# PRINCIPLES AND POLICIES

## INTRODUCTION

In Chapter 1 the broad conservation philosophy adopted for the MNR is given. According to these guidelines the approach towards management is dictated by the ultimate objective of rehabilitating and conserving the MNR ecosystems in their most pristine state possible. In pursuing this course it is accepted that the current situation pertaining to the MNR is largely dominated by:

- a collection of farms that have been physically and biologically impacted, to a more or lesser degree, by past land-use practises;
- the confinement of animals to fenced subdivisions which do not necessarily represent ecological units, and
- the suppression of natural processes due to the unplanned provision of water and the exclusion of veld fires.

## ECOLOGICAL GUIDELINES FROM THE PAST

To gain a perspective of the position occupied by the MNR in a broader ecological context it is necessary to take the geomorphological features and their associated biota over a much wider geographical region into account.

Much of the eastern sector between the Soutpansberg Mountain Range and the Limpopo River is dominated by granite and sandstone formations. The soils derived from the granites are generally shallow, stony , nutrient poor and support a poor grass cover. Soils derived from sandstone often result in deep sands with a better grass cover than the granitic soils. However, the quality of the grazing is not particularly high. In both cases local patches of loam soils – derived either from intrusive rocks or the leaching of clay minerals – are found that produce better quality grazing.

The MNR falls entirely within the land types outlined above.

The Malonga Plains, to the south of the MNR and to the east of Tshipise, are characterised by major outcrops of basalt. These outcrops form the northern extreme of the broad band of basalt that stretches down the eastern half of the Kruger National Park. The area encompassed by the basalt is generally flat, or only very mildly undulating, the soils are deep and black in colour and are high in clay content. These soils are highly fertile and support a lush grass cover with several highly favoured and nutritious food plants. This area is known as the Malonga Plains.

The major area of the Malonga Plains is currently subjected to agriculture, notably cattle ranching, and a scattering of human settlements. The area is devoid of any large wild mammals.

The rainfall of the entire area north-east of the Soutpansberg is relatively low, with a mean annual rainfall of 200 - 300 mm along the Limpopo Plain and 300 – 400 mm in the northern foothills of the Soutpansberg range (Midgely et al 1990). This places the area in the category of semi-arid.

Prior to human exploitation the perennial water resources of the area were limited to five rivers, i.e. the Sand, Nwanedzi, Mutale, Nzhelele and Limpopo. Of these the Sand River, for the most part, formed the western boundary of the area under consideration and the Limpopo River the northern and eastern boundaries. The Nzhelele River serviced much of the central region and the Nwanedzi and Mutale rivers the south-eastern regions. Though the Limpopo and Sand rivers were not truly perennial they retained a flow of water for much longer periods than currently and also maintained several perennial pools.

The perennial water resources of the rivers were further augmented by a widespread scattering of springs.

To manage the MNR towards a situation emulating its erstwhile pristine state a broad ecological picture needs to be created and interpreted to provide guidelines for determining the management priorities for the area. In this respect the evidence presented by the two pioneers to the area (see ---) can play an important role and a number of deductions may be made of the generalised ecological patterns that once existed in the area. The rehabilitation of the MNR and the reinstatement of these patterns may then be accepted as the ultimate objective for determining management policies and priorities.

From the evidence presented it is probably reasonable to assume that the following was the case in more pristine times:

*Water resources*
It is most likely that the network of rivers and perennial springs, together with ephemeral pans, provided sufficient water to allow most large mammal species free access to most areas of the region north of the Soutpansberg and east of the Sand River. However, in the absence of the large number of artificial water resources presently established in the area it may also be accepted that water resources were more limited during the dry winter months and that game concentrations were consequently higher and more localised around the perennial resources during dry seasons, and more especially during prolonged droughts.

It is also probable that there was a clear pattern of contraction and expansion in the utilization of habitats by herbivores during the drier and wetter periods, respectively. In consideration of the proximity of the rich grasslands on the basalt soils of the Malonga Plains the possibility of seasonal migrations of at least some species should also be taken into account.

*Vegetation*
From various sources (photographs, pioneers, etc) it would appear that the general features of the physiognomy (structure) of the woody vegetation have not changed over the years. Most changes brought about appear to be areas that have been bush cleared, eg cultivated lands (both under irrigation and dry lands), and for human and stock habitations. Clearings for lands are most obvious on the flood plains of the Nzhelele River though evidence of old disused lands and habitations are widespread throughout the MNR. Where such areas fall into disuse they are rapidly invaded by *Acacia tortilis,* in shrub and small tree growth forms.

Due to the extensive stock farming practises (primarily cattle) of the past the woody vegetation has remained relatively unscathed and for most parts of the MNR probably represents a situation close to what it was 100, and more, years ago. If anything, there has probably been an increase in the density of the woody vegetation.

The field layer (grass sward) is the component of the vegetation that has been subjected to the most ecological stress through heavy and continued overgrazing.. It is, therefore, likely that the structure (density, basal cover, height, etc) and species composition may have undergone changes over a period of time. However, the skeletal soils of the granitic areas and the deep sands in the sandstone areas, together with the low rainfall, are not expected to provide particularly good grazing , even under locally optimal conditions.

The riparian vegetation of the Nzhelele River on the MNR remains predominantly natural. However, the riparian vegetation of all the rivers in the region was significantly affected by the high floods of February 2000. Although the floods were considered to be a natural phenomenon, their impact was most probably amplified by upper catchment land use. The brecent incursion of exotic vegetation along water courses in disturbed areas should be noted, as well as the increased thickets of Bitterbush (*Pechuel-Loeschea leubnitziae*).

*Herbivore and carnivore populations*
In accordance with the observations of the two 'old-timers' (see ---) the land types supported by the granite and sandstone formations are most suitable for browsers and mixed feeders (browsers and grazers) with generally low densities and scattered pockets of grazers.

The reports by Fourie and Van der Walt (*pers comm.*) of high concentrations of kudu and impala could have been expected. The abundance of browse and geomorphological features of the area are well suited to kudu and presently still carry particularly high densities of this species.

The hilly country of especially the Dover Section with its scattered springs, could also have provided suitable habitats for sable antelope and waterbuck. The reference to wildebeest and zebra as 'abundant' by Fourie (*pers comm*.) but not by Van der Walt (*pers comm*.) may well reflect the impression gained from scattered herds in suitable, but localised, habitats. The differences of opinion may also have arisen from the possibility of seasonal migrations.

