infrastructure

Current tourist facilities are:

1. Camping Sites

There are currently a number of ordinary camping sites in the MGR but the reserve management does not provide any water, fuelwood or other facilities for campers.

2. Research Camp

There is a research camp at Ibaya that was built in the 1960's and was originally intended for self-catering tourists. Sometimes during the 1970's it was converted to a research camp and in the 1990's it was rehabilitated to house members of the Mkomazi Ecological Research Programme.

3. Tourist roads and circuits

There is a well established network of roads and tracks currently being rehabilitated and developed in the western part of the MGR by the Trust. This road network covers the western and central part of the MGR to include areas of wildlife concentration as well as scenically attractive parts of the reserve. The network is considered more than adequate at this stage of development.

4. Dams and wildlife concentration areas

There are several dams which are being currently being rehabilitated and desilted and which provide attractive picnic sites and areas where wildlife concentrates during the dry season. These are the Dindira, Nguranga and Kavateta dams. The Kavateta dam is being rehabilitated.

5. Information centre

There is an information centre at the Zange HQ's but with no exhibits and personnel to staff the centre..

7.3 Problems

1. Lack of camping facilities

There are no proper camping sites with camping facilities which provide water, toilets, fuelwood etc. at the moment in the reserve. The reserve used to have 1000-1500 visitors per year who would camp in the reserve. The lack of basic facilities hinders the development of tourism.

2. Lodge development and investments

There is no lodge at the moment. Initial investors were kept away because of uncertainty in the status of the reserve and the ambivalent WD policy towards tourism (tourism or hunting).

3. Deterioration of Ibaya research camp

The Ibaya research camp has been rehabilitated but is deteriorating because of a lack of maintenance. However, the buildings are still sound and it would not be expensive to improve its facilities and make use of it.

4. Little wildlife and game viewing opportunities

The MGR has suffered from severe poaching, cattle encroachment, overgrazing and soil erosion which has affected wildlife habitats, wildlife numbers, distribution and wildlife behaviour. Wildlife is shy and difficult to see. With proper law enforcement, reintroduction of endangered species and habitat management it can be rehabilitated.

5. Access and communications

The access road from Same to Mkomazi is in a reasonably good condition and would not take much to improve. Otherwise, the reserve is easily accessible from Arusha (3 hours drive or a 30 minutes flight) the gateway to the northern Tanzanian tourist circuit. Also it is well placed for tourists driving to Tanga and the coast and using Mkomazi as a stop-over.

6. Publicity

There are no brochures, posters, maps or guides which describe the reserve and there is no information of the reserve on the web site. There are few tour operators who have been to the reserve and very little is known about its potential and attractions. The reserve is the Cinderella of Protected Areas in northern Tanzania, therefore it requires publicity and a concerted effort in selling its attractions.

7. Attitude of the WD

In the past the WD has let the reserve deteriorate (infrastructure, wildlife, habitats) and it has had an ambivalent approach to development and use. This has been compounded by the lack of a management plan setting out park objectives and development programmes. In the meantime a change in attitude has occurred and the present PM with the help of the WD is rehabilitating the reserve.

7.4 Programme of Activities

The following activities are required for tourism development:

1. Publicise the lease of lodge sites to lodge investors

Mkomazi provides a great wilderness experience far from other areas of tourism. This would attract specific investors and operators interested in such opportunities. Pinpoint areas for lodge construction and development, describe the concession areas, length of lease, concession fees etc., and bring potential investors to the sites and the reserve. Negotiate lease agreement and sign. The lease area should be large enough for the development of an 12-18 bed lodge and no other lodges/campsites etc should be allowed to be built within a 5-10 km radius. This would give a certain amount of exclusivity to the lodge owner while

safeguarding the right of passing through to other users of the reserve. The lease should be long-term and the initial payments reduced so as to attract potential investors. Fees could be based on a percentage of gross income or on a bed night rate. The lodge site needs to have adequate water supplies and a bore hole should be sunk and financed by an aid agency. Conduct an EIA according to WD stipulations.

2. Publicise the lease of a site to a wildlife field centre

There is considerable demand from abroad from academic institutions or tour operators offering students courses in wildlife ecology and management. The site would cater for approximately 20 students doing a 3 week course on wildlife ecology. At the end of the course, the participants would do a little research project and a foot safari to complete their studies. The field centre could in that way contribute to the management of the reserve. Write up a brochure and distribute to academic institutions and tour operators, pinpoint a potential site, bring potential investors to the field site, negotiate with the investors on lease payments and opportunities, write up contract and sign. The lease should be long-term and the initial payments reduced so as to attract potential investors. The field centre should be kept simple and rustic. The site requires an adequate supply of water and a bore hole should be sunk and financed by an aid agency. Conduct an EIA according to WD stipulations.

3. Rehabilitate the Ibaya research centre and turn into self catering bandas

The present Ibaya research site is unsuitable for either a lodge or a field centre. It would most probably not pass an EIA in its present condition and for it to be turned into a lodge or field centre it would be easier to completely tear it down and rebuilt it from scratch. The only solution to this problem is to make it into self catering bandas for tourists not wishing to camp. There would be perhaps 4-5 bandas with a communal kitchen, dining room, ablution block and store. The bandas would supply cutlery, bedding, water and fuelwood but food would have to be brought in by the tourists themselves. The rehabilitation of the research centre and the conversion into self catering bandas could be financed by an aid agency.

4. Promote wilderness safaris and a wide range of activities (riding, walking)

Look into the opportunities for walking and riding safaris, determine suitable areas, encourage tour operators and lodge owners to include such activities in their itineraries. Provide suitably trained game guards to accompany tourists when they wish to go on a foot safari or just a walk from their camping site or banda.

5. Construct ordinary and special camp sites and devise booking arrangements

Choose ordinary and special camp sites and construct the appropriate facilities. The camp sites can be booked by tour operators and private parties alike, determine booking arrangements and set fees for the different camp sites. Establish campsites with basic facilities such as toilets, water, rubbish pit, firewood and askari to look after camp. Provide game guard to accompany tourists on walks.

6. Liaise with Forestry Department for the use of the Forest Reserve as a tourism destination

The Forest Reserves on the Pare mountains offer additional tourism attraction for walkers, riders and naturalists. They provide a different destination to that of the reserve with

mountain forests, grassland, ravines and springs. They are important areas for forests birds, mammals and alpine flowers. Their geology is different to that of the reserve. Determine routes, make maps of the area and set fees for tourists in conjunction with the Forestry Department. Contact FD and coordinate activities.

7. Incorporate the Rhino Sanctuary into the tourism itinerary

The work of the WPTF should be incorporated into the tourist attractions of the reserve as and when the black rhino are breeding successfully. Allow visitors to see the rhino sanctuary for a set fee, provide them with a guide and explain to them the rhino conservation activities of the Trust and the WD. This gives tourists the opportunity to see a conservation project at first hand and to learn about conservation issues.

8. Train game scouts to accompany campers and lodge visitors on walking safaris

Basic skills required are: wildlife and plant identification, use of firearms, first aid procedures, history of the reserve, tracks and signs of animals, map reading. These game scouts need to be carefully chosen for their initiative, discipline and teaching abilities. They need to speak English.

8. Community Conservation

It has become fashionable to incorporate community development projects into the activities of park managers and wildlife personnel but so far there are very few examples where it can be shown that community projects have made an impact on such essential issues as poaching and encroachment, habitat deterioration and the attitudes of people towards wildlife conservation and protected areas. This is because community composition and structures are complex and community development priorities change with time. Community development projects usually require the long-term involvement of some donor agency or NGO over a period of some 15 to 20 years since Wildlife Departments initially do not have the funds, personnel, time and expertise to do so. Even after such a long period of time, it cannot be guaranteed that the ultimate objective of most wildlife community projects, which is an improvement of living standards and a change in attitudes towards wildlife conservation, can be achieved. Ultimately community development projects are a way of redistributing the income earned from tourism and wildlife conservation to areas adjacent to National Parks and Game Reserves in the belief that an improvement of living standards will positively affect the attitude of people to wildlife conservation and protected areas.

The theory goes that if communities benefit from wildlife then poaching should go down, encroachment will diminish and that Park management will have a better relationship with neighbouring communities. The basic idea is to provide benefits from wildlife over and above what community members currently receive (usually through illegal hunting or lost opportunities from cultivation, grazing, timber extraction and other uses). To achieve this aim, community projects usually encompass a wide range of measures which for example can include: public awareness campaigns, creation of employment, training of community members in sustainable resource use, establishment of wildlife/community steering committees, limited use of certain natural resources in the Protected Area and revenue sharing from tourism and wildlife income. Community projects have to be focused and with the limited amount of money available park managers and development agencies have to

decide on priority areas, the likelihood of success (or failure) and what is realistically achievable in a certain period of time. Ultimately, community projects are contracts between the community and the respective Protected Area managers entailing specific responsibilities and rights. This contract just as in any other business agreement can be changed, dissolved or abrogated if any of the partners does not fulfill their obligations. In the end a combination of law enforcement and adherence by both parties to certain responsibilities is the right mixture for a successful community project.

8.1 Objectives

The goal of the community programme is to provide benefits to the community from wildlife so as to ensure the long-term survival of the Mkomazi G.R. This will be done through implementing the following objectives:

1. Improve the relationship between neighbouring communities and Park management.
2. Improve the living standards of adjacent communities.
3. Introduce systems of sustainable resource use in the reserve.
4. Make local communities aware of the values of the Mkomazi G.R. and wildlife conservation.

8.2 Present Community Projects

In 1993, the Mkomazi Game Reserve Outreach Programme was started and financed by the Trust and the Sticing Mkomazi Game Reserve Outreach Programme (The Netherlands) who provided two coordinators. The aims of the Outreach Programme are to improve community relations between the reserve and local communities by providing social amenities. In order to do so the Outreach Programme has concentrated on school projects and women's groups in and around Kisiwani village. To date some US\$ 175,000 has been spent on community projects. More specifically the following activities have been accomplished:

1. Information about wildlife conservation and the environment at schools and to the general public
2. Rehabilitation of 5 primary schools in Kisiwani
3. Building of a secondary school at Kisiwani
4. Establishment of women's groups (Kuhawa groups)
5. Training of women's groups in leadership activities, organisation of women's groups and public speaking
6. Creation of the Mkomazi Game Reserve football team (which was done prior to the establishment of the Outreach Programme in 1992)
7. Assistance to the National Polio Programme
8. Establishment of a community forum to discuss problems of mutual concern
9. Provision of cement and building materials for Kivingo secondary school and Mnazi primary school

At present the programme does not have any coordinators as the previous ones returned to Holland but development activities have carried on. The programme has started of well but needs be more focused. In order to do so development priorities need to be established and some base line studies are required which will establish community views and wishes. It is

therefore recommended that an organisation such as African Wildlife Foundation (AWF) be asked to come up with a detailed outreach programme listing priority areas, identifying key community groups, training needs, development activities and an initial five year budget. Base line studies should be carried out in order to assess achievements and to provide indicators by which the programmes can be evaluated and assessed.

8.3 Problems

Mkomazi has some 40,000-50,000 people living in two districts that are adjacent to the reserve boundaries. There is very little land left for development and in some locations villagers are farming right along the edge of the reserve. Right from the start this poses some crucial problems to any community development effort, the major one being that the benefits from the reserve when divided amongst so many people become absolutely meaningless. Therefore, a strategy has to be followed which bundles benefits and supports basic village needs rather than dividing the benefits amongst so many recipients. More specifically the problems associated with community conservation are:

1. Threat to degazette the reserve

Threat by politicians and local leaders to degazette the Game Reserve or to excise certain areas from the reserve, especially during election time and times of crisis.

2. Unsustainable land-use in the Pare and Usambara Mountains

Poor farming practices lead to soil erosion and habitat degradation with the result that soil fertility decreases, dams silt up and springs dry out. Movement of people onto the plains and against the reserve boundary.

3. Lack of conservation awareness and negative attitude to wildlife

People do not understand the objectives of the Mkomazi G.R and the aims of park management. Negative attitude to the MGR in particular and wildlife in general because of wildlife damage to crops and livestock.

4. Few benefits from the reserve

Little revenue and income from tourism and few employment opportunities provided by the reserve.

5. No legal use of the reserve's natural resources

No access to natural resources in the reserve be it for firewood collection, traditional foods, honey, medicinal plants, thatching grass and any other related products.

8.4 Programme of Activities

Park management when dealing with communities should concentrate on what it can realistically do rather than being overly ambitious. This means concentrating on wildlife and natural resource management. More specifically it means: 1)dealing with wildlife issues, 2) sustainable resource use within the reserve and 3)benefit sharing from income derived from tourism. There should be a direct link between community development and the success or failure of wildlife conservation efforts. This means that if wildlife and tourism increases in the reserve then there will be more money available for community projects.

Other development projects such as livestock and farm management, soil conservation efforts, tree planting and agro-forestry projects should be done by donor and government agencies who have the expertise, personnel and money to do so.

1. Problem animal control

Park management needs to train up a specialised group of rangers who can deal with problem animals and their control. They require special equipment, mobility and expertise to deal with this kind of work. Special efforts need to be undertaken in agricultural areas where animals are destroying crops or killing livestock.

2. Establish a committee to discuss park management and community issues

A committee should be established which comes together on a regular basis and consists of representatives from park management and village committees to discuss issues of mutual concern such as poaching, problem animals, encroachment, illegal use of the reserve, community development requirements and resource use. The committee should also discuss the allocation of revenue collected from tourism and which has been earmarked by the PM for community development projects. The authority, structure, composition and voting modalities of the committee has to be clearly defined.

3. Arrange visits and field days for villagers and village leaders to the reserve

The reserve management should organise regular visits for villagers to the reserve to see its wildlife, tourism facilities, road and dam infrastructure and any other items of interest. Specific groups should be targeted such as school children, teachers, village elders, government officials and politicians. A truck is required for such excursions and someone capable of leading the group discussions and itineraries.