Species regarded as 'rare' by the two sources referred to above were roan antelope and elephant. In addition, Van der Walt (pers comm.) also listed eland, wildebeest, zebra and buffalo as rare. These observations are significant and may reflect the broader, uninterrupted ecological picture of the time. Both gentlemen alluded to the fertile Malonga Plains as the area with the major game concentrations and the source from which some species siphoned to the area currently encompassed by the MNR. In many respects this resembles the situation found in the northern regions of the KNP between the basalt plains, in the east, and the granite landscapes in the west.

The impression gained from the interviews with Fourie and Van der Walt (pers comm.) was that the species regarded by them as 'rare' were mostly lone bulls and bachelor groups, with very few breeding herds.

The only apparent anomaly between the observations of Fourie and Van der Walt is their reference to eland as 'rare' in the MNR region while it is particularly prolific under the present circumstances. This could possibly be explained by the nomadic habits of eland under natural conditions and that they possibly seasonally migrated to the MNR area while spending more of their time in other areas of their home ranges (eg Malonga Plains).

Of further interest was the insistence by both Fourie and Van der Walt (pers comm.) that both species of rhinoceros (black and white) and giraffe were absent in the area representing the MNR. Other species also listed as absent were buffalo (Fourie, pers comm.) and hartebeest (no reference to species), tsessebe, reedbuck and ostrich (Van der Walt pers comm.).

Van der Walt (pers comm.) expressed the opinion that nyala were initially absent in the MNR region but migrated into the area from Pafuri in the 1950's.

Hippopotamus and crocodiles were reportedly fairly numerous in the more perennial pools of the Limpopo and Nzhelele rivers.

Of the larger carnivores both Fourie and Van der Walt (pers comm.) considered lion to have been 'numerous', as were leopard, cheetah, wild dogs, brown hyaena and bat-eared foxes.

The recollections of the 'old-timers', if not in conformation with strict scientific prescriptions, are derived from an intimate knowledge of the area and, together with the available ecological data on the region, provide a useful framework for interpreting the present ecological situation pertaining to the MNR..

The accounts given by Fourie and Van der Walt (pers comm.) should also be seen against the background of the available data on the erstwhile distribution ranges of the various large mammals, as presented by Nel (2001, Section ????). Together these data provide a sound basis for determining future priorities.

*Management considerations*

The accounts given by Fourie and Van der Walt (pers comm.) are not considered, or intended, to give an exhaustive or conclusive account of the past ecological structure of the MNR. However, they do present a broad picture of what the MNR probably looked like in more pristine times, with the following as the major notable changes:

- the natural water resources, and more specifically their yield, have changed due to induced impacts but are still largely intact. A large number of artificial water resources have also been established;
- other than along the perennial river reaches, primarily the Nzhelele River and other scattered localities, the woody vegetation is essentially unaltered, although it may have increased in density. The riparian vegetation of the Nzhelele and other major rivers has been impacted by the 2000 floods and encroachment by some species.
- The major impact on the vegetation has, however, been on the field (grass) layer which is presently severely depleted;
- in addition to a number of introduced alien species, and with the exception of hippo, viable populations of all the large herbivore species that once inhabited the area encompassed by the MNR are still present. Peripheral species that siphoned in from adjoining areas, notably the Malonga Plains, have been extirpated. The most radical changes have probably been limited to changes in the relative numbers (densities) of the various species, and
- with the exception of lion, which have been extirpated, all the large carnivore populations are still represented, albeit as numerically depleted populations in some cases.

From this brief overview the following may, therefore, be identified as the major focal points for the ecological management of the MNR:

1. the stabilization of the natural water resources and their ecological functions, both relating to the terrestrial and aquatic environment and the protection of established food chains;
2. an evaluation of the effect and desirability of the artificial water points;
3. the rehabilitation of anthropogenically induced impacts on the vegetation and the implementation of measures to assist the recovery of especially the field layer;
4. the maintenance of viable populations of all the large herbivores known to have inhabited the MNR region and the reintroduction of those species known to have occurred in the area, albeit in low numbers;
5. consideration be given to the introduction of species known to have occurred in the immediate neighbourhood of the MNR but which have been noted as absent by old-timers such as Fourie and Van der Walt (pers comm.), and
6. viable populations of the full range of carnivores, other than lion, be encouraged and the effect of the loss of the lion population be assessed.

The guidelines outlined above may be updated from time to time as more information becomes available but will suffice at this stage to underpin the management objectives of the MNR.

**ZONATION**

A system of zonation whereby different categories of development and/or activities are allocated to specified areas has been successfully applied to various conservation areas in South Africa and elsewhere. Zonation usually caters for different levels of management and utilization and may range from strictly wilderness areas where no infrastructure, services, vehicular travel, hunting, etc is allowed, through categories of escalating intensity of activities and the provision of infrastructure, eg hunting areas, non-hunting game viewing areas, accommodation facilities, etc. The need for a zoning system is, therefore, to provide for different forms of activities while preserving the core qualities of the area.

A system of zonation is, therefore, to enable the MNR to accommodate the full range of activities required to meet its objectives without detracting from the primary conservation interests.The most fundamental objectives of the MNR are to provide an area where the natural attributes reflect their pristine state as closely as possible and to preserve the tranquillity and wilderness ambience that is associated with it. However, it also needs to serve the economic and social interests of the adjoining communities by job creation, generating income and making the area accessible to others. Such activities may include hunting, game viewing for tourists, hiking trails, etc.

It is not envisaged that the MNR will be open to heavy, possibly even regular, tourist traffic but that such traffic could possibly be limited to selected guests only. Similarly, and at least in the initial stages , the MNR is unlikely to be open to large numbers of hikers. Furthermore, hiking trails will primarily be limited to the scenic vistas offered by the most mountainous areas where vehicular travel will inevitably be limited to specified routes. A clash between game viewing visitors and hikers is, therefore, not anticipated. Similarly, accommodation facilities in the MNR will be limited to a few relatively small camps and will pose no threat to the wilderness atmosphere of the MNR. The major source of income for the MNR at present, and most likely for some time to come, is trophy hunting.

The major challenge facing the MNR is to provide for hunting while not jeopardising the qualities of the experiences of other visitors. People who visit conservation areas to experience the tranquillity and wilderness atmosphere are usually severely upset by the *sight* of hunters, and even more so by *hearing* the reports of rifle fire. Furthermore, animals that are skittish and have long flight distances distract from the qualities of game viewing and the experience of tranquillity.

The situation in the MNR is further complicated by the fact that it is subdivided into two halves, i.e. the Dover and Nzhelele sections. Due to the fact that the two halves are sealed off from one another and have to be managed as discreet units it makes it even more difficult to accommodate conflicting interests.

To achieve the essential management goals zonation in the MNR will obviously require innovation and a deviation from customary approaches. In this respect a number of options may be available to mitigate against the disruptive effects of especially hunting. These options may include both fixed zone and 'temporal zone' approaches and/or a combination of both. Models based on this approach may include the following:

- the retention of specified areas as strictly non-hunting areas. Areas already falling in this category are the Udini plain, the floodplains of the Nzhelele River on the farms River View and Njelele's Drift and sections of the farms Magdala and Steenbokrandjes.

- The zoning of hunting on an annual, or even bi- or triennial basis. This could include the subdivision of the two MNR sections into 'temporary' hunting zones for a year or more, eg the areas to the east and west of the Nzhelele River, or specified farms in the north and south of the Dover Section.

- 'temporal' hunting zones, i.e. limiting hunting to specific areas at specific times of the year, eg hunting on Dover only during the Winter and Nzhelele during the Summer for a year or two and then reversing the seasons.

The MNR is still in its early formative years and clear guidelines regarding its future development in terms of tourism, infrastructure development, tourism opportunities to be exploited and even the ultimate expectations from hunting need to be clearly defined. As an interim measure the strict non-hunting areas should be maintained.

# MANAGEMENT POLICIES APPLICABLE TO THE MAREMANI NATURE RESERVE

## 1. AREAS OF HISTORICAL AND/OR ANTHROPOLOGICAL INTEREST

### Archaeological and rock art sites

***Background***

The MNR is situated in a region rich in historical and cultural legacies. San shelters and archaeological sites have been identified at numerous sites. It also falls within an area that once witnessed the southwards migration of black tribes, and the establishment of the Venda people, and the northwards expansion of colonialism together with the developments and cultural values brought about by these events.

***Policies applicable to historical and cultural legacies***

a) Historical events of the past, and the relics of developments that accompanied such events are accepted as an integral part of the MNR.

b) Thorough inventories of all rock-art and anthropological sites will be commissioned to ensure that these are appropriately recorded.

c) Appropriate attempts, in compliance with legal requirements and in consultation with acknowledged experts, shall be made to make selected sites accessible to the public for research, educational and tourism purposes.

d) No unauthorised person, including staff, shall be allowed to remove any artefacts from archaeological sites, disturb structures, graves or any other features associated with such sites, or to attempt to enhance the artwork at rock-art sites by any means what-so-ever.

## 2. ABIOTIC COMPONENTS

### Water

***Background***

Geomorphological features give rise to the development of landscapes with associated drainage systems. Water run-off and associated erosion result in the formation of seasonal watercourses and perennial rivers, which represent aquatic ecosystems and provide diversity to the surrounding terrestrial ecosystems. Drainage systems are, therefore, a natural feature and form an integral and essential part of natural ecosystems. Natural water resources are further augmented by springs and pans.

An adequate supply of surface water is indisputably one of the vital resources for the maintenance of viable populations of most (if not all) the large mammal populations of the MNR, in addition to the multitudes of lesser vertebrates and invertebrates dependent upon water to survive and/or complete their life cycles.

In terms of water dependent species water plays an all-important role in determining distribution and density patterns. The ecological role of water is enhanced by its availability, distribution and the form in which it is available. The availability of surface water is solely and directly related to rainfall. Availability could, however, also be affected by factors influencing run-off, such as the degree of afforestation of catchment areas, the condition of the field layer of the vegetation, the depth of the water table, etc. It nevertheless remains a fundamental consideration that the availability of surface water is an environmental variable in harmony with the other components of the ecosystem, as dictated by the rainfall. Superfluous water resources reflect high rainfall and consequently lush vegetation and a generally wider distribution of the animal populations. Similarly, a general lack of water is a result of low rainfall, with related reduction in primary production, poorer grazing and browsing conditions and more contracted distribution patterns of the animal populations. Water in its natural state is, therefore, an essential element in retaining natural harmony.

The distribution of water dictates which areas (habitats) are available to animals. As the relative densities of animal populations reflect the suitability of habitats, it is obvious that the distribution of natural surface water supplies also plays an important role in maintaining the relative abundances of the populations involved. Such relationships are important in maintaining ecological stability and resilience.

In historical times the animal populations of the MNR had access to three sources of water, i.e. the major rivers (Sand, Nzhelele and Limpopo), springs and the seasonal pools and pans from rainfall. In the absence of fences animals could also utilize these resources in harmony with the other environmental variables (e.g. grazing/browsing conditions). These natural processes also included rhythmic seasonal movements and/or migrations, resulting in seasonally alternating concentration areas for the various different species.

Changes that have altered (disrupted) the natural situation include fencing, which has seriously curtailed the freedom of movement, the provision of artificial water points and major impacts on the flow regimes of the major rivers. The Limpopo River has been effectively fenced off from the MNR while both the Sand and Nzhelele rivers retain only a severely reduced flow of water and pools. Following the floods of 2000 the number of deep perennial pools along these rivers has also diminished. The springs are still largely intact and the water resources provided by the pools in seasonal rivers and the ephemeral pans unaltered.

***Policies applicable to water resources***

- The importance of water resources in maintaining biodiversity and the health of ecosystems is acknowledged.

- The fluctuating nature of rainfall and its influence on the availability of the water resources, and the important role played by these fluctuations in maintaining healthy ecosystems under pristine conditions, is acknowledged.

- The primary objective in providing a system of artificial water resources is to mitigate against the impacts inevitably imposed upon the MNR, especially due to fencing.

- The principles underpinning the water provision programme should, however, at all times be to enhance the natural role of water in accordance with ecosystem principles.