4. Encourage sporting activities between reserve personnel and village communities

Sporting activities should be encouraged which publicise the reserve and which brings the employees of the reserve into contact with surrounding villages and their teams. This makes the reserve less remote and improves the relationship between the reserve and the villagers.

5. Provide employment opportunities

Villagers should be employed by the reserve whenever necessary when building roads, buildings, constructing dams or any other development project. In this way, the villagers will receive an income, training and interest in the continuance of the reserve.

6. Establish community development fund to finance community projects

Revenue from lodges, camping fees and entrance fees should be channeled to a community development fund. This fund can also be a recipient of donations from private individuals, NGO's and any other organisations. The fund would finance community projects and provide venture capital to local entrepreneurs. These projects would be suggested by the communities and their representatives and proper accounts and budgets need to be prepared. The fund would have a Board of Trustees who are in charge of the fund and determine its activities.

7. Allow communities limited access to the reserve

Reserve management needs to evaluate the feasibility of allowing limited access to communities interested in gathering firewood, collecting medicinal plants, harvesting local fruits, collecting thatching grass and harvesting honey. No grazing, cultivation or other uses should be allowed. Limited Access Zones are not necessarily permanent but can be moved to new areas and localities whenever necessary. Tree felling should only be allowed in the reserve if it is part of habitat management and infrastructure development. Initially a pilot scheme should be developed to test the feasibility of such a programme. If it succeeds then it can be expanded. If it fails then it should be closed down.

Water is an essential resource and the possibility of desilting the Chatto dam in order to provide water to Same town has been discussed with local officials. An extensive hydrological survey needs to be carried out as to the suitability of the dam which lies within the Reserve boundaries but is now rarely used by wildlife owing to human encroachment. In exchange local villagers are prepared to patrol and conserve the North Pare forests which exist within the Reserve and are in close proximity to their agricultural land.

8. Train community members in resource use

If the PM allows communities limited access to its resources then resource groups need to be established from different villages and trained in sustainable use, product storage, marketing and sales of the product, accounting and budgeting. The members of each resource group would be allocated a certain area in the reserve where under supervision from reserve personnel they would be allowed to collect specified amounts of products for a limited time.

9. Conduct a socio-economic survey and PRA of neighbouring communities

In order to work with communities surrounding the reserve and implement community programmes, it is important to collect base line data on human population numbers, trends, economics, land use and natural resource use. This data should be augmented by information on the attitudes and awareness of the people to conservation issues and the values of wildlife/game areas. The rural assessment should also provide data on people's development needs and priorities. This information provides the base line data for evaluating community projects and people's changing attitudes to the game reserve and wildlife conservation. A donor agency should be asked to develop and implement a long-term community programme in areas adjacent to the game reserve.

9. Habitat and Wildlife Management

The habitat and wildlife management requirements for Mkomazi Game Reserve are straightforward and concentrate on three measures all of which are aimed at stabilising wildlife populations and habitats. Once that has occurred, then further rehabilitation measures will be undertaken to improve grazing capacity, availability of water and the reintroduction of extinct species. Up to now management measures at Mkomazi include the protection of wildlife populations, the rehabilitation of existing dams and pans and the control of wild fires which occur during the dry season. To facilitate the control of fires a network of roads along seepage lines and "mbugas" has been constructed which acts as a firebreak as well as providing the backbone to future tourism developments and game viewing activities. Management in Mkomazi should be adaptive and flexible and always willing to change in light of new findings and realisations. This is especially the case for such

little known ecosystems as Mkomazi where ecological information still has to be built up and where ecological changes are an every day occurrence.

9.1 Objectives

The overall goal of habitat and wildlife management is to maintain species diversity and habitats in good condition. In the case of the MGR this will be achieved through a variety of measures which include, bush control, fire management, soil erosion measures, forest protection, reintroduction of extinct species and creation of watering points and dams.

9.2 Present Management Activities

1. Fire management

Management has concentrated on the suppression of fires by constructing a series of roads which act as fire breaks in the northern and central sectors of the reserve. These roads circumvent the "mbugas" and act as a fire break to fires sweeping in from outside the reserve or which have been started within the reserve by pastoralists. They will form the backbone for any future fire management programme of these important grazing areas.

2. Wildlife management

The MGR together with the WPTF has embarked on a plan to re-establish extinct and endangered species. This is to be achieved through re-introduction and breeding programmes for the highly endangered African hunting dog and the black rhinoceros. The Mkomazi Game Reserve is considered ideal for the propagation black rhino because of its quality habitats which have a high carrying capacity for black rhinos. The Mkomazi area was an important part of the black rhinos former range. The rhino sanctuary was constructed and staffed during 1996-97 by the Trust. The rhino sanctuary covers an area of 4500 ha and has a potential carrying capacity for at least 20 black rhino. The sanctuary is of an extremely high standard and consists of an outer ring fence with 14 strands of coated electrified wire (7 negative, 7 positive), a cantilever with 3 strands (2 negative and 1 positive) carrying a current of between 5000-6000 volts, a holding boma for new rhinos, staff quarters for 18 people and several internal fire breaks and airstrips. The sanctuary relies on water from the nearby Kisima HQ's and some of the seasonal water supplies which occur within the rhino sanctuary. Drilling is now in progress for more permanent sources of water. In 1996, the South African National Parks carried out a wide ranging ecological assessment of the Mkomazi rhino sanctuary area which also included an assessment of the security situation, long-term sustainability and community relationships. All criteria for Mkomazi were rated adequate or good with the only reservations made over the availability of water. In 1997, four black rhino were translocated by air from South Africa and released into the sanctuary after a 5-6 week period in holding bomas. A further 4 rhinos will probably be translocated from South Africa in 2001. The rhinos come from the Addo N.P. in South Africa and consist of the subspecies *Diceros bicornis michaeli* which used to occur in Mkomazi.

Another collaborative programme between the WD and the Trust is the capture, captive breeding and reintroduction of the African hunting dog (*Lycaon pictus*). An initial 25 pups were captured in the Maasai Steppe in 1995 between the age of 3-5 weeks and brought back to Mkomazi where a holding pen had been constructed. In 1998, the number of dogs had increased to 34 and in 2000 it stood at 52. The dogs are raised in family units until they

are able to return to the wild and establish their own social and hunting patterns. It is envisaged that wild dogs will be released into areas of about 5000-10000 km² because they require a home range of between 500-1500 km². A minimum of 2 dogs of the same sex will be released at a time which are between 18-36 month old. New packs can be formed in the wild by two dispersing groups of the opposite sex meeting on neutral ground well outside the home ranges of their former packs or when an all female sex group joins an all male group still resident on the males home range. The programme aims to supplement small existing populations and to re-introduce wild dog into areas with no resident populations. Reintroduction sites need to be carefully chosen and prepared. A boma of some 40x30 m needs to be built at the re-introduction site with two small connecting enclosures of 15x5 m. There the dogs will remain for some 1-3 months until they are released. An important aspect of the wild dog programme are the regular veterinary and medical check ups and the monitoring of the dogs once they have been released. It is envisaged that 20 dogs will be bred and released every year in 2-3 introduction sites with 7-10 animals released per site.

3. Water Management

The reserve management has undertaken an ambitious programme of dam rehabilitation and improvement. The Dindira dam was constructed in the fifties and was recently rehabilitated. The dam wall has been rebuilt but the dam itself needs some more desilting. The Kaveteta dam is presently being desilted and the Ngurunga dam needs desilting. The Maore pan as well as the Mabata dam needs annual desilting. This is taking place. Future plans involve the construction of further additional watering points and the deepening of already existing pans in the southern sector to open up that area for wildlife and game viewing (see fig. 11).

Fig. 11 Pans such as the Maore Pan are Essential Watering Points for Wildlife

9.3 Problems

1. Bush encroachment

There is considerable evidence that bushland communities in the Mkomazi G.R. are closing up (as shown by the amount of tree regeneration and tree densities) and many of the open "mbugas" are being invaded by acacias and other tree species. The reason for this bush encroachment is the setting of fires by livestock keepers in the early part of the dry season in order to stimulate a flush of green grass. This debilitates grassland growth to the advantage of trees and bushes. Another reason is the present lack of browsers such as elephant and black rhino which previously kept bushlands in an open condition and encouraged grass growth. Early burning leads to bush encroachment because the soil dries out and grasses are less able to compete with the subsequent invasion of shrubs and trees. Another affect of overgrazing by livestock is that the carrying capacity of the grassland is reduced because it leads to the proliferation of annual grasses which are less palatable and nutritious than perennials.

2. Lack of water in the dry season

Previously wildlife had access to riverine forests and pools of water which occur at the base of the Pare and Usambara Mountains during the dry season. As human population pressure mounted in the hills, people started developing areas along the base of the range with

wildlife coming into conflict and eventually being ousted from these dry season concentration areas. In the reserve, illegal grazing of some 10,000 head of livestock during the dry season uses up precious water supplies and further aggravates the water situation for wildlife. As a consequence wildlife is forced to move out of the reserve onto village land or into Tsavo West National Park where there are sources of permanent water. As a management measure previous reserve wardens established dams well within the reserve to compensate for the lack of water and as a way of opening up parts of the reserve for wildlife use and tourism activities. However, because of the general lack of reserve management in the past these dams and pans have silted up but are now being rehabilitated.

3. Species loss and wildlife decline

Wildlife numbers and species diversity in Mkomazi have been heavily affected by poaching but also by bush encroachment and the lack of available water in the reserve. Due to inadequate funding and levels of protection in the seventies and eighties, Mkomazi G.R. deteriorated significantly and lost several of its most important wildlife species. Mkomazi used to have some 3000-4000 elephants and some 1000 black rhino. The elephant population has been drastically reduced to around 300 and the rhino population has been wiped out altogether. Other species such as black and white colobus, greater kudu and sable antelope have become extinct through a combination of habitat changes, lack of water and poaching pressures. The loss of black and white colobus has been caused by the destruction of montane forests in the reserve whereas the extinction of sable was most probably due to it being at the edge of its range and therefore extremely vulnerable to poaching.

4. Destruction of montane and riverine forests

Fires if left unchecked sweep up steep mountain slopes and if they are fanned by strong winds can destroy large tracts of montane forests. Fires destroy forest edges and with time gain access to the forest interior where they destroy forest trees which are not adapted to fires (smooth bark). The result is that forests become fragmented and only exist in sheltered ravines and rocky areas which are inaccessible to fires. A hard edge is a sign that fires are an annual event in montane areas and that the forest is being destroyed by fierce fires sweeping up the mountain slopes.

There is a small band of riverine forest and woodland along the Uмба river which in addition is the only source of permanent water in the reserve. The Uмба river forms the eastern boundary of the reserve but unfortunately the boundary alignment covers only one side of the river bank. This means that settlements and farms are springing up along the river embankment right next to the reserve boundary. Poaching, habitat loss and tree felling activities are inevitable.

9.4 Programme of Activities

1. Reintroduction of extinct or rare species

The programme for the reintroduction of black rhino is going ahead with the acquisition of a further 4 rhino in 2001. The current rhino sanctuary has a potential carrying capacity for at least 20 rhino. Thereafter, it is intended that the sanctuary be enlarged by a further 4500 ha so that eventually 30-40 rhino can be bred up in the sanctuary for release. The Mkomazi

sanctuary then has the potential to re-stock large areas of the Tsavo ecosystem as well as to reinforce existing populations in northern Tanzania. In order to improve the surveillance of the sanctuary a training programme has been drawn up which involves the following activities: a 2-week training course at the Lewa Wildlife Sanctuary, Kenya which will include such topics as: communication and radio procedures, arrest procedures, patrol techniques, night operations, firearms practice, ambush techniques, intelligence gathering, game capture and rhino monitoring. In order to improve the efficiency of the rhino game rangers an equipment list has been drawn up which includes such items as: hand-held VHF and HF base station communication sets, binoculars, night vision binoculars and monocular scopes fitted to rifles. The training courses as well as the additional equipment have been funded by the Rhinoceros and Tiger Conservation Fund.

The wild dog programme suffered a severe set-back in 2000 when 49 out of the 52 died from canine distemper. This set-back is not irrevocable and already the remaining female is pregnant and it is anticipated that she will have a litter of 10 pups. The fact that the dogs bred well and reproduced successfully is a major advance in the conservation of wild dogs and it is only a matter of time that a suitable vaccine will be developed against canine distemper. It should also be remembered that African wildlife management is a young profession and although great strides have been made during the last 20 years many of the techniques used still have to be perfected and adequately tested under different field conditions. It is therefore to be expected that set-backs, as in the wild dog breeding programme, should occur. Such set-backs however are an invaluable learning experience and if properly documented are more valuable in the long-run than successes which have come about by mere chance.