- In accordance with the above principles the management of the water resources should comply with the following:

    i) establishing and monitoring sustainable ecological flows which meet criteria of natural variability and water quality in all rivers and wetlands falling within the MNR (implementing the reserve through a process of open negotiation with regional water resource managers);
    ii) recognising the importance of historical migration routes along river courses and endeavour to maintain or rehabilitate such migrations;
    iii) stabilizing historically known natural water supplies, and
    iv) developing artificial water resources in such a manner that they will be under full control to allow for the opening and closing of such resources, if and when required, and
    v) in recognising the importance of the above principles, the MNR management needs to take cognisance of the downstream environment demands of the lower catchment.

**Geology**

***Background***
Geological formations provide the base material from which soils are derived and largely determine the geomorphological features of the landscapes.

The MNR is endowed with a particularly diverse range of geological formations, dominated by granites in the western half and sandstone in the south-eastern half. The rich geological diversity gave rise to extensive prospecting, especially during the earlier half of the 20$^{th}$ century. A number of commercial mines were also in operation at various times during the same period, eg iron ore mines on the farm Magdala and open cast graphite mines on the farm Dawn. Apparently these mines did not prove to be very profitable and no mines are presently in operation.

***Policies applicable to geological formations***

a) Geological formations are accepted as an integral part of the natural diversity of the ecosystems of the MNR.

b) All efforts will be made to resist future attempts to exploit the geological formations of the MNR for commercial or any other purposes.

c) The need to stimulate an awareness of the role of geological formations as integral components of ecosystems is acknowledged and provision will be made to include collections of rock specimens and *in situ* examples of geological formations in environmental education programmes envisaged for the MNR.

**Soils**

***Background***

The soil provides the substrate which supports and sustains all forms of higher biota. Together with the climate it forms the essential element in determining the composition and structure of ecosystems.

Poor land management practises, eg prolonged heavy over-utilization and the injudicious creation of water points, resulting in the denudation of the field layer and other disturbances to the topsoil, frequently lead to accelerated run-off and erosion rates. This form of 'unnatural' erosion can lead to the serious loss of topsoil, with accompanying impoverishment of the terrestrial and aquatic (river) components of the ecosystems. The long time span involved in the generation of topsoil dictates that it should be conserved with the utmost care.

***Policies applicable to soils***

a) The role of soil in producing and sustaining ecological diversity is acknowledged.

b) The vulnerability of topsoil to degradation due to poor land-use practises and unnatural run-off, and the serious consequences of the resultant ecosystem impoverishment is also acknowledged.

c) The periodic denudation of the field layer, associated with heavy grazing pressure and in harmony with climatic fluctuations, is accepted as a natural phenomenon. It is also acknowledged that natural drainage systems, with associated soil erosion, represent a natural process.

d) The rehabilitation of areas of unnaturally induced soil erosion, including the physical prevention of further erosion and the removal of the causative agents, will be treated as a matter of the highest priority.

e) All development programmes, and in particular road construction, imply disturbances to the topsoil and the inherent danger of soil erosion. Development projects should, therefore, be preceded by an impact assessment with particular reference to the possibility of soil erosion and provision made for measures to be instituted to counter negative impacts.

f) Disturbances that could impact on the soil in the riparian zone should be limited to the minimum.

g) Cognisance is taken of the problems and threats related to the soils of the MNR, as pointed out by Nel (2001), and of the recommendations for the conservation of the soils. A commitment is, furthermore, given for the implementation of the recommendations within the framework of the principles outlined above. The recommendations include the following:

The compilation of a comprehensive soil management plan, including details on legal aspects, erosion control, road management, pollution control and the integration of soil management considerations in the overall wildlife management programme of the MNR.

## 3. BIOTIC COMPONENTS

## VEGETATION

### *Introduction*

The two major attributes of the vegetation are its structure and species composition. The structure is generally highly variable and is strongly influenced by seasonality, while the composition is more resilient and is generally only subjected to change through long-term influences.

The vegetation is the resource base on which *all other biota* in the ecosystem are, in one way or another, dependent. It serves as a food source, as shelter and provides a multiplicity of compositional and structural diversity which is also reflected in the faunal communities.

The vegetation is comprised of two major components, i.e. the field (grass) layer and the woody plant strata.

### *The field layer*

### *Background*

The grass layer plays a vital role in sustaining the populations of a wide range of herbivores, both invertebrates and lower and higher vertebrates. These, in turn, provide the food source for the range of carnivores at all trophic levels.

In addition to its role as a food resource the field layer also plays an important role as a soil binder and replacing organic nutrients.

### *Policies applicable to the field layer*

a) The vital role played by the field layer in sustaining biodiversity and the maintenance of ecological equilibria and stability is acknowledged;

b) The maintenance of a healthy field layer, in harmony with the soil types, is regarded as a priority of the highest order;

c) It is acknowledged that the field layer of the MNR is in a state of severe depletion and that the necessary steps need to be taken to rehabilitate it.

## *Bush encroachment*

### *Background*

Under natural conditions at least two sets of circumstances can lead to an increase in woody vegetation. During the dry phase of the climatic cycle low primary production, the lack of veld fires and an increase in grazing species capable of exploiting such conditions, primarily impala, wildebeest and zebra, can result in an increase of certain woody plant species. On the other hand, increased germination and survival of seedlings to maturity during the high rainfall phase of the climatic cycle can yield similar results, though the particular species may differ. Should the normal sequence of events be allowed to take their course, it may be expected that the opposite changes would be incurred in the next phase or subsequent climatic cycles. Certain herbivore species, notably elephant, are also capable of impacting on the woody component of the vegetation. In any of these cases the increase/decrease in the density of the woody vegetation may be interpreted as an inherent part of ecosystem dynamics. Any measures to counter such processes should take cognisance of the fact that they represent an integral part of the interrelatedness of the dynamics within ecosystems.

Misinterpretation of the concept of bush encroachment is also apparent. In many areas where bush fires have been deliberately excluded woody growth previously suppressed by fires is allowed to develop. The increase in the height of such plants, and more especially the increase in the spread of the canopies of the woody vegetation, creates the impression of bush encroachment.

Available data suggest that significant differences exist between different plant communities in terms of the time scales and extent to which the woody vegetation is subject to changes affecting either composition or structure.

### *Policies applicable to bush encroachment*

- It is accepted that fluctuations in the density of woody plant species reflect the dynamic nature of ecosystems and is, therefore, accepted as a natural phenomenon.

- Any consideration for bush clearing must take cognisance of the fact that bush encroachment is part of a dynamic process and is, in itself, an *effect* and not a *cause*.