2. Controlled burning

Bush encroachment can change a landscape within a relatively short period of 10-15 years because these trees and bushes grow rapidly and have an abundance of regeneration and seeds. Key habitats for grazing animals in the Mkomazi Game Reserve are the "mbugas" grasslands, contour seepines, natural pans and valley bottoms situated on black cotton soils with impeded drainage (edaphic grasslands). These key habitats need to be kept open from bush encroachment and their soil moisture must be conserved. Therefore these areas should have no hot fires, no drainage channels, no livestock, no canalization, no roads disturbing their ecology. These habitats are open to invasion by woody plants during periods of droughts when they can establish themselves and when grasses become less competitive because they lack water. Once these trees are established they pump the areas dry and maintain "drought" conditions. This encourages further invasion of trees which suppress grass growth. Once trees have reached a certain height they can withstand waterlogging whereas saplings/seedlings cannot. In the Mkomazi G.R. these grassland areas have been overgrazed in the past by livestock and now there is a considerable amount of Acacia bush encroachment coming in from the edges. As there are not enough giraffe, elephant, black rhino and gerenuk to keep the bushes in check, fire is the only feasible large scale management tool to control bush encroachment and to maintain grass vigour and productivity (Acacia woodlands or regenerating woodlands are a sign of low elephant densities). In the absence of large herbivores, fire maintains the vigour of grasslands because if there are no herbivores to stimulate growth, grasses become moribund and the grass centre dies. However, there should be no burning during droughts and extended dry

seasons. If there is little game, grasses should be burnt every 3-4 years and after the first 15-20 mm of rain to obtain a cool burn. Fires should be started in the late morning to mid day when there is low humidity, high temperatures (dry conditions) and low wind. Burn the entire perimeter but start downwind and gradually move upwind. Burning against the wind produces a hot slow burn with maximum affect. With dense bushland burn every year for 3 years. Valley bottoms, seeplines and "mbugas" should be burnt. Where applicable mowing is good grassland management (it has been shown to yield 8 times as much grass as burning) but mowing is costly and should only be done in key habitats such as seeplines and around lodges and artificial watering points. Mowe old bomas sites where there is a lot of rank grass. Use a mower which can also cut small bushes and scrub (up to 10 cm diameter). Burning or mowing should not be done in the early dry season when nutrients are being translocated to the roots. To facilitate fire management tracks and/or firebreaks should be aligned along the upper edge of the seeplines or within the tree line of the valley slope on sandy red soils. There should be no tracks going through seeplines. Start managing seeplines and "mbugas" which are least affected by bush encroachment and leave the worst affected to last.

3. Provision of water

The provision of water is an excellent way of spreading wildlife to hitherto inaccessible areas of the reserve. Dams and waterholes need to be carefully sited and not too close to one another for fear of overgrazing and soil erosion. Dams should be at least 15-20 km apart and if boreholes are used then they should be closed down if signs of overgrazing and soil erosion become evident. Boreholes should be at least 5-6 km apart. Seeplines, "mbugas" and valley bottoms can be improved for wildlife by constructing shallow pan dams. Dams and pans hold water either throughout the dry season or they dry up during the dry season. Disadvantage of dams is that they silt up and can be destroyed in flood years. Dams are less useful than boreholes because they cannot be switched off and game is not forced to move on when the area is being restored.

4. Control of soil erosion

A careful assessment of each site is needed before reclamation work starts. There are usually two approaches to the reclamation of eroded areas. One is to increase the vegetation cover through veld management techniques. This should be done where the potential for recovery is high. The second technique is through applying special treatment such as mechanical soil disturbance methods (ripping) and re-seeding. This is done where the areas are severely degraded. Mkomazi is for the most part flat to undulating and therefore severe soil erosion is not a problem. Where erosion does occur as in gulleys draining into "mbugas" or rivers flowing downstream into dams then some measures need to be taken for otherwise the dams would silt up. A very simple and inexpensive way is to cut down trees and branches (or make stone packs) and to lay them in parallel lines across the ground. Another method is to create a series of small basins in the soil surface .Then during rains, soils, humus and seeds accumulate at the base of the tree stems or within the basins and within a few years the area starts to grass up. In time the brush decomposes and then the area can be lightly grazed once more. Resting such areas during the growing season is highly desirable. The restoring of heavily eroded areas is extremely expensive and the chances of complete restoration are slight. Restoration can only succeed if it is accompanied with improved grassland management throughout the catchment area. The Dindira dam

area is one such area in the reserve which requires constant attention and surveillance. Gullies can be packed with stones, brushwood and the crowns of cut trees. Grasses can be used to reclaim eroded areas using such species as common reed, couch grass and kikuyu grass. The use of awned grasses also has decided advantages when bare areas have to be re-seeded. Rhizomatous and stoloniferous grasses are recommended for disturbed soils, steep slopes and areas where run-off is high..

5. Protection of forests and riverine areas

The main source of forest destruction in Mkomazi are wild fires started during the height of the dry season which destroy the forest edge and encroach into the forest. It is extremely difficult to protect montane forests from fires because of their inaccessibility, dispersion and extreme terrain. The only way to protect the forest is by protecting the forest edge from fires. This can be done by either cutting a fire break along the forest edge or better still starting an early burn along the edge so that there is insufficient combustible grass material during the end of the dry season for a hot burn. Before the PM starts on a fire management programme he needs to set priorities and analyse the feasibility of protecting some forests and not others. Vegetation on kopjes should also be conserved as well as riverine vegetation such as along the Uмба river. The ultimate life supporting systems during droughts are areas where there is still some green pasture and surface water. Therefore, it is essential to conserve the riverine zones, the "mbugas", the valley bottoms and the seepage lines of the Mkomazi G.R. Additional areas can be created by building water points and rehabilitating seep lines and "mbugas".

6. Bush control

Bush encroachment is the rule rather than the exception because in savanna areas natural succession is towards woody vegetation. Particularly troublesome are *Acacia* spp., *Combretums* spp., *Commiphora* spp., *Dichrostachys* spp., and *Euclea* spp.. Bush control can be used to increase forage production. For example a 42% reduction in *Commiphora* increased forage by 77%. Many bushland stands in the Mkomazi G.R. are in a young to semi-mature stage with a proliferation of young age classes. As a consequence grasses are being shaded out and visibility is substantially reduced. Bushland habitats are suitable for browsers but not for grazers and if bushlands proliferate they can change the wildlife spectrum away from grazers to browsers. On the whole, however it is preferable to have more grazers than browsers as they form the bulk of one's wildlife attractions. Where bushland has become so thick that it is impenetrable it might be feasible to open up such areas for grazing by a combination of tree felling, fire and by some mechanical means. Trees should always be cleared in the best and most productive areas (i.e. valley bottoms). Mechanical bush control is usually expensive and should only be done in special cases (as when clearing an area around a lodge site or a new watering point). Village labour could be used for bush control, dam construction and road building and charcoal production when clearing bushes.

10. Research and Ecological Monitoring

Reserve management needs to know the resources within the Protected Area, how they function and what is happening to them. This forms the basis for management decisions, development plans and conservation activities. A well thought out research and monitoring programme is an essential part of adaptive management and provides the reserve manager

with up-to-date information on biological, environmental and socio-economic data. Unfortunately, much wildlife research is driven by external institutions which have often conducted research which is not very relevant to park management. In future, research and monitoring programmes need to be much more oriented towards park management and in situ conservation measures. It is the responsibility of the reserve manager to determine these research and monitoring priorities. In many cases priorities will be determined by the availability of research personnel, equipment and funds which is often dependent on donor funding and therefore can be fairly erratic. This does not mean, however that the PM becomes inactive, rather it means that the reserve authorities need to prioritise research and monitoring activities to suit the reserve's budget and the personnel that are at the reserve's disposal. Much of the continuous ecological monitoring can be done by reserve personnel and game rangers with a minimum of equipment and vehicles while most long-term research falls within the realm of local or foreign universities or institutions who have the funds, personnel and scientific back-up to do so. Broadly speaking the Mkomazi G.R. requires the following research and monitoring activities:

1. Collection, analysis and evaluation of previous research and monitoring data. Identification of gaps in knowledge. Compilation of data into useable maps, lists, graphs and tables for management purposes and decision making.
2. Creation of an on-going monitoring programme to assess ecological trends and the effect of management measures.
3. Research into specific issues such as wildlife/habitat relationships and the ecology of key species.

10.1 Objectives

The goal of the research and monitoring programme is to provide information on the ecology of the reserve and the trends of key species and communities. More specifically the objectives of the research and monitoring programme are:

1. Develop a long-term ecological monitoring programme
2. Assess the findings of previous research and monitoring programmes and make use of data in reserve management
3. Establish priorities for a management oriented research programme

10.2 Present Research and Ecological Monitoring Activities

In spite of the fact that Mkomazi Game Reserve is relatively unknown, a surprisingly large amount of work has been done in the reserve which provides sufficient basis for management and conservation decisions. A short description of the reserve was published by Anstey in 1956 and from 1964 through to 1969 climatological, soils, vegetation and animal studies (elephant, rhino) were conducted which provided the basis for understanding the ecology of this semi-arid environment. Of particular importance was the survey done by Anderson (1967) of the land use potential of the reserve. In the late sixties, Harris (1968) studied the population dynamics of elephants in the reserve and then carried out between 1970-1972 a more detailed ecological study of the reserve (Harris, 1972). This study provides some excellent base line data on wildlife numbers, distribution and movement on which to base present management decisions. It was not until 1993 that further research was carried out in the Mkomazi G.R by the Mkomazi Ecological Research

Programme from 1993-1998. The research done during those years attempted to close any existing gaps in our knowledge of the ecology of the reserve. The programme contributed check lists of the floral and faunal diversity of Mkomazi's habitats, provided information on species distribution and abundance of both the small and large mammals and produced socio-economic data on communities living around the reserve boundaries. The maps made by the research team provide useful information for future reserve management. However, one item which is lacking and of great importance for management purposes is a detailed vegetation map of the MGR and a system of vegetation plots where vegetation changes are monitored.

10.3 Gaps in Knowledge

The problems related to the research and monitoring programme are more to do with regular monitoring than with applied research. These are:

1. Wildlife trends

There are no regular and consistent game counts which use the same techniques of the reserve to determine numbers, biomass, distribution and movement of key species. This information is essential to gauge the effect of law enforcement activities and other conservation measures. Of particular importance is the monitoring of reintroduced animals.

2. Vegetation map

The present vegetation map is far too inaccurate and broad based to base management decisions by. The reserve management requires an up-to-date and detailed vegetation map showing the key vegetation communities and habitats.

3. Vegetation trends

To establish vegetation trends is important because they have a bearing on wildlife and species diversity and are a sign of ecological changes. The monitoring programme with the use of transects determine changes in vegetation composition and structure. Especially important is to gauge the effects of fire management on different vegetation communities.

4. Information on anti-poaching and law enforcement activities

There is little information on poaching and the success/failure rate of anti-poaching activities. Systematic data needs to be collected on affected areas, type of poaching, movement of poaching gangs and the efforts of the anti-poaching force. This information is essential to improve law enforcement activities and to be responsive to new threats posed by poaching.

5. Status of rare and endangered species

One of the aims of the Mkomazi G.R. is to conserve species diversity and protect rare and endangered species/habitats and to initiate appropriate conservation measures well in advance of their demise. This requires knowledge of such species and habitats and their occurrence in the reserve so that measures can be taken to conserve them.

6. Management Maps

Maps are an extremely useful way of showing, in an easy and comprehensible manner, spatial information about such things as: infrastructure development, wildlife distribution, environment factors and anti-poaching activities. There are numerous maps of the reserve but these are either inaccessible, outdated or the information they provide has not been adapted/edited to be useful for management purposes.

10.4 Programme of Activities

1. Management Maps

Maps showing the biological and physical features of the game reserve should be prepared on a scale of 1:100 000 or 1: 50 000. The current Landsat photographs produced in 1997 should be used for making a vegetation map of the reserve. Mapping can be done either by a consultant or an agency/company specialising in aerial photography and mapping.

2. Vegetation

Method used is based on the measurement of species composition and basal cover. Each grass species is classified as a decreaser, increaser I, II and III. Habitats which are dominated by decreasers are in optimal condition and those which are dominated by decreaser II species in poor condition (overgrazing). Tree and shrub strata are sampled separately (coppice growth less than 2m, greater than 2m trees). The area sampled is 30x30m with 200 points per area. With trees at least 200 trees should be sampled. Use wheel-point or step-point method for grasses. Choose a bench mark site which is an area in excellent condition and compare data to a sample site. Survey benchmark site and sample site at the same time (i.e. in the wet or dry season). Trees should be divided into browse and non-browse species. For further information see Tainton (1981). As a corresponding form of documentation, take fixed line photographs of all major vegetation types at 5 year intervals to document vegetation changes. Also photograph those areas which were photographed by Anstey in 1957 and by Harris in 1967 on a regular basis so as to establish changes in vegetation structure and composition. Train suitable wildlife personnel to undertake monitoring activities.

3. Wildlife

Put into place a regular and systematic system of aerial and ground counts which provides data on wildlife numbers, biomass, distribution and movement. The use of systematic and parallel transects covering the entire reserve is a useful way of establishing wildlife distribution and such parameters as the occurrence of water, fires, livestock, bomas, encroachment areas and incidences of poaching. Because of the clumped nature of wildlife distribution in the reserve, do total counts in and around sources of permanent water (such as dams) and along "mbugas" during the dry season. The systematic aerial counts can be done by the TWCM whereas MGR personnel could do the total counts. When doing the ground counts use the same transects as previous research workers. Train suitable wildlife personnel to do monitoring activities. It might be of interest to monitor specific species such as elephant, buffalo and impala in order to establish numbers, age structure and increment. Specific groups need to be divided into adult, subadult and juveniles by sex at the end of the dry season and then again at the end of the rainy season. The difference between the dry and wet season counts is the mortality. At the end of the next year rainy season the various age classes move up (the juveniles become subadults and the subadults become adults). The second year population is then made up of the remains of the first year population and the increment of the first years population. Recruitment is then determined by comparing the first and second year population at the end of the rains. A working rule is to have a sex ratio of 1:4.

4. Fire

It is important that the reserve management monitors the use of controlled burning in the reserve, especially in the grassland areas and along the forest edges. A system of late burns should be initiated in the grassland areas in order to keep them open from bush encroachment and to maintain grassland condition. A further priority is early burns along the forest edge in order to protect forest ecotones from the damage caused by hot fires started late in the dry season.

5. Socio-Economics of Adjacent Communities and their Attitude to Mkomazi G.R.

This work should be left to an NGO or donor agency to do who is in charge of community projects but it is just as well that the reserve personnel is involved with some aspects of data collection. This includes the survey determining people's attitudes to the protected area, the problems they have with wildlife and their perception of conservation issues.