- Bush clearing exercises can only be justified if the qualities of natural ecosystems are being jeopardised due to spatial or other unnatural constraints.

- ‘Bush clearing’, i.e. the elimination of woody vegetation, should not be allowed, only limited bush thinning, where considered necessary.

## *Veld burning*

### *Background*

Veld fires are currently acknowledged as a natural phenomenon in savanna ecosystems. There is no doubt that lightning plays an important role in igniting such fires. Within an ecosystem context it may, therefore, be accepted that at various stages such lightning induced fires played their part in the dynamics of the natural environment. However, it is likely that

unnatural (man-induced) fires largely replaced natural fires with the advent of the first human settlers in the Lowveld (possibly even prior to the Early Stone Age).

It is not known to what extent the early inhabitants resorted to veld burning, but judging from old established traditions it may reasonably be assumed that the veld has been burned annually for the greater part of the past two centuries (and most likely for even longer). These fires were primarily ignited towards the end of the Winter, but possibly also at the earlier stages of the dry season.

The incidence of veld fires, both natural and unnatural, is closely linked to climatic cycles, As such, fires represent an important environmental variable of a cyclic nature in ecosystem processes.

Available data indicate that fires exert both short and long term effects on the vegetation. In the short- term the influences mainly affect vegetation physiognomy (structure) while the long- term effects may also be evidenced in changes in the species composition and structure of plant communities. Such changes will inevitably also affect the species composition and densities of the associated fauna.

Structural changes to the vegetation include the removal of accumulated combustible litter, variations in the height and ground cover of the field layer and a reduction in the woody plant cover by reducing the height and canopy regime of shrubs up to 2,0m tall. The time- span of such changes is directly related to rainfall and in years of 'normal' rainfall (equivalent to the long- term mean), it is in the order of 1-2 years for the field layer, and 2-4 years for the woody vegetation. Changes to the vegetation structure occur largely irrespective of the time of the fire, though the degree of the changes depend on the intensity of the fire.

Changes to the vegetation composition are of a longer term nature and involve primarily the field layer. Such changes are also more closely related to the frequency and time of the year of the fires and the nature of the grazing pressure subsequent to the fires.

The structural changes to the vegetation have a direct effect on the distribution and density patterns of the animal populations. The responses of animals to burned areas frequently follow a successional pattern in accordance with the different stages of regrowth of the vegetation.

The effects of fires are not confined to the large mammal populations only but also affect, to a larger or lesser degree, all the other small mammal, lesser vertebrate and invertebrate populations.

Since the area comprising the MNR was turned into commercial farms, and particularly since the 1940's when farms were fenced, it may be assumed that veld fires were accidental, patchy and sporadic. This is primarily due to the general attitude that existed in agricultural circles at the time that fires were to be resisted, on the one hand, but also due to the general lack of combustible material due to heavy stocking rates.

***Policies applicable to veld burning***

a) Naturally induced veld fires are accepted as a natural and essential phenomenon in maintaining healthy ecosystems.

b) Due to its restricted size the MNR can no longer accommodate natural fires. However, the incorporation of veld fires is acknowledged as an essential management tool and should be applied according to the following guidelines:

- areas scheduled to be burned should be preceded by a veld condition assessment and a determination of the fuel load;
- fires will only be scheduled for years when the forecast is 80%, or more, in favour of average to above average rainfall;
- the areas to be burned should be as large as possible but should preferably not include more than 60% of a particular plant community;
- fires should simulate natural fires as far as possible and be applied as close as possible to the first Spring rains (October/November), and
- frequencies should, at least until the field layer has recovered, be limited to no more than once in three years (triennially).

***Invasive alien plants***

***Background***

Invasive alien plants have become a major problem in South Africa and a threat to the conservation ideals of maintaining the pristine qualities of natural ecosystems. The ability of invasive alien plants to displace natural plant communities, and therefore also the natural fauna, leads to a depletion of the natural biodiversity. The functioning of natural ecosystems is adversely affected by alien plants through, amongst others, the inhibition of germination and seedling establishment of indigenous plants, food and/or water resources required by animals are denied to them, erosion of bare soil under dense canopies of alien vegetation is enhanced, stream dynamics are changed, water loss through transpiration is increased, fire regimes are altered through changes in the fuel loads and many of the alien plants are poisonous.

The invasion of natural plant communities by alien plants is non-cyclical but rather exponential and permanent. The permanent loss of ecological diversity inevitably leads to reduced stability and resilience in ecosystems.

In the Kruger National Park more than 200 alien plants have established themselves in the last 50 years. This poses a threat, not only to the KNP ecosystems, but also to those in adjoining areas, such as the MNR. Furthermore, it is quite obvious that the entire character of the Limpopo River has been changed through invasive plants.

***Policies applicable to invasive alien plants***

a) The dangers of invasive alien plants to the ecology of the MNR are acknowledged.

b) In recognising South Africa's ratification of the Convention on Biological Diversity and the Conservation of Agricultural resources Act (Act 43 of 1983), the obligation of

the MNR management to strive towards the eradication of invasive alien plants is recognised.

c) To counter the spread of invasive alien plants into and within the MNR the MNR Management pledges itself to:

- fully participate in any co-operative programmes (e.g. the Work for Water programme) to identify and eradicate invasive alien plants and to assist in public awareness campaigns against the dangers of such plants;
- solicit the assistance of co-responsible organisations and the public to eradicate such plants at their source of origin and in invaded areas, and
- continue to combat the spread of invasive alien plants and strive towards their total eradication within the MNR by all possible means not regarded as detrimental to the indigenous vegetation.

d) The list of alien plants compiled for the KNP, as representative of the Lowveld and as contained in an Annexure to this Management Plan, is accepted and all efforts will be made to eliminate such plants already in the MNR or to avoid their entry.

## FAUNA

### Carnivores

***Background***

Prior to the establishment of commercial farming the complete range of carnivores indigenous to the area were known to occur in the area encompassed by the MNR. According to eye-witness accounts (Fourie, Van der Walt, *pers comm*.) species such as lion, leopard, cheetah and wild dogs were common. In pristine times there is no doubt that these predators played an important role in promoting the health of the ecosystems in harmony with the other natural processes. However, it is also accepted that this role was altered/impacted with the advent of especially commercial farming and the fragmentation of the land into fenced units.

Viable, albeit probably reduced, populations of all but lion survived in the area and the present populations represent stock from the original populations. These populations pose no threat to the existing prey populations, are not a threat to humans and would not endanger species earmarked for reintroduction into the MNR. Lion, on the other hand, could endanger – or at least impact upon – all three the interests mentioned above.

***Policies applicable to large carnivores***

a) It is acknowledged that the full range of carnivores represent an integral part of natural ecosystems and that viable populations of such predators is a priority in achieving the ultimate goals of the MNR.

b) Until such time that populations of herbivore species earmarked for reintroduction have been securely established, and possibly until the fence between the Dover and Nzhelele sections has been removed, lion should not be considered for reintroduction.

c) The populations of the other large predators are considered to be healthy and possibly in equilibrium with their prey populations. The status of the wild dog population, especially with respect to its home range requirements and seasonal movements, should be clearly established.

## Herbivores

***Background***

Pressure on animal numbers, in general, and selective decimation of certain species through hunting commenced during the latter half of the 19th century. The suppression of animal populations was further aggravated by the Rinderpest panzootic that ravaged through southern Africa during the mid-1890's and by the turn of the century the numbers of most of the larger herbivores were severely reduced while a number were driven to the brink of extirpation (eg. elephant, buffalo, eland and both species of rhinoceros).

Whether any of the affected populations ever recovered to their former status is uncertain. However, it is clear from various accounts that several of the indigenous species were common to well within the 20th century and it was only toward mid-century that species such as sable antelope (at least one herd of up to 60 on the farm Aletta, Van der Walt, pers comm.) roan antelope (though very rare) and hippo became locally extinct. Some of the more resilient species (eg. kudu, impala and warthog) continued to maintain viable populations, even with the advent of the more recent commercial farming practices.

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Within recent years, particularly the past two decades, wildlife utilization, and in particular hunting, has increased considerably as a means of income generation. This has also lead to accelerated restocking programmes which included indigenous as well as exotic species. Populations of both categories of species still occur in the MNR.

At present there are three species that have not been reintroduced to the MNR. These are sable and roan antelope and tsessebe.Uncertainty exists whether tsessebe or Lichtenstein's hartebeest once roamed the area though both Fourie and Van der Walt (pers comm.) were adamant that no 'hartebeest' were present in the area comprising the MNR in earlier times and all published accounts only refer to tsessebe.

In 19?? a number of elephant bulls and a small breeding herd were released into the Dover Section. Their numbers have since increased to ?? bulls and ?? in the breeding herd. Though low in number these elephants are creating a visible impact on their surroundings. Furthermore, their presence may limit the options open to visitors, especially hiking and horse riding trails.

White rhinoceros have also been reintroduced to the MNR and released in the Dover Section. Since the release of ?? in 19?? their numbers have increased to ??. White rhino are relatively

placid animals and do not pose the same threat to visitors (hikers and horse riders) as elephant.

Black rhinoceros, of the subspecies *Diceros bicornis minor,* were reintroduced to the MNR in two groups, i.e. six (3 males and 3 females from Pilanesberg) and six (two males and four females from KwaZulu/Natal) in 2002 and 2003, respectively. One male from Pilanesberg died shortly after release. Two males and two females from KwaZulu/Natal were released on the Dover Section, the rest on the Nzhelele Section.

***Policies applicable to herbivores***

- Implicit in the fundamental objective of rehabilitating the MNR to its most pristine state possible is the commitment to reintroduce all the herbivore species once known to have occurred in the area.

- In compliance with accepted international conservation principles the MNR also commits itself to only reintroduce animals from the same genetic stock as the extirpated populations.

- It is accepted that the taxonomic status of all species that may be considered for reintroduction is not necessarily at an acceptable level. In this respect, and in compliance with (b) animals from the same ecological region should, as far as possible, receive precedence.

- It is acknowledged that in more pristine times some of the species listed for reintroduction only occurred peripherally in the area encompassed by the MNR and that attempts to establish viable populations of such species should comply with the overall ecological potential and management objectives of the MNR.

- All efforts should be made to eliminate the exotic species, e.g. Hartmann's mountain zebra, red hartebeest, blesbuck and oryx.

- In addition to conservation principles the reintroduction of species and/or the management of reintroduced species will also be subject to other management considerations, e.g. the compatibility of such species with tourism and the impact of the fences on habitat utilization and movement patterns.

## Hunting

***Background***

The utilization of natural resources, underpinned by a nature conservation ethic, has gained considerable momentum in South Africa over especially the past two decades. In all its many different facets it has become one of the leading industries and a major economic force. Hunting, as one of these facets, annually generates a very considerable foreign exchange income. Furthermore, nature conservation, including hunting, is essentially based on sustainable utilization and therefore conforms to internationally accepted resource utilization criteria.

The challenges offered by hunting in the form of perseverance, patience the application of almost all the senses in finding and interpreting cues for the tracking and outwitting of the hunted, the proficiency ultimately exercised in securing the targeted animal and the anticipation of adding a new species to a list of trophies provide the ingredients of a sport which is particularly attractive to a large number of local and foreign participants. Limited opportunities and the status value attached to the hunting of certain species, together with an over-demand have also contributed to the development of hunting into a lucrative business.

In spite of the above sentiments, the killing of wild animals, for whatever reason and at the best of times, remains a sensitive issue. These sensitivities may vary in intensity from one species to the next and are mostly manifested as mere differences of opinion, as sharp disputes or even relentless public controversies. It is, therefore, of paramount importance that hunting should conform to the highest standards of moral and ethical integrity.

***Policies applicable to hunting***

a) Hunting is accepted as a form of sustainable utilization and one of the many facets of nature conservation.

b) Hunting quota's will be based on an annual assessment of the population trends of the species selected for hunting and caution should be exercised to limit trophy hunting to the recruitment rates to the particular segment of the population selected for hunting.

c) The highest moral and ethical standards shall apply at all times. These standards are based on the definition of a *fair hunt* which entails a *competition in which the tracking and shooting skills of the hunter are pitched against the evasive abilities of the hunted.*

d) As a corollary to (c) the highest levels of professional conduct shall apply at all times. This could be achieved by the MNR employing its own hunter to conduct and supervise the hunting operations, or alternatively or in conjunction with the above, to allocate hunting quota's to reputable professional hunters.

e) All possible precautions should be taken to ensure that the wounding of an animal is limited to the minimum. This implies that the weapon used must be adequate to ensure instant death, and that the hunter be requested to prove his/her proficiency in the use of the weapon before commencing the hunt.

f) In compliance with the definition of a fair hunt the execution of a hunt shall conform to the prescripts of the Magud Hunting Method, which dictates the following:

    - the hunt shall be executed on foot, and
    - all possible precautions shall be taken to avoid disturbance to the remainder of the herd and, in particular, to avoid any association between the rifle shot and human presence.

g) In addition to the above the code of ethics of the South African Professional Hunters Association shall also be strictly adhered to.