6. Law Enforcement Activities

In order to assess the success/failure rate of law enforcement activities, the PM needs to quantify anti-poaching activities and methods of reporting. First of all the type, area, time of year and species poached needs to be registered. Then the effort (by km walked, hours spent on patrol or area covered) it takes to apprehend one poacher (catch per effort) in a specific area and for certain times of the year. The catch per effort data can tell us whether the amount of illegal hunting is decreasing or increasing. One also needs to analyse the outcome in the law courts of poachers imprisoned, fined, awaiting trial and acquitted.

7. Resource Use in the Reserve

If park management is to allow resource use within the reserve by neighbouring communities then a survey has to be made of available natural resources and the sustainable offtake rate. A brief management plan should provide details about access, control, use, offtake and training of the participants.

8. Archives and Research Library

The reserve management needs to collect all available research publications, reports and documents concerning the Mkomazi Game Reserve. Also an analysis should be made of archival reports and documents (a lot has already been done by Anstey). Furthermore, copies should be made of all maps available of the area. This information should be stored in the PM's office and be readily available to visiting research workers.

9. Extension of Reserve Boundaries

The Umba river forms the boundary of the reserve for some 38 km along the eastern part of the reserve. The boundary does not incorporate the other side of the Umba river which is on village land. It is important that some of this land be given some form of protection in order to conserve wildlife coming down to the river to drink. A survey should be done of potential conservation areas. These could either be incorporated into the reserve or alternatively leased on a long-term basis from the village communities. Such an area would be of interest to tourism and could provide some income to villagers.

10. Environmental Impact Assessment

Any major activities in the MGR requires an EIA, especially where the building of lodges,

infrastructure and other major facilities are concerned. EIA's should follow the guidelines set down by TANAPA. However, it should be remembered that an EIA is there to help the company or organisation involved build something which does not infringe on the ecological integrity of the reserve. It should not be used as a bureaucratic hurdle to stop suitable development and investor inputs.

11. Reserve Infrastructure

This chapter deals with infrastructure such as buildings, roads and airstrips as well as office equipment, utilities and radio communications which are used directly in the management of the Mkomazi Game Reserve. Infrastructure built for tourism such as camping sites, the Ibaya research centre and some proposed lodge sites are dealt with under tourism. In the past reserve infrastructure has been badly neglected by the WD but ever since the reserve has been designated a special project and with considerable help from the Trust, the infrastructure has improved substantially. There are several constraints which limit reserve management. These are: 1)the lack of an adequate radio communications system linking the fields force with park HQ's, 2)the inadequate number of buildings that are required to house additional staff and game guards and 3)the lack of an adequate road system linking up all areas within the reserve not only for anti-poaching patrols but also for tourism. For each item such as buildings, radio communication, office equipment etc. a list has been drawn up of existing or current items and required procurements.

In a way these lists are quite substantial and it is a matter of conjecture if the PM will ever obtain the items requested since it depends very much on available funds from the WD and aid largess. In order to improve the chances of obtaining at least some of the requested items, the PM needs to refine the list and set priorities for procurement.

11.1 Objectives

The goal of the reserve infrastructure plan is to develop and maintain reserve infrastructure and facilities so that the reserve can be properly managed for wildlife and developed for tourism.

11.2 Present Infrastructure and Programme of Activities

Buildings

Park HQ's are at Zange which is located on the north western boundary of the reserve. There are also two gate posts, one at Njiro and another one at Kivingo both of which are located on the southern boundary of the reserve. There are a further two game posts at Umba Darajani in the south eastern corner of the reserve and another one is proposed for Ndea which is located in the north western side of the reserve. Human population pressures and illegal activities are primarily prevalent in the eastern, southern and western part of the reserve and therefore Zange, Njiro, Kivingo, Umba Darajani and the proposed Ndea posts have been established in these areas. The posts are on average 40 km apart and by using foot patrols, which cover approximately 20 km per day, they can just about police the entire reserve.

The Zange HQ's consists of an office, information centre, armory, store, 2 staff houses for 3 families, toilet facility for visitors and a gatepost with a reception office (see fig.12). HQ's

needs to be expanded to accommodate additional staff. The existing infrastructure at Njiro gate consists of a staff house for 4 rangers and 1 office. The staff house requires rehabilitation. The gate post needs to be expanded to accommodate additional staff. At Kivingo gate there is a staff house for 2 rangers but no other facilities. Work has to be done to provide more accommodation and office facilities. At Umba Darajani there is 1 rest house, 1 office and a staff house for 4 rangers. The rest house, office and staff house require renovation. The game post needs more accommodation. At the Ibaya Research Centre, there is a staff house for 4 rangers and 1 house for 1 wildlife officer but these facilities have never been used. It is proposed that these houses be used for other things when the research centre is turned into self-catering bandas. It is proposed instead that a game post should be built at Ndea sometime in the future to guard the western boundary of the reserve as well as the Dindira Dam area.

Fig.12 Zange HQ's at Mkomazi Game Reserve

Buildings (accommodation)

Designation	Existing	Required	Comments
Zange			
1)Project Manager	0	1	
2)AGO/Anti-Poaching Officer	1	0	
3)GMO/Community Officer	0	1	
4)AGO/Ass. Comm. Officer	0	1	
5) AGO/Administrator/Works	0	1	
6) Accountant	0	1	
7)Secretary	0	1	
8)Storekeeper	0	1	
9)Mechanic	0	1	
10)Ass. Mechanic	0	1	
11)Driver	0	1	
12)Game Scouts	2	8	
SUB-TOTAL	3	18	
Njiro			
1)AGO/ Sector Manager	0	1	
2)Driver	1	0	Requires Rehabilitation
3)Game Scout	3	4	Requires Rehabilitation
SUB-TOTAL	4	5	
Kivingo			
1)GAI/Ass.Sector Manager	0	1	
2)Driver	0	1	
3)Game Scout	2	3	
SUB-TOTAL	2	5	
Umba Darajani			
1)AGO/Sector Manager	0	1	
2)Driver	0	1	
3)Game Scout	4	6	
4)Rural Medical Assistant	0	1	

SUB-TOTAL	4	9
Ndea		
1)GAI/Ass.Sector Manager	0	1
2)Driver	0	1
3)Game Scout	0	10
SUB-TOTAL	0	12
TOTAL	13	49

Buildings (offices, stores and other building infrastructure)

Designation	Existing	Required	Comments
Zange			
1)Office	1	0	
2)Workshop	0	1	
3)Armory	1	0	
4)Store	1	1	
5)Lock-Up	0	1	
6)Visitors Toilet	1	1	
8)Information Centre	1	0	As part of info.centre
9)Community Centre	0	1	
10)Gate-Post with Office	1	0	As part of info.centre
SUB-TOTAL	6	5	
Njiro			
1)Office	1	0	
SUB-TOTAL	1	0	
Kivingo			
1)Office	0	1	
SUB-TOTAL	0	1	
Umba Darajani			
1)Office	0	1	
2)Resthouse	1	0	Requires Rehabilitation
SUB-TOTAL	1	1	
Ndea			
1)Office	0	1	
SUB-TOTAL	0	1	
TOTAL	8	9	

Office Equipment

To support the additional staff and to upgrade the existing facilities, some office equipment is required. This is particularly the case with Zange HQ's where the reserve manager requires two desktop computers, a photocopying machine and a fax for administrative work. The information centre together with the community room requires tables, chairs and other furniture to make it useable and to be able to present exhibits and photographic information to the community and visitors alike.

Designation	Existing	Required	Comments
Zange			

1)Desktop Computer & Printer	0	2
2)Photocopying Machine	0	1
3)Filing Cabinet	1	5
4)Office Desk	4	9 Info/comm Centre 2
5)Map Cabinet	0	2 Info/comm Centre 3
6)Cupboard/Bookshelves	0	6 Info/comm Centre 1
7)Tables	0	5 Info/comm Centre 3
8)Blackboard	0	1 Info/comm Centre 5
9)Information Board	0	4 Info/comm Centre 1
10)Chairs	4	29 Info/comm Centre 4
SUB-TOTAL	9	64 Info/comm Centre 23

Njiro

1)Filing Cabinet	0	1
2)Desks and Chairs	0	1
SUB-TOTAL	0	2

Kivingo

1)Filing Cabinet	0	1
2)Desks and Chairs	0	1
SUB-TOTAL	0	2

Umba Darajani

1)Filing Cabinet	0	1
2)Desks and Chairs	0	1
SUB-TOTAL	0	2

Ndea

1)Filing Cabinet	0	1
2)Desks and Chairs	0	1
SUB-TOTAL	0	2
Total	9	72

Radio Communications

Good radio communications are essential if law enforcement is to be successful and if the reserve manager is to keep in touch with isolated guard posts and foot patrols. Radio communications cut down on vehicle expenditure and are important in emergency situations be it with park management or tourism. They are also important for ranger morale and provide a sense of belonging for game scouts when living in remote areas. Currently only reserve headquarters at Zange has HF and VHF radios (see fig.13). No other posts or foot patrols have radio communications. It is therefore a priority to establish radio communications with Njiro, Kivingo, Umba Darajani and Ndea posts. This will be done by providing these stations with VHF radios and with the required backup of repeaters, solar panels, solar batteries, battery chargers and antennas. Emphasis will be placed on the ability of foot patrols to communicate at any time with their respective game guard posts and with the anti-poaching unit officer at reserve headquarters. Each foot patrol will have a set of two hand held VHF radios.

Fig. 13 Good Radio Communications is Essential for Reserve Management

Designation	Existing	Required
Zange		
1)HF Radio	1	0
2)VHF Radio	4	4
3)Handheld VHF & Charger	0	2
4)Repeater (Kisima)	1	1
5)Antenna HF	1	0
6)Antenna VHF	1	1
7)Solar Panels HF	1	1
8)Solar Panels VHF	1	1
9)Battery Chargers	0	2
10)Solar Batteries	2	2
11)Transformers (240-110V)	0	4
SUB-TOTAL	12	18
Njiro		
1)VHF	0	1
2)Handheld VHF & Charger	0	2
3)Antenna VHF	0	1
4)Solar Panels VHF	0	2
5)Solar Batteries	0	1
SUB-TOTAL	0	7
Kivingo		
1)VHF	0	1
2)Handheld VHF & Charger	0	2
3)Antenna VHF	0	1
4)Repeater	0	1
5)Solar Panels VHF	0	4
6)Solar Batteries	0	2
7)Generator/Battery Charger	0	1
SUB-TOTAL	0	12
Umba Darajani		
1)VHF	0	1
2)Handheld VHF & Charger	0	2
3)Antenna VHF	0	1
4)Solar Panels VHF	0	2
5)Solar Batteries	0	2
6)Generator/Battery Charger	0	2
SUB-TOTAL	0	10
Ndea		
1)VHF	0	1
2)Handheld VHF & Charger	0	2
3)Antenna VHF	0	1
4)Solar Panels VHF	0	2
5)Solar Batteries	0	1
SUB-TOTAL	0	7
Total	12	53

Utilities

Currently, reserve HQ's has a phone with 2 lines, a telephone antenna and 12 solar panels with which to power the telephone. No other gate or guard posts require telephones. Reserve HQ's should upgrade their telephone system with a fax machine and e-mail connection. Reserve HQ's has a generator to supply electricity but a back up should be brought as the present generator is unreliable. Power also needs to be supplied at Umba Darajani and Ndea. Reserve HQ's requires a larger holding capacity for water (15000 lit.) and a water pump is required to fill the water tanks. A water bowser should also be acquired for supplying water to Njiro and Ndea guard posts. Umba Darajani needs some 2 km of piping and fittings to draw its water supply from the Umba river. A water pump should be installed.

Designation	Existing	Required	Comments
Zange			
1)Telephone (2 lines)	1	0	
2)Antenna	1	0	
3)Fax/E-mail	0	1	
4)Solar Panels	12	0	
2)Water pump	1	1	Requires Rehabilitation
3)Water bowser	0	1	For use at Njiro & Ndea
4)Generator	1	1	
SUB-TOTAL	16	4	
Njiro			
1)Water bowser (ex Zange)	0	0	To be stationed in Zange
SUB-TOTAL	0	0	
Kivingo			
1)Pipe Line (est.2 km)	0	1	
SUB-TOTAL	0	1	
Umba Darajani			
1)Water pump & piping	0	1	
2)Generator	0	1	
SUB-TOTAL	0	2	
Ndea			
1)Water bowser (ex Zange)	0	0	To be stationed at Zange
2)Generator	0	1	
SUB-TOTAL	0	1	
Total	16	8	

Roads

Roads and airstrips were initially cleared and destumped by hand and graded by dragging a tree crown over the road or airstrip. With the acquisition of machinery by the Trust, a harrow and a scraper was then used and now a JCB (front end/rear hoe loader) and Caterpillar 12G grader. Currently there are approximately 365 km of existing roads in the reserve (see fig.14). In 2001, approximately 110 km of new roads will be built in the northern section of the reserve. Between 2002-2003, a further 140 km of roads will be built in the central section and between 2004-2005, an additional 165 km of roads will be constructed in the southern part of the reserve. The reserve should then have a total road

network of 780 km.

Fig.14 Caterpillar Grader at Work Clearing Roads and Reserve Boundaries

Airstrips

Airstrips are vital for easy access to remote areas of the reserve during anti-poaching campaigns and as an entry point for tourists visiting the reserve. They also greatly assist in locating broken down plant. Where there is no road network, a feasible option is to build airstrips as a way of supporting park personnel and remote outposts. There are airstrips at the following sites: 1)Zange HQ's 2)Ibaya Research Centre 3) Kavateta Dam 4)Kisima Hill 5) KZ (servicing the rhino sanctuary) 6)Maore Pan and 7)Kamakota. The airstrips are used for reserve management but some could also be used by tourists visiting the reserve. There is one airstrip (KZ) next to the rhino sanctuary for rhino security purposes. The airstrip at Kisima Hill can accommodate large aircraft such as Hercules Transport Machines by which rhino are flown into Mkomazi from South Africa. The original airstrips constructed in the fifties were no longer serviceable so new airstrips were put in as close as possible to the original sites along with new airstrips (Zange, Kamakota). They are all weather airstrips (except for Ibaya), approximately 800 m long and 50 m broad and can be used in the rainy season. A further 4 airstrips are proposed for 1)Kivingo Gate 2)Mabata Pan and 3)Umba Game Post and 4)Umba River. Airstrip sites were chosen on the basis of their strategic importance as well as providing a support to road building and maintenance activities. Airstrips are mowed twice a year at the end of the rainy season and graded whenever necessary. Windssocks are replaced at regular intervals.

Boundaries

The proper demarcation of reserve boundaries is important since a lack of demarcation can lead to encroachment (especially in the vicinity of villages) and illegal grazing (where pastoralists are unsure of the reserve boundaries). There is also some uncertainty of the boundary alignment in the north western part of the reserve. This needs to be cleared up immediately. The northern boundary of the Mkomazi G.R. forms the international border with Kenya as well as with Tsavo West National Park. It has been demarcated and graded by KWS from where Tsavo West National Park and Mkomazi G.R. form a common boundary to Kavuma Hill (some 66 km) and there are plans that KWS will continue from Kavuma Hill to the end of the Mkomazi G.R. boundary (a further 43 km). The boundary demarcation work of KWS is being assisted by the WD and the Trust. The eastern boundary of Mkomazi is from the international boundary south to the Umba river a distance of some 15.9 km. A cut line demarcates the boundary. The southern boundary which is approximately 161.8 km runs at first along the Umba river for some 38 km and then from the Umba river it branches out in a north westerly direction for some 123.8 km to where Zange HQ's is situated. This boundary has been demarcated with a cut line. From Zange HQ's the boundary runs at first in a northerly and then north easterly direction to the international boundary, a distance of some 43.5 km. This boundary has also been demarcated with a cut line. In all the Mkomazi boundary is 330.2 km long (see map of Mkomazi G.R., 1990 Scale 1:200000 compiled and drawn by the Forestry Division, DSM). The Ndea to Maji ya Juu boundary needs verification. It is recommended that boundaries be marked with concrete beacons every 1 km apart. The beacons should be made out of concrete and have a sound foundation. The grass around the beacons should be slashed and the area kept clean of trees and bushes.

Footpaths/Nature Trails

There are no footpaths or nature trails currently in the reserve.

12. Transport and Field Equipment

The reserve cannot fulfil its administrative and management functions if it does not have sufficient transport and field equipment. Currently the Mkomazi G.R. does not have enough vehicles to carry out the various management programmes that have been recommended in this management plan. In addition to that plant is old or non-existent and what there is has been neglected for many years and requires rehabilitation. Usually only one vehicle out of 6 is operational at a time. This chapter provides a list of equipment which is required for administrative purposes but also for other activities which have been prioritised in the management plan. Since new vehicles are expensive, it should be the reserve's policy to rehabilitate existing ones before any new ones are bought. Priorities for the purchase of new vehicles and equipment should then be in this order:

- ✘ Anti-poaching operations (AGO Anti-Poaching Officer)
- ✘ Public awareness campaigns and monitoring activities (GMO Community and Monitoring Officer)
- ✘ Workshop and roads maintenance (AGO Administrator/Works)
- ✘ Administration (AGO Sector Manager)

12.1 Objectives

The objectives of the transport and plant section is to provide and maintain the necessary vehicles and equipment for the proper administration and management of the reserve.

12.2 Present Transport and Programme of Activities

Transport

Designation	Existing	Required	Comments
Zange			
1) Toyota pick-up	2	2	Requires Rehabilitation
2) LR station wagon 110	1	2	Requires Rehabilitation
3) LR pick-up 110	1	1	Requires Rehabilitation
4) Isuzu tipper	1	1	Requires Rehabilitation
5) Dodge	1	0	Phase Out
Total	6	6	

It is proposed that the rehabilitation of the present 5 vehicles should be financed by the WD, and that the purchase of any new vehicles should be then financed by the retention scheme and any donor aid that might be forthcoming. Once the vehicles have been rehabilitated and are roadworthy, then the maintenance can be done by the proposed workshop which will be constructed at Zange HQ's.

Plant

Designation	Existing	Required
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Zange

1) Tractor MF 375 WD	0	1
2) Trailer 3.5 t tipper	0	1
3) Rotor slasher	0	1
4) Water bowser	0	1

The tractor and trailer will be used for construction work and road maintenance. The rotor slasher for cutting road verges, airstrips and camp sites. The water bowser will supply water to game outposts, game scouts in the field and camping sites.

Workshop

There is no workshop at Zange to service and maintain park vehicles and transport. At the moment vehicles are sent to Same or Arusha/Moshi for repairs which is time consuming and expensive. It is therefore proposed that a small workshop be built at Zange to service reserve vehicles and transport. If necessary the Trust workshop at Kisima can help with major overhauls and repairs. A list of essential workshop items is given below:

- 1) Gas/electric welding plant
- 2) Tyre changer and levers
- 3) Hoist and winch
- 4) Hi-lift jacks
- 5) Assorted tools and spanners
- 6) Pit
- 7) Electric grinder
- 8) Electric drill
- 9) Battery charger
- 10) Air compressor
- 11) Power hacksaw
- 12) Work bench with vice
- 13) Generator 3.5 KVA

Field Equipment

Game scouts require basic field equipment which will enable them to stay out on patrol for 4-5 days at a time. This will increase the coverage of the game reserve and make inaccessible areas more accessible. A list of equipment is given below for 36 game scouts divided up into 9 patrols each consisting of 4 game scouts:

- 1) 2-Man tents 18
- 2) Bedrolls 36
- 3) Rucksacks 36
- 4) Raincapes with hoods 36
- 5) Cooking equipment 36
- 6) Water bottles 36
- 7) Binoculars 8x56 9
- 8) GPS 9
- 9) Maps, compasses and rulers 9

9) Water drums (200 l.) 18

10) Jerry cans (20 l.) 36

Firearms

Firearms

Item	Existing	Required	Comments
1) .458 bolt action	7	0	PAC
2) .404 bolt action	1	0	
3) .303 bolt action	4	0	
4) .375 bolt action	1	4	PAC
5) .30-06 bolt action	2	3	PAC
6) .22 L/R bolt action	1	0	
7) .22 H bolt action	1	0	
8) G.3 automatic	9	5	
9) S.A.R. automatic	6	10	
10) .30 MI automatic	3	0	
11) AK	0	5	
12) Shotgun (flares)	3	0	
13) SMG shotgun	0	5	PAC
14) .32 revolver	1	0	
15) 7 mm pistol	0	4	

The armoury at Zange would also require 20 l. of gun oil, 20 cleaning rods and 15 packets of cleaning cloth. 200 rounds of ammunition are also required for each of the S.A.R, G.3, SMG and AK automatic rifles and shotguns as well as 50 rounds for each of the 7mm pistols.

13. Administration and Law Enforcement

13.1 Administration

This chapter summarises the administrative organisation and line of command that is necessary to run the reserve effectively and efficiently. The administration of the reserve can be split up into the following key sections:

- ✘PM's office
- ✘Accounts
- ✘Anti-poaching
- ✘Communities
- ✘Research and Monitoring
- ✘Infrastructure
- ✘Outposts

The headquarters of Mkomazi Game Reserve is at Zange which is also the main entrance to the game reserve. It is well-placed and in a good strategic position from which to administer the reserve. The infrastructure that exists and is required at Zange has already been

described in chapter 11. For administrative purposes as well as law enforcement activities, there are also outposts at Njiro, Kivingo and Uмба Darajani. The outpost at Iбaya is not being used, instead it is planned that an outpost be built at Ndea to cover the northern reaches of the reserve. The reserve has a current workforce of 21 which consists of the PM, 1 officer currently undergoing training (M.Sc. programme), 2 drivers and 17 game scouts (of which 2 are stationed at the rhino sanctuary). The reserve management lacks senior officers with which to administer the reserve and properly co-ordinate anti-poaching activities. It also does not have anyone in charge of community/monitoring activities and there is no one to supervise the proposed workshop and vehicle maintenance unit.

13.1.1 Objectives

The objective is to administer the Mkomazi G.R. efficiently and effectively as set down by the present management plan and wildlife act.

13.1.2 Programme of Activities

1. Recruitment of additional staff

The current workforce is considered insufficient to properly administer and control the reserve and it is recommended that the workforce be increased from 21 to 43 over the next five years. First of all it is recommended that the reserve recruits an officer in charge of anti-poaching, a community/monitoring officer, an administrator in charge of vehicles, plant and roads and also 2 sector managers to be stationed at Njiro and Uмба Darajani who would be responsible for the various game outposts under their command. In order to cut down on personnel, the management plan recommends that community and monitoring work be done by one person. It is proposed that the reserve services and maintains its own vehicles and plant and so a workshop will be built at Zange, with a mechanic in charge and an assistant mechanic to help him. In addition, the management plan foresees the recruitment of some additional 26 game scouts. Recruitment will be phased over a 3 year period with the recruitment of anti-poaching personnel having priority. Figure 3 shows the proposed organisation structure of the MGR.

Staff Requirements

Post	Existing	Required
Zange		
1) Project Manager	1	0
2) AGO Anti-Poaching	0	1
3) GMO Community	0	1
4) AGO Ass.Community	0	1
5) AGO Administrator/Works	0	1
6) Accountant	0	1
7) Secretary	0	1
8) Storekeeper/Armourer	0	1
9) Mechanic	0	1
10) Ass.Mechanic	0	1
11) Driver*	2	0

12) Game Scouts	2	8
13) Game Scouts (Rhino Sanctuary)	2	0
SUB-TOTAL	7	17

Njiro

1) AGO Sector Manager	0	1
2) Driver	0	1
3) Game Scouts	6	0
SUB-TOTAL	6	2

Kivingo

1) GAI Ass.Sector Manager	0	1
2) Driver	0	1
3) Game Scouts	0	5
SUB-TOTAL	0	7

Umba Darajani

1) AGO Sector Manager	0	1
2) Driver	0	1
3) Game Scouts	7	3
4) Rural Medical Assistant	0	1
SUB-TOTAL	7	6

Ndea

1) GAI Ass.Sector Manager	0	1
2) Driver	0	1
3) Game Scouts	0	10
SUB-TOTAL	0	12
TOTAL	20	43

* one driver will be transferred to Ndea.

2. Training

A training programme needs to be developed which reflects the priorities set out by the management plan. As a first measure, gaps will be identified in training on the basis of job description and the level of training and expertise which the person has. This will be the bench mark for identifying any additional training course. Further training should not be regarded as a right but should be based on the candidate's ability and hard work with the prior appraisal of the candidate's performance before he or she is eligible for training. If the course has been successfully completed it should lead to career advancement and so be an incentive to hard work and initiative. Much of the training will be done on-the-job and organised by the respective officers in charge.

The officers at Zange HQ's need to be able to use the computers which will be installed at reserve headquarters. A short 1-2 week course in how to use word processing, statistics and accounting programmes should be organised.

Some 4 game scouts will require training in wildlife and vegetation ecology in order to assist in the monitoring programme which will be undertaken by the community and monitoring unit. The head of the unit will also require some additional training in monitoring techniques and the evaluation and presentation of data.

3. Organisation structure

The expansion of reserve operations requires a clearly defined organisation structure which at the moment does not exist. The proposed organogramme (Fig.) shows a clear line of command from the Project Manager to the Sector Managers and Anti-Poaching Officer. The Wildlife Preservation Trust Fund has been incorporated into the proposed structure as it plays a major role in the rehabilitation of the reserve and as its officers and personnel come into contact with the PM on a day to day basis (for some inexplicable reason the previous draft management plan had left this out).

13.2 Law Enforcement

Currently there are 15 game scouts stationed at Zange, Njiro and Uмба Darajani with an additional 2 game scouts stationed at the rhino sanctuary at Kisima. Game scouts are in the field for approximately 20 days per month. Game scouts stationed at Zange patrol the Ngurunga, Njiro, Kavateta, Ndea and Dindira dam areas whereas the game scouts stationed at Uмба Darajani patrol the Uмба river, Kivingo, Kamakota and Maore areas. The Kisima area is patrolled by game scouts manning the rhino sanctuary. These game scouts are employed by the Trust in addition to the 2 game scouts coming from the WD. Poaching occurs throughout the year, but especially during the dry months from August to November. During the dry season poaching occurs around dams and pans which hold water and where game concentrates within a radius of 20 km. During the rainy season when much of the wildlife has dispersed throughout the reserve, poachers follow the game wherever it occurs. Species which are particularly sought after are: giraffe, buffalo and eland but impala, zebra and dik-dik are also taken. Game meat is sold in the neighbouring villages at half the price of beef and the demand outstrips the supply. Poaching gangs are between 1 and 4 persons armed with shotguns, snares and bows and arrows. Heavy calibre rifles are used when poaching elephants. Poaching for game meat is continuous whereas ivory poaching due to the fall in ivory prices is a more sporadic activity with the last elephants to have been poached happening some 3 years ago.

Game scouts are armed with G. 3 automatic rifles as well as .303 and .30-06 bolt action rifles. During 1998-2000 18 poachers were caught of which 2 were subsequently imprisoned, 11 were fined and 5 were acquitted. The fines ranged from T.Sh. 48,000/- to T.Sh. 5,000/- Fines are considered low and inappropriate to the offence and are currently being revised by the Director of the WD. Game scouts on patrol are paid night out allowances for only 10 days because there is not enough money to pay them any additional night out allowance. There are no rewards for capturing poachers and their firearms.

At present, it seems that management is operating under a benign system of law enforcement with no apparent Code of Conduct for staff which is detrimental to morale, esprit de corps and response to senior management decisions. Uniforms seem to be optional for both senior and junior staff and this can be confusing in a military organisation such as the WD empowered to carry arms and arrest poachers. This situation needs to be

changed and the WD ought to bring in a Code of Conduct (if it has not done so already) at the earliest possible moment.