## *Parasites and diseases*

### *Background*

A wide range of parasites, infectious and non-infectious diseases have been identified in wild animals. Highly contagious diseases which may be transmitted to domestic stock, e.g. foot-and-mouth disease, have impacted upon and/or played an important role in the management of several conservation areas. However, most of the diseases transmitted to domestic stock by wild animals have limited, if any, detrimental effect on the vector populations under natural conditions.

In attempting to rehabilitate natural areas to their most pristine state possible and to restore the biodiversity of such areas it is essential to take cognisance of the fact that parasites and diseases contribute towards diversity and represent an integral part of the biotic communities.

Indigenous diseases/parasites are life forms which have had a common evolutionary history with their hosts in a specific area and this has led to a reduction or even a complete cessation of detrimental effects and, with time, even to beneficial relationships between parasitic forms, hosts and habitats. Depending on their ecological relationships these parasitic forms will mostly be dormant and unnoticed, but will occasionally flare up in the form of disease. Natural stress situations, such as drought, population pressure, rutting, etc., may act as trigger mechanisms and cause disease outbreaks, e.g. mange, high tick burdens, papillomatosis and anthrax. These diseases are, however, often density dependent and when the stress situation is relieved , clinical disease usually disappears.

Imbalances in natural cycles leading to disease outbreaks can also be created artificially by introducing exotic or foreign parasites/diseases into an ecosystem. The rinderpest panzootic which swept through Africa in 1896/97 and the introduction of bovine tuberculosis to the Lowveld ecosystems in the 1960's are prime examples. The rinderpest panzootic left thousands of cattle and wild animals dead in its wake and not only devastated the ungulate populations of the Lowveld but reduced the buffalo population to one or two isolated pockets.

Imbalances in host/parasite relationships can also be caused by the introduction of foreign exotic hosts into areas to which they are not adapted. It is likely that the MNR harbours indigenous African diseases such as foot-and-mouth disease, African swine fever, malignant catarrhal fever, African horse sickness, blue tongue, heart water, anthrax and corridor disease which have adpted to their natural hosts. Interactions, sometimes of an epidemic nature, may occur in exotic hosts, such as livestock on the borders of the MNR.

### *Policies applicable to parasites and diseases*

a) Indigenous parasites and diseases are accepted as an integral part of the biotc communities of ecosystems and their role in sustaining ecological stability and resilience is acknowledged.

b) Alien parasites and diseases are viewed in the same light as their counterparts in the floristic and faunal communities. In this respect all efforts should be made to:

i) prevent such aliens from establishing themselves within the MNR biotic communities; and
ii) take all possible steps to identify and, if relevant, to counter the effects of established alien parasites and diseases with the objective of eliminating them from the MNR. Important diseases in this respect are rinderpest, bovine tuberculosis and bovine brucellosis.

c) Diseases known to be recent historical encroachers of the Lowveld and which could appear in the MNR are rinderpest, anthrax and bovine tuberculosis.

d) In consideration of socio-economic and zoo-sanitary interests beyond the boundaries of the MNR the MNR-management pledges itself to abide by all prescribed procedures to contain and/or combat notifiable (proclaimed) diseases, of which the following are the most important in terms of the MNR: foot-and-mouth disease, African swine fever, rabies, bovine brucellosis, corridor disease, anthrax, bovine malignant catarrh and bovine tuberculosis. This responsibility is shared with the Directorate of Animal Health to whom full support and co-operation is pledged.

## 4. MANAGEMENT ORIENTATED RESEARCH AND MONITORING PRIORITIES

***Introduction***

It is readily accepted that the ecosystems of the MNR have been impacted by human (unnatural) interference and have, in many respects, lost their pristine qualities. These impacts have not only impacted on the composition and structure of the various ecosystem components but most likely also on the scope and responses of the integrated dynamic processes (functions). Research and management programmes should, therefore, take cognisance of such impacts and aim to rehabilitate the affected areas, where appropriate, and also be designed to understand and perpetuate the intrinsic pristine qualities of the ecosystems. To endorse this approach an ecosystem-oriented research programme may be defined as:

> ***the study and analysis of ecosystems, with detailed consideration of their dynamic nature and the interdependency of the constituent components, with the view to assessing their pristine attributes and interpreting and predicting changes to serve as basis for the implementation and evaluation of management strategies as necessitated by circumstances.***

The above definition makes provision for three distinct research categories, i.e.

- a retrospective study to determine the nature of the pristine attributes of the ecosystems and an analysis of the nature and scope of the impacts;

- a detailed analysis of their present state, and
- the implementation of monitoring programmes to determine trends and evaluate the achievement of objectives (i.e. adaptive management).

***Research priorities***

***a) Historical background***

The present status of the ecosystems may be expected to reflect past events of both artificial and natural occurrence. To interpret the present situation it is, therefore, of the utmost importance to obtain any information on the area that may have been of relevance to its ecological history. In this respect the following is of particular importance:

i) the land-use history of the farms comprising the MNR. Most farms have had a rather chequered history and have been subjected to, amongst others, stock ranching (especially cattle and goats), heavy and selective hunting pressure and some form of environmental protection for varying lengths of time.

In recent decades excessive artificial watering points were created, veld fires were effectively controlled and the indigenous animal populations affected in one way or another.

All efforts should, therefore, be made to obtain data on the following:

- land-use;
- management practices applied to farms (eg. livestock, veld burning, water provision, etc.);
- population trends and distribution patterns of as many species as possible;
- natural water resources (especially perennial supplies);
- vegetation trends.

A variety of sources are available to acquire of the above nature, eg. previous landowners, memoirs of 'old timers', archives, diaries, etc.

***b) Baseline research and monitoring***

***i) Climate***

Order A weather stations are maintained at Musina and Tshipise. These are probably sufficient to provide the overall parameters of the various features comprising the "climate". However, rainfall is one of the more variable components of the climate and of particular importance in management considerations. A number of recording stations should, therefore, be identified and the following recorded:

- total rainfall per 24 hour cycles;
- duration of rainfall and time of day/night, and
- form of precipitation (eg. drizzle, light rain, heavy showers, thunder storms, etc.).

### *ii) Water resources and aquatic biota*

A comprehensive inventory and distribution map of all surface water resources needs to be maintained and updated, as required. The following categories need to be distinguished:

- Perennial resources: rivers, pools in rivers and seasonal tributaries, springs, other;
- Seasonal resources: pools in watercourses, pans, other, and
- Artificial resources: troughs, pans, other.

Aquatic fauna and riparian vegetation frequently provide good indicators of water quality and the conservation status of water bodies and drainage systems. Baseline research on these aspects and the institution of long term monitoring programmes are considered high priorities.

### *iii) Soils and geology*

Other than in fairly localised areas the soils of the MNR shallow and stony and are vulnerable to both water and wind erosion. The deep sandy soils maintain the best grass cover and are, therefore, of especial importance to the MNR. A soil protection programme, as recommended by Nel (2001) and noted under the relevant management principles, needs to be drawn up and stringently adhered to.

### *iv) Vegetation*

The vegetation is the basic resource that sustains all the other biota. It is, therefore, important that the following receive special attention:

- Phytosociological surveys – comprehensive phytosociological surveys need to be undertaken, with special emphasis on plant associations and plant-soil relationships.
- Monitoring surveys – intensive monitoring of the field (herbaceous) layer and woody vegetation needs to continue by means of line transects with detailed analyses of the trends in both these categories, at least until a satisfactory recovery of the vegetation, in particular the field layer, has been recorded.

  In addition to the above, fixed-point photographic sites should also be established to provide a rapid means of assessing the following: a general indication of the ground cover and ratio of forbs to grasses, height of the field layer, phenological characteristics and intensity of utilization.

  Fixed-point photography can also be helpful in determining trends in the woody vegetation, especially in terms of increases/decreases in density, changes to vegetation structure, phenological status, utilization intensity and recovery.

### *v) Animal populations*

#### *Herbivores*

Population trends

Populations of large herbivores can impact strongly on their habitats and are subject to rapid temporal and spatial changes. They are,

therefore, major roleplayers in the dynamics of ecosystems and require accurate monitoring. The most plausible means of achieving the above objective is through regular (annual) aerial censusing (cf Joubert 2001). From the aerial surveys the following may be achieved:

- the determination of population trends;
- the recording of population structures, and
- the determination of density and distribution patterns.

Population structure
To complement the population trends derived from the aerial census, analyses of the population structure of the major larger species should also be undertaken. These analyses should include:

- sex ratios, and
- age class distributions.

In most cases surveys undertaken annually at the end of the dry season (August – October) will suffice. The calving/lambing season of the majority of the large herbivores coincides with the Summer (wet) months and the initial high mortality rate has abated by the end of the Winter. Juvenile survivors at that time therefore give a good indication of recruitment to the reproductively active segment of the population. In specific cases surveys at more frequent time intervals may also be considered necessary.

***Carnivores***
Carnivores represent an important component of faunal communities and data on the population status of the various species is considered a high priority. However, rapid techniques to satisfy the requirements of a monitoring system have, as yet, been devised. This aspect needs serious consideration.

***vi) Other research and monitoring considerations***
To satisfy management requirements research and monitoring efforts are generally largely concentrated on the vegetation and the large herbivores and carnivores. In the process the lesser taxa, including small mammals, lesser vertebrates and invertebrates, are frequently overlooked. However, these 'lesser biota' are not only important in terms of their contributions towards biodiversity but can also play an important role in the interpretation of ecosystem processes due to their rapid responses to environmental stimuli and the generally quick turn-over rates of their populations. Every effort should, therefore, be made to include these categories in the general research and monitoring programme. Provision should also be made to record phenomena such as:

- population outbursts (eg. rodents, birds, insects, etc);
- arrivals/departures of migratory birds;
- high density nesting sites of birds, or the lack thereof;
- extraordinary concentrations and/or behavioural traits regarding small mammals, birds, reptiles, amphibians and invertebrates.

### *c) Geographic Information System (GIS)*

To integrate the data collected from various fields of research and monitoring and to assist in the identification of the interactions and the interdependencies of the various ecosystem components the use of a GIS system could be of invaluable use. A GIS has become indispensable in understanding the relationships between geomorphological features and floristic and faunal communities, and their responses to the impacts of ecological processes (eg. fluctuating rainfall, veld fires, etc) and man-induced disturbances. The installation of a GIS to meet the needs of the MNR should be regarded a high ptiority.

## 5. ENVIRONMENTAL AUDITING

In recent years environmental audits for industrial developments in South Africa have become mandatory. These audits have been instituted to monitor the implementation of environmental management plans, thereby exercising control over standards of performance. They also serve the important function of providing credibility, transparency and accountability.

At present environmental audits are not compulsory for nature conservation areas, though some institutions have voluntarily subscribed to this form of management.

An environmental audit for the MNR would entail an examination of its performance in terms of its stated objectives and adherence to its management plan. Such an audit could be achieved at two different levels, i.e. (i) an 'internal' audit by the Chairman of the Foundation and the MNR management team, and (ii) by the Directorate of Nature Conservation of the Limpopo Province. Audits of this nature contribute liberally towards enhanced performance and closer liaison with parties who could offer objective assessments at high levels of expertise.

## ADMINISTRATION

### Introduction

The MNR is presently still in its early formative years. Two managers have been appointed, probably somewhat fortuitously, due to the fact that the area is, by virtue of a public road, divided into two almost equal halves (the Dover and Nzhelele sections). Each manager has his own staff and is responsible for all activities on his Section. A secretary is shared by the

two managers and is responsible for accounting and general administrative functions. Heavy machinery is also shared by the mangers.

Given the fact that the MNR is still very much in the phase of land acquisition and the rehabilitation of the infrastructures and impacts of past landowners the present administrative arrangements may be regarded as adequate.

At this stage the MNR comprises some 40 000ha and is rapidly becoming a major roleplayer