Fig. 15 Proposed Organisation Structure

The strict enforcement of wildlife laws and implementation of anti-poaching measures is still considered essential for wildlife conservation measures to succeed. This experience has been backed up by recent surveys conducted in various African countries which have all come to the same conclusion that law enforcement is of prime importance in wildlife conservation and that it will remain so in spite of a plethora of well intentioned community outreach programmes and development projects. To a great extent the success or failure of anti-poaching activities depend on the following key activities:

- 1) Coverage of game reserve by game scouts (area covered and time spent)
- 2) Information available on poaching gangs (undercover work)
- 3) Incentives for capturing poachers with their firearms
- 4) Field equipment

The current number of game scouts and staff involved in anti-poaching is considered inadequate for the proper patrolling of the reserve. At the moment it stands at 1 game scout per 193 km² which should be increased to 1 game scout per 100 km². Anti-poaching activities should concentrate more during the dry season around the existing pans and dams as these are key areas for wildlife as well as livestock which are brought illegally into the reserve to graze. One aspect which should be considered in future is the incorporation of village game scouts in anti-poaching activities and information gathering (Kisiwani village has offered to do so).

It must, however be pointed out that successful anti-poaching activities are not only a question of having enough staff on the ground but they also depend for example on such things as staff motivation, equipment and training. In future, budgets should include the payments of rewards for arresting poachers as well as buying the requisite field equipment to maintain game scouts in the field. Another deficiency is the number and type of firearms which the game scouts are supplied with. In order to arm the additional game scouts more automatic rifles and shotguns for anti-poaching activities are required as well as bolt action rifles for problem animal control (see chapter 12). Ultimately, the success or failure of the anti-poaching force will depend to a large extent on the officer in charge of anti-poaching and the PM himself who needs to provide the necessary motivation and direction essential for a good anti-poaching unit. Apart from the time spent in the field, the area covered and the number of patrols, it has been shown that an important ingredient in successful anti-poaching operations is the amount of information one can gather about how, where and when poaching gangs operate. This can be done relatively inexpensively by setting up a network of informers in the neighbouring villages as well as systematically collecting information from captured poachers. The information needs to be collected and evaluated by the anti-poaching unit with the help of the monitoring unit. The results should then be incorporated into the future planning and organisation of patrols.

13.2.1 Objectives

The objectives are to establish an effective law-enforcement unit with sufficient staff and resources with which to control the reserve and to prevent illegal activities.

13.2.2 Programme of Activities

1. Training of game scouts

Game scouts require additional training in anti-poaching techniques, radio communications, ambush procedures, first aid and the presentation of evidence at court in order to improve their performance and success ratio. The officer in charge of anti-poaching needs to evaluate the present performance of his game scouts and devise an appropriate training programme. This might involve receiving additional expertise from the army, police, AG's office and from the WD game scout training school at Pasiansi. The effectiveness of the anti-poaching units will be monitored by the monitoring and extension unit (see chapter 10).

2. Recruitment of additional game scouts

The present number of game scouts will be increased from 17 to 43. They will be stationed at Zange, Njiro, Kivingo, Umba Darajani and Ndea and operate in groups of 3-5 per patrol. From time to time they will be seconded to mobile field stations which will be located during the dry season near watering points such as the Dindira dam and the Maore and Mabata pans in order to protect them and their wildlife from livestock encroachment and poaching. The PM should also look into the modalities of involving village or community game scouts into law enforcement and intelligence gathering activities. This has to be well thought out and the responsibilities and duties of the village scouts have to be exactly defined. They will also require proper training.

3. Resource requirements

An inventory of resource requirements needs to be done by the officer in charge of anti-poaching which should include field uniforms, camping equipment, binoculars, compasses and maps. A short list of field equipment for game scouts has already been supplied in the chapter on Transport and Field Equipment. The equipment needs to be purchased by the WD or in some cases donated by an aid agency or donor.

4. Establish informer network

The head of the anti-poaching unit will establish a network of informers to provide information on poachers and the illegal wildlife trade in the neighbourhood. He will also liaise with other intelligence gathering agencies such as the police and the CID.

5. Review fines

The current level of fines for poaching and illegal activities are very low and need to be reviewed. The reserve management will together with the WD legal adviser look into ways of increasing the fines to an appropriate level and which will act as a deterrent to law breakers. It is suggested that fines be pegged to the trophy value of the animal concerned.

6. Rewards for capturing poachers

The statistics kept by the reserve management indicate that very few poachers are caught. This could have several reasons, one of which might be that there are no incentives to catch

poachers and seize their firearms and poaching equipment. A system of cash rewards should be instituted for successfully apprehending poachers as well as their equipment. The rewards which the game scouts receive will be graded according to the seriousness of the poaching activity and the danger involved. Such a system has been instituted for the Selous Game Reserve as well as other Protected Areas and the PM should adapt it to the Mkomazi situation.

14.3 International Conservation Agreements Appropriate for the Mkomazi Game Reserve

1) Mkomazi Game Reserve as a Biosphere Reserve

Since Mkomazi Game Reserve aims to conserve the rich biodiversity of a savanna area for the benefit of present and future generations, it is important to emphasise that this objective can only be achieved if the game reserve and its surrounding areas have been integrated into a comprehensive land use plan. In future, the ecological integrity of the Mkomazi Game Reserve will be affected more and more by what type of human activities occur in the neighbouring village areas, forest reserves and open areas. It will therefore be of vital importance for the reserve management to have a say in the management of adjacent areas so as to mitigate any detrimental activities which might occur there and which if not checked which would have a negative impact on the ecological integrity of the game reserve. Examples of such detrimental activities are:

- 1) the destruction of water catchment areas in the Pare and Usambara Mountains which lead to the drying up of water courses in the reserve
- 2) the increase in soil erosion which silt up the dams in the reserve
- 3) the occurrence of wild fires early in the dry season which contribute to bush encroachment
- 4) the overgrazing of grasslands in communal areas which force livestock owners to move their livestock into the reserve in search of grazing
- 5) the unsustainable use of wildlife and other natural resources in adjacent areas which in turn increases illegal use of the resources within the reserve

The solution to these ecological, socio-economic and institutional problems could be the establishment of a Biosphere Reserve which would include the Mkomazi Game Reserve, the surrounding village areas and open areas and the neighbouring Forest Reserves in the Pare and Usambara Mountains. The concept of Biosphere Reserves has been developed by the UNESCO "Man and Biosphere" programme (MAB) which in the year 2000 represented a world-wide network of 368 Biosphere Reserves in 91 countries.

The purpose of a Biosphere Reserve is to conserve the diversity and integrity of biotic communities and to integrate all forms of land use into the management of the entire ecosystem. Biosphere Reserves are to provide opportunities for ecological research, monitoring, education and training. In addition, Biosphere Reserves must involve local populations as much as possible in their management. The criteria for selection and management includes one or more of the following:

- 1) contain representative examples of natural biomes
- 2) include unique communities or areas with unusual natural features or exceptional

interest

3) provide examples of harmonious landscapes resulting from traditional patterns of land use

4) contain examples of modified and degraded ecosystems capable of being restored to more natural conditions.

A Biosphere Reserve should be large enough to be an effective conservation/management unit and to accommodate different uses without conflict. Each Reserve must be approved by the Man and Biosphere International Co-ordinating Council before it can receive the designation of a Biosphere Reserve. For management purposes the Biosphere Reserve is zoned into different categories ranging from a strict protection zone, to a reclamation zone and a use zone incorporating agricultural and livestock activities. If the Mkomazi Game Reserve and adjoining areas become part of a Biosphere Reserve, then it will benefit from the UNESCO structures and expertise such as the Biosphere Reserves Integrated Monitoring System (BRIM) and such agro-industrial products as sawn timber could benefit from added value when it is certified that it was produced in a Biosphere Reserve. The sourcing of aid and the establishment of development projects is also made easier if the area belongs to a Biosphere Reserve.

2) Mkomazi Game Reserve as a Transfrontier Protected Area

Mkomazi Game Reserve shares a common boundary with Tsavo West National Park in Kenya and together with Tsavo East National Park, they protect the largest area of the Somalia-Masai Regional Centre of Endemism in East Africa (24,276 km²). The Mkomazi Game Reserve and Tsavo West National Park have more or less the same ecological characteristics and can be considered as one management unit. Although there are informal meetings between the managers of the two Protected Areas and information is exchanged on such things as poaching activities and joint management actions (at present the demarcation of the common international and Protected Area boundary is being financed by both parties), nevertheless the international border dividing the two Protected Areas constitutes a definite limit to joint operations and management procedures. In future, it would benefit both Protected Areas if regular meetings were held to discuss such issues as law enforcement, infrastructure development, tourism promotion, research and monitoring. Both Protected Areas have similar problems and so it would be beneficial to learn from each others experience and expertise. Mkomazi Game Reserve would particularly benefit from the free movement of tourists between the two Protected Areas as this would increase tourist income for the reserve. The creation of a Transfrontier Protected Area would formalise such co-operation and place it on a sound and long-term footing. The development of a joint tourism strategy linking up both Protected Areas would be particularly useful as would be a common strategy on anti-poaching activities and infrastructure development.

The first Transfrontier Park was created in 2000 in southern Africa when the Kalahari Gemsbok National Park of South Africa and the Gemsbok National Park in Botswana were amalgamated to form the 38,000 km² large Kgalagadi Transfrontier Park. Under such a unified system of control and management, tourists are able to move freely across the international boundary and within the enlarged National Park. Both countries, however retain their territorial integrity and separate legal systems in their respective areas. The

agreement envisages the free movement of tourists and the development of joint management plans. Conservationists throughout the world have welcomed the establishment of the Kgalagadi Transfrontier Park and it is widely perceived as a model for other Transfrontier Parks elsewhere in Africa. The creation of a Transfrontier Park requires the clear commitment by the respective Heads of State if it is going to succeed because each Transfrontier Park must be supported by an international agreement between the two countries, by a record of understanding between the Wildlife Departments concerned and by a management plan which will determine the day to day running of the Transfrontier Park. The creation of a Transfrontier Park also requires adequate political support at the national as well as at the local level and Government agencies such as customs and immigration, police, national security etc. need to be consulted. Where Transfrontier Parks have been created usually a significant proportion of tourist revenue is ploughed back into the management of the Transfrontier Park and the development of neighbouring community projects. The advantages of a Transfrontier Park are:

- 1) the potential to increase revenue and jobs from tourism is considerably greater than if each of the Protected Areas continues to operate in isolation
- 2) considerable savings in costs if capital equipment and infrastructure are shared
- 3) an increase in the size of Protected Areas reduces the chance of local species extinctions which comes from habitat fragmentation and isolation
- 4) improved management with sharing of equipment, managerial and research staff, tourist reservations and tourism marketing across international boundaries
- 5) cross-border co-operation should ensure better control of such problems as fires, poaching, security and smuggling
- 6) investment opportunities are created or improved for private/public sector partnerships which wouldn't have been there before.

14.4 Programme of Activities

1. Evaluate the establishment of a Biosphere Reserve

The WD should hire a consultant to establish the feasibility of creating a Biosphere Reserve which incorporates the Mkomazi Game Reserve, the Forest Reserves in the Pare and Usambara Mountains and the adjoining village and open areas. The consultant needs to identify boundaries, land use options, funding and management procedures. The proposal needs to be sent to the MAB Co-ordinating Council for approval.

2. Evaluate the establishment of a Transfrontier Protected Area

The WD should employ a consultant to evaluate the feasibility of incorporating the Mkomazi Game Reserve and the adjoining Tsavo West National Park in Kenya into a Transfrontier Protected Area. The report should clearly spell out how such a Protected Area will be managed and the benefits which accrue from such joint management as far as tourism, reserve management and biological conservation are concerned. The example of the Kgalagadi Transfrontier Park which has recently been created between South Africa and Botswana needs to be evaluated and where necessary the steps taken to create such a Transfrontier Park adapted to suit Tanzanian and Kenyan conditions.

Part 4 - Revenue and costs

15. Income from Tourism

One of the objectives of this management plan is to increase the revenue from tourism, which at the moment is totally inadequate, to the point where the reserve can finance a substantial part of its budget through tourist income. The reasons for insufficient tourist income is that there are no acceptable tourist facilities in the reserve and that the current low wildlife populations cannot attract the same number of visitors as do the more attractive and famous Protected Areas in the northern tourism circuit. The current source of tourism income is from entrance and camping fees. Visitors come for game viewing, they come on average for one night, camp bringing their own equipment and drive or walk around within a few kilometres of the camp.

The principal strategy of this plan is to increase revenue through providing different kinds of tourist accommodation and to diversify the number of possible tourist activities. The current 6 month tourist season also needs to be extended to the entire year (the basis for this has already been achieved by the recent construction of an all-year round road network). The range of accommodation and activities has been identified as:

- ✘Lodge concession
- ✘Banda rentals
- ✘Camping sites
- ✘Wildlife field centre

In order to attract potential lodge owners and tour operators to invest in the Mkomazi Game Reserve and to bring tourists to this forgotten and rather isolated wildlife area, the WD needs to offer attractive investment incentives over and above those that are being offered for other wildlife areas. Such incentives for example could include one or more of the following:

- 1) long-term leases
- 2) reduced fees (bed night fees or a percentage of gross income fees)
- 3) reduced concession rates

The WD and the reserve management also needs to review the current tourism fees which were posted in November 1997 and which are far too high, inappropriate and do not provide good value for money. Instead of attracting the tourists to the reserve, the current price schedule deters tourists. It is suggested that the WD staggers its park entrance and camping fees according to the location and attraction of the game reserve. This means that less well known reserves such as Mkomazi should charge less than for example the more famous Selous Game Reserve or a similarly well known National Park. There are also striking anomalies in the present schedule which need to be changed. For example, there is no difference in infrastructure between an ordinary and special camp site and yet the current schedule charges double for a special camp site. A charge is also made for the use of walking trails although no walking trails exist and an adequate charge is made for walkers when they take out a guide. Although there is no difference between an official guide and a walking safari guide a tourist has to pay double the going rate for a walking safari guide. The

problem with guides is made even worse as the present guides do not have any specific training nor do they speak English which makes it difficult for them to communicate with their visitors (this is especially important in times of danger!).

The following chapter discusses the possible tourist activities in detail, projects financial returns to the reserve and recommendations are made for suitable entrance and lease fees. The current number of visitors to the reserve is negligible being approximately 100 persons per year of which 23% are foreigners, 47% foreign residents and 29% citizens. While most foreigners and foreign residents camp, approximately 85% of all citizens only come for the day and leave the reserve in the late afternoon. Therefore, in the revenue calculations, the citizen category has been left out as they contribute so little to overall income projections.

The revenue forecasts predict a substantial increase from the current \$ 1,014 to \$ 106,682 over the lifespan of this 5 year management plan but the increase hinges on the development of a lodge and a wildlife field centre. What the predictions also demonstrate is that Mkomazi has the potential to generate a significant amount of revenue if properly managed and developed. If it can be achieved over the relatively short period of 5 years needs to be seen since that will depend on several key factors. These are:

- 1) the sourcing of bona fide investors and the building of a lodge and a wildlife field centre (these activities alone account for 81.2% of the total income)
- 2) the publicity required to interest tour operators, tourists and students to visit the reserve
- 3) acceptance of the proposed pricing strategy and investment proposals by the reserve management and the WD
- 4) the wholehearted support of the WD in completing the rehabilitation of the reserve

The current predictions are based on the following price schedule. The current price schedule has been changed and some of the prices have been reduced in order to make Mkomazi more competitive and to give better value for money. No changes have been made for citizens and other charges such as filming, aircraft landing fees etc. need to be evaluated as developments occur.

Proposed Fees

Adult foreign resident	\$ 5
Adult foreigner	\$ 10
Child foreign resident	\$ 2.5
Child foreigner	\$ 5
Vehicle Tanzanian registered	\$ 5
Vehicle foreign registered	\$ 7.5
Adult foreign resident camping	\$ 5
Adult foreigner camping	\$ 10
Child foreign resident camping	\$ 2.5
Child foreigner camping	\$ 5
Special camping site - per site	\$ 120
Adult foreign resident banda	\$ 10

Adult foreigner banda	\$ 20
Child foreign resident banda	\$ 5
Child foreigner banda	\$10

15.1 Camping

The reserve management needs to set aside: a) ordinary camp sites, b) special camp sites and c) provide adequate facilities suitable for each type of camp site (see chapter 7 on tourism). Special camp sites are exclusive and only one party at a time may use them. In the calculations on income a ratio of 30% foreigners to 70% foreign residents has been taken as the average for the ordinary camp sites and 50% foreigners and 50% foreign residents for the special camp sites. The number of visitors using ordinary camp sites at the moment are approximately 70 which is predicted to increase to 175 within a five year period. The income from ordinary camp sites will therefore increase from \$ 455 to \$1,138 in the fifth year. The income from the special camp site is predicted to begin in the second year and rise from \$ 1,200 to \$3,000 in the fifth year. The first year does not show an income as the special camp site still has to be fitted with water and toilet facilities.

1)Income Projections for Ordinary Camp Site

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
No. of visitors	70	100	125	150	175
Income (\$)	455	650	813	975	1138

2)Income Projections for Special Camp Site

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
No. of groups	0	10	15	20	25
Income (\$)	0	1200	1800	2400	3000

3) Total income

Total Income (\$)	455	1850	2613	3375	4138
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15.2 Banda Rentals

It is proposed that the present Ibaya research camp be turned into 3 bandas, a kitchen, a dining area, toilets and ablution block. The management plan proposes that an aid agency such as the EU finances the construction of the bandas. Each banda contains two beds and will be rented out on a daily basis with foreigners paying \$ 40 per day and foreign residents \$20 per day per banda. The calculations have been made on a ratio of 50% foreigners to 50% foreign residents. The bandas should be built in the first year of the management plan and therefore there is no income for that year. The projections predict an initial occupancy rate of 5% in the second year, rising to 20% in the fifth year. By the end of the five year period the bandas should be generating \$ 6,570 per year. In time the WD might want to divest itself of the bandas and lease them to a private operator to develop and manage.

Potential Projections for the Bandas

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
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Occupancy rate (%)	0	5	10	15	20
Bed/nights	0	110	219	329	438
Total Income (\$)	0	1643	3285	4928	6570

15.3 Wildlife Field Centre.

The chapter on tourism proposes the establishment of a student camp which offers short courses in wildlife management and conservation. The predictions for this venture come from experience gained by The School for Field Studies in Athi River, Kenya (pers. comm. Sommerlatte, 2001). The camp will have an initial capacity of 10 beds but with time this could be enlarged to twenty. Visitors will come on a 14 –21 day field course and the rate per visitor is \$120 per person per day. It is envisaged that 10 courses per year will be initially offered increasing to 14 if the demand warrants it. The initial occupancy rate has been fixed at 40% in the third year and increasing to 50% in the fifth year. The first two years will be spent constructing the camp, recruiting staff, acquiring teaching equipment, developing courses and teaching materials and marketing the courses overseas as well as in East Africa. The WD will have two sources of income from the camp. One is a % of the gross annual income and the other one is a land rent or concession fee. The percentage gross income starts at 5% in the third year when the camp becomes operational and rises to 10% in the fifth year. The land rent or concession fee is an annual fee starting in the third year with \$ 2500 and rising to \$5000 in the fifth year. The camp does not generate any income in the first two years but in the third year it is predicted at \$ 5,860 and increasing to \$ 16,760 in the fifth year.

Potential Projections for the Wildlife Field Centre

	Yr.1	Yr.2	Yr.3	Yr.4	Yr5
No.Courses p.a.	0	0	10	12	14
Occupancy Rate (%)	0	0	40	45	50
Bed/nights	0	0	560	756	980
Grosse Income (\$)	0	0	67200	90720	117600
% of Gross Income	0	0	5	7.5	10
% of Gross Income (\$)	0	0	3360	6804	11760
Land rent (\$)	0	0	2500	3500	5000
Total Income (\$)	0	0	5860	10304	16760

15.4 Lodge Concession

The management plan envisages that one lodge will be built during the duration of the present management plan. The lodge will have a capacity of 20 beds and charge a rate of \$ 200 per person per day. The lodge projections made in this management plan are based on a consultancy done by Silvester and McIntyre (1995) for the Director of Wildlife. The lodge will be built in the first two years of the management plan and marketed abroad so that no income to the reserve is envisaged during this period. For the third year an occupancy rate of 15% has been incorporated rising to 25% in the fifth year. The income to the reserve is from two sources. First there is a % of the gross annual income and secondly there is a land rent or concession fee. The % gross income starts in the third year when it is 5% and rises to 10% in the fifth year. The land rent starts in the third year at \$ 5,000 and increases to \$ 10,000 in the fifth year. While the % gross income is variable, the land rent is fixed. The total income to Mkomazi from the lodge is \$ 15,950 in the third year and increasing to \$ 46,500 in

the fifth year.

Potential Projections for the Lodge

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
Occupancy rate (%)	0	0	15	20	25
Bed/nights	0	0	1095	1460	1825
Gross Income (\$)	0	0	219000	292,000	365,000
% of Gross Income	0	0	5	7.5	10
% of Gross Income (\$)	0	0	10950	21900	36500
Land rent (\$)	0	0	5000	7500	10000
Total Income (\$)	0	0	15950	29400	46500

Entrance Fees and Vehicle Charges

A further source of income is entrance fee and vehicle charges. These can be quite substantial, especially when the lodge and wildlife field centre are in operation (approximately 84% of all entrance fees can be attributed to the lodge and field centre).

1) Potential Projections for Entrance Fees

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
Campers	455	1100	1488	1875	2263
Bandas	0	688	1369	2056	2738
Wildlife Field Centre	0	0	5180	6993	9065
Lodge Visitors	0	0	10129	13505	16881
Total Income (\$)	455	1788	18166	24429	30947

2) Potential Projections for Vehicle Charges

The projections for vehicles include charges for persons coming in their own vehicles such as campers, users of the bandas and some of the lodge visitors. Most of the lodge visitors will be either flying in or being brought to the lodge with lodge vehicles while the same applies to visitors to the wildlife field centre. Projections for aircraft use have not been made and are not included in the calculations.

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
Campers	104	269	366	469	566
Bandas	0	175	344	513	688
Wildlife Field Centre	0	0	0	0	0
Lodge Visitors	0	0	308	411	513
Total Income (\$)	104	444	1018	1393	1767

15.5 Total Income from Tourism

	Yr.1	Yr.2	Yr.3	Yr.4	Yr.5
Camping	455	1850	2613	3375	4138
Bandas	0	1643	3285	4928	6570
Wildlife Field Centre	0	0	5860	10304	16760
Lodge	0	0	15950	29400	46500
Entrance Fees	455	1788	18166	24429	30947
Vehicle Charges	104	444	1018	1393	1767

Total Income (\$)	1014	5725	46892	73829	106682
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If the predictions are correct then the lodge will generate an income over the next five years of \$ 91,850 which is 59.8% of the total income of \$153,631 (excluding entrance fees and vehicle charges). The wildlife field centre will produce an income of \$ 32,924 or 21.4%, the bandas \$ 16,426 or 10.7% and campers \$ 12,431 or 8.1%. This shows the importance of developing a lodge and a wildlife field centre in the reserve as soon as possible as together they contribute 81.2% to the total predicted income.

16. The Budget Schedules

The budget runs for the entire 5 year management plan. The budget schedules have been split between: a) Capital expenditure and b) Running costs. The budget does not include salaries which are paid by the Government. Capital expenditure is paid for by the Central Government, the WD and donors (Trust). Running costs are paid for by the WD and by donors (Trust). The retention scheme would pay for some of the capital expenditure as well as for some of the running costs. Capital expenditure is based on the list of buildings, equipment and vehicles which has been provided in previous chapters.

Capital expenditure

Items	Cost (\$)	Comments
1. Vehicles and transport	259500	This includes rehabilitation and purchase of new vehicles
2. Plant and utilities	37500	This is the purchase of new plant
3. Workshop equipment	6970	For Zange HQ's only
4. Field equipment	18970	For game scouts
5. Firearms	8700	
6. Research and monitoring	2410	
7. Anti-poaching equipment	5000	Special anti-poaching equipment
8. Game capture equipment		- Is already available/Trust
9. Radio communications	22750	
10. Office equipment	4340	
11. Roads and firebreaks	35000	This includes new roads only
12. Dams and boreholes	171000	This only includes new dams and boreholes
13. Camping sites	3700	This is for one ordinary and one special camp site
14. Airstrips and hangars	7500	
15. Furniture and fittings	35000	
16. Buildings and outposts	356666	
17. Game fencing		- No new expenditure foreseen
18. Training courses	10000	
19. Contingencies	49217	5% of total costs
Total	1033557	

The total capital expenditure is \$ 1,033,557 over a 5 year period, or \$ 206,711 p.a. The greatest portion of this expenditure is made up of buildings and game scout outposts (34.5%), vehicles and transport (25.1%) and dams and boreholes (16.5%). Income from tourism is scheduled to reach approximately \$ 100,000 p.a. in the fifth year of which 50% should be retained by the reserve and flow back into developing the Mkomazi game reserve. That means, approximately \$ 50,000 is available for capital expenditure and running costs. If the \$ 50,000 is split up evenly between capital expenditure and running

costs, there would remain a deficit of \$ 181,711 p.a. This gap can only be filled by donors and the WD. Since this would be difficult to achieve, the only solution to the problem is to spread the expenditure over a 10 year period with annual expenditure then coming down to \$ 103,356 or to substantially reduce capital expenditure. Considerations should then be given to reducing the building and vehicle budget line.

The annual running costs are \$ 119,491 of which 29.3% are used up by vehicle maintenance, 14.9% by building maintenance and 14.1% plant maintenance. If one deducts the \$ 25,000 from the retention scheme from the annual running costs, then approximately \$ 94,491 needs to be found from either the WD or the donors or both. On the other hand, if one reduces building and vehicle expenditure then running costs will also be substantially be reduced.

Running costs

Items	Running cost (\$)	Comments
1. Water and energy	3524	4 generators and 3 water pumps
2. Fuel for vehicles & transport	8800	9, 4 WD vehicles and 2 trucks
3. Fuel for plant	10880	1 tractor, 1 grader and 1 rotor slasher
4. Maintenance of vehicles & transport	35000	9, 4 WD vehicles and 2 trucks
5. Maintenance of plant	16850	1 tractor, 1 grader, 1 water bowser, 1 slasher, 1 tra
6. Maintenance of buildings	17833	5% of costs
7. Maintenance of roads & boundaries	11620	156 km of roads p.a. and boundary beacons
8. Maintenance of airstrips & hangars	2500	2 airstrips p.a.
9. Maintenance of field equipment & firearms	1384	5% of costs p.a.
10. Maintenance of communications	2275	10% of costs p.a.
11. Maintenance of camping sites	185	5% of costs p.a.
12. Maintenance of dams & boreholes	8640	18 days at \$ 480 p.day
Total	119, 491	

17. Long-Term Funding and Development

The successful implementation of the management plan hinges to a large extent on the availability of adequate funding for the different management programmes. The current five year management plan proposes that the management programmes will be financed by a variety of institutions including the WD, aid agencies, the Wildlife Preservation Trust Fund and the private sector. This combination of financiers might be feasible in the short-term but in the long-term the WD will have to bear the responsibility of providing sufficient funding to maintain and develop the reserve. The previous chapter has shown the amount of income which Mkomazi can generate in the long run and this is more than adequate to finance development costs. It is therefore proposed that a retention scheme be created for the reserve which will form the basis for long-term funding.

17.1 Present Situation

At the moment, the Mkomazi Game Reserve is underfunded and therefore the reserve management cannot fulfill its management and conservation obligations. This is particularly true for law enforcement and essential equipment. The current budget for the Mkomazi Game Reserve is approximately T.Sh. 40 mil. or \$44,444 per annum which is insufficient to

cover the operating costs of vehicles, the development of infrastructure and the payment of night-out allowances.

17.2 Objectives

The objective of a long-term funding programme is to enable the reserve management to finance a substantial part of the development and recurrent activities through income derived from tourism receipts.

17.3 Programme of Activities

1. Creation of a Retention Scheme

The management plan proposes the establishment of a retention scheme which will retain 50% of the revenue generated by tourism. Such a retention scheme has been implemented for the Selous Game Reserve (Sommerlatte, 1992) and several other game reserves in southern Tanzania. The experience that the WD has had with retention schemes has been positive as it improves management and the development of the Protected Area. In the past all wildlife revenues have gone to the Finance Ministry and as a consequence many of the game reserves have been run down because they have been allocated insufficient funds. This has now changed and income from tourism and wildlife utilization is split up between the Treasury and the WD which channels money back into wildlife conservation.

In a recent study by Price Waterhouse (1991) for Uganda it was shown that the ability of a Park or Game Reserve to retain and manage its own budget is the best way of motivating park managers to maximise their income. If revenue raised locally is reinvested in the game reserve, then a direct link has been established between conservation efforts, staff welfare and the development of the reserve. The Mkomazi retention scheme should be used to finance activities which will improve reserve surveillance and law enforcement, develop and maintain reserve infrastructure and equipment, sustain staff welfare and maintain a monitoring programme.

Part 5 - Implementation of the management plan

18. Activity Schedules and Responsibilities

The basis for the following series of activities is laid down in the Mo U signed between the Trust and the Ministry of Tourism & Natural Resources in 1995 and also the discussion involved whilst preparing this management plan between the Project Manager of MGR, the Field Director of WPTF and the Consultant.

Tourism

Activities	Indicators	Responsibility
1 Tourist Facilities		
1.1 Provide guidelines for lodge site and wildlife field centre	One lodge and one wildlife field centre built	PM and Trust
1.2 Contact investors/institutions and show them the MGR and potential sites	Ibaya rehabilitated and functioning as self-service bandas	WD and Trust

1.3 Complete lease agreements with investors/institutions	Three ordinary camp sites and two special camp sites built with facilities	WD
1.4 Source aid agency to rehabilitate the Ibaya centre and turn it into self catering bandas	Visitor centre completed and functioning	WD and Trust
1.5 Choose appropriate ordinary and special camp sites and develop facilities accordingly	MoU with FD on use of Forest Reserves	PM and Trust
1.6 Furnish and complete the visitor centre at Zange HQ's	New fee structure in place and booking arrangements functioning	PM
1.7 Liaise with FD in the use of the FR's for tourism and walking safaris	EIA's completed where appropriate	PM
1.8 Review fee structures and booking arrangements		PM
1.9 Conduct EIA's where appropriate		Consultant
2 Publicity		
2.1 Produce brochure, map, web site of MGR and distribute		Consultant and Min. Tourism
2.2 Place signboards at strategic roads and junctions to the entrance of the MGR	One brochure, map and web site produced	Administrator/Works
2.3 Write up guide to the MGR and sell at visitor centre and other outlets	Appropriate signboards constructed and erected	Wildlife NGO and Comm/Monitoring
2.4 Write up articles for newspapers and tourist magazines and do radio programmes	One tourist guide to the MGR completed	Comm/Monitoring
3 Game Circuit	At least 3 articles per year and 2 radio programmes on MGR activities	
3.1 Contact tour operators and travel agents about banda and camping facilities		PM and Trust
3.2 Bring them to the MGR and show them the facilities and game viewing opportunities		PM and Trust
3.3 Incorporate the rhino sanctuary when appropriate into the game viewing and education circuit	At least 5 operators and 3 travel agents shown around	Trust and Comm/ Monitoring
4 Guide Training	Rhino sanctuary incorporated into tourism and education circuit	
4.1 Develop training programme and schedules		PM and Private Operator
4.2 Select suitable game scouts for training	At least 8 game scouts trained as guides	PM
4.3 Train game scouts as guides		PM and Private Operator

Community conservation

Activities	Indicators	Responsibility
1 Cooperation		
1.1 Attend regularly Government meetings at district and ward level	Attended regularly appropriate meetings	PM
1.2 Attend village meetings where	Joint Conservation/ Management	PM and Trust

wildlife is an issue	Committee established and functioning	
1.3 Establish committee between MGR and village representatives where wildlife problems are discussed		PM
2 Awareness		
2.1 Explain wildlife and reserve values at village meetings and public functions		GMO /Comm. & Mon.
2.2 Take community members to the MGR and show them facilities and work in progress	Attend regularly at village meetings	GMO/ Comm. & Mon. and Trust
2.3 Encourage sporting activities between reserve personnel and villagers	Conduct at least 6 trips per year for	GMO/ Comm. & Mon. and Trust villagers to MGR
2.4 Produce film/video on Trust and MGR activities	Hold regular sporting events	Trust and PM
3 Benefits	One 30 min. video or film produced on Trust and MGR activities	
3.1 Conduct socio-economic survey and PRA on surrounding communities		NGO
3.2 Identify community areas and villages, projects and priorities		NGO and GMO/ Comm.
3.3 Establish community fund from tourism income to finance some community projects		PM and NGO
3.4 Contact aid organisations to undertake community projects	Survey completed of all relevant areas and communities	WD and PM
3.5 Employ as many people from the community in MGR development and tourism projects	Development priorities established and communities and areas identified	PM, Trust and Lodge Owners
4 Land Use	Donor identified and starting projects	
4.1 Evaluate the feasibility of creating Limited Access Zones	At least 50 people employed in MGR on a part time or regular basis	Consultant/NGO and PM
4.2 Train members of the community in resource use	One pilot scheme started and evaluated	Consultant/NGO and GMO/Comm.
4.3 Install licensing system and quota allocation for resources	Training of up to 20 villagers in resource use Licensing system installed and resource quota established	Consultant/NGO and GMO/ Comm.

Habitat and wildlife management

Activities	Indicators	Responsibility
1 Vegetation		
1.1 Establish firebreaks around areas to be burnt or to be totally protected		AGO/ Admin & Works and Trust
1.2 Controlled late burning of grassland areas and "mbugas"	Essential firebreaks established and maintained	AGO/ Admin. & Works and Trust
1.3 Protection of forest and riverine vegetation with early burning if necessary	Controlled burning programme installed and functioning	AGO/Admin. & Works and Trust

1.4 Bush clearance of campsites, lodges and key wildlife areas	Key areas cleared of bushes and scrub	AGO/Admin. & Works and Trust
2 Wildlife		
2.1 Increase number of rhinos in sanctuary and wild dogs in breeding pens	Breeding of rhino and wild dog successful	Trust
2.2 Rehabilitate and desilt existing dams and pans	All existing dams and pans rehabilitated	AGO/Admin. & Works and Trust
2.3 Build new dams and create pans /watering points where necessary	2 new dams and/or pans established	AGO/Admin. & Works and Trust
3 Soil Erosion		
3.1 Survey eroded areas and choose appropriate reclamation techniques		NGO and AGO/ Admin. & Works
3.2 Reclamation of key eroded areas and gulleys	3 eroded gulleys re-habilitated	NGO and AGO/Admin. & Works
3.3 Replant some of the forest areas	2 forest areas replanted	NGO and AGO/Admin. & Works
4 Problem Animals		
4.1 Create a PAC unit	1 PAC unit established, trained and functioning	PM and AGO/Anti-Poaching
4.2 Select and train members of the PAC unit		AGO/Anti-Poaching
4.3 Equip and arm the unit		WD, PM, AGO/Anti-Poaching

Research and monitoring

1 Research		
1.1 Identify gaps and draw up priorities for a research programme	Research programme established and written up	GMO/Comm. & Monit.
1.2 Write up research proposals and distribute to research institutions	On-going management related research	GMO/Comm. & Monit.
1.3 Conduct research which is pertinent to the management of the MGR		Research Institutions
2 Monitoring		
2.1 Establish priorities and monitoring programme	Monitoring programme established	GMO/ Comm. & Monit. And Consultant
2.2 Train staff to collect data, evaluate and present it	Staff trained and suitably equipped	GMO/ Comm. & Monit. and consultant
2.3 Monitor elephant populations and other key species	Monitoring of wildlife and vegetation done on a regular basis	TWCM and GMO/ Comm. & Monit.
2.4 Monitor grassland burning programme and vegetation trends		GMO/Comm. & Monit.
2.5 Monitor poaching activities and law enforcement		GMO/ Comm. & Monit.
3 Management Plan and Reserve Boundaries		
3.1 Evaluation of past research results and incorporation into management plan	Past research data analysed and incorporated into management plan	GMO/ Comm. & Monit.
3.2 Production of maps for management purposes	Production of maps showing wildlife, vegetation and soils distribution	GMO/ Comm. & Monit.
3.3 Review boundaries along the Umba river and extend if possible	Report on boundary extension	GMO/ Comm. & Monit. and PM

Reserve infrastructure

1 Buildings and Office Equipment		
1.1 Expand Zange HQ's to accommodate additional staff	All staff have appropriate accommodation	AGO/ Admin. & Works and donors

1.2 Rehabilitate Njiro and expand to accommodate additional staff	Njiro rehabilitated	Same as above
1.3 Expand Kivingo to provide accommodation and office space	Kivingo expanded	Same as above
1.4 Rennovate Umba Darajani and provide additional accommodation	Umba Darajani rennovated	Same as above
1.5 Establish new game post at Ndea	Ndea established	Same as above
1.6 Purchase office equipment for Zange and other outposts	Office equipment purchased	Same as above
1.7 Purchase office equipment for visitor and community centre	Visitor and community centre furnished	Same as above
2 Communications, Utilities and Roads		
2.1 Equip Zange HQ's and outposts with appropriate radio equipment		AGO/ Admin. & Works and Trust
2.2 Install at Zange a proper water supply as well as at other outposts	Zange properly equipped and with a water supply	Trust
2.3 Maintain existing road network in the west and all access roads	Existing road network maintained	AGO/Admin. & Works and Trust
2.4 Create new roads in the central and southern part of the reserve	New roads created in central and southern part	Same as above
2.5 Maintain present number of airstrips	Old airstrips maintained and new one built	Same as above
2.6 Build new airstrips at suitable locations		Same as above
3 Boundaries		
3.1 Maintain international boundary with KWS	Intentional boundary maintained	PM and KWS
3.2 Maintain all other reserve boundaries	All other boundaries maintained	AGO/ Admin. & Works
3.3 Check the alignment of the Ndea/Maji ya Juu boundary	Alignment checked and verified	Gov. surveyors

Transport and field equipment

Activities	Indicators	Responsibility
1 Transport		
1.1 Rehabilitate all existing vehicles if feasible	All vehicles rehabilitated and roadworthy	WD and PM
1.2 Purchase new vehicles as set down by management plan	New vehicles bought according to mgmt. Plan	WD, PM and Donors
2 Plant		
2.1 Purchase tractor, water bowser, trailer and rotor slasher	Plant purchased	WD, PM and Donors
2.2 Provide outposts with water and water storage tanks	All outposts with water containers and functioning water supply	AGO/Admin & Works
3 Workshop		
3.1 Build workshop at Zange HQ's	Zange workshop completed	AGO/Admin & Works and Donors
3.2 Equip with necessary tools and equipment	Workshop equipped	Same as above
4 Field Equipment		
4.1 Make an inventory of existing equipment and supplement when necessary	Game scouts on patrol suitably equipped	AGO/Anti-Poaching
4.2 Purchase additional firearms and	Firearms functioning and	WD and PM

repair old ones

additional ones purchased

Administration and law enforcement

Activities	Indicators	Responsibility
1 Administration		
Select, recruit and employ appropriate personnel according to the management plan	Appropriate personnel employed according to mgmt plan	PM and AGO/Anti-Poaching
1.1 Identify training needs and establish training programme for		
1.2 staff	Training programme established	AGO/Anti-Poaching
Train staff in computer use, accounting, monitoring and record		
1.3 keeping	Regular training courses on line	Training Institutions
2 Law Enforcement		
Select and recruit additional game scouts and deploy to respective stations	Game scouts recruited and deployed according to mgmt plan	WD, PM and AGO/ Anti-poaching
2.1 Identify training needs and train game scouts in law enforcement, field techniques and court		
2.2 procedures	Training of game scouts on line	AGO/Anti-Poaching
	Informer network around southern boundary established and functioning	AGO/Anti-Poaching
2.3 liaise with village communities	Village game scout system established around Kisiwani and functioning	AGO/Anti-Poaching
2.4 if feasible		

International conservation agreements

Activities	Indicators	Responsibility
1 Biosphere Reserve		
1.1 Assess the MGR and neighbouring areas and write up proposal	Consultant's report recommending Biosphere Reserve	Consultant, PM and WD
1.2 Submit proposal to the MAB secreteriat	Biosphere Reserve proposal submitted and accepted	WD and PM
1.3 Establish area as a Biosphere Reserve		WD
2 Transfrontier Protected Area		
2.1 Assess the MGR and TSN and write up proposal to WD and KWS	Consultant's report submitted	Consultant, PM and KWS
2.2 Discuss proposal with appropriate authorities and begin negotiations	Planning of TPA completed and agreements finalised	WD, GoT and GoK
2.3 Work out administration and management of the TPA	TPA established	WD, GoT and GoK
2.4 Establish TPA and implement joint management		WD, GoT and GoK

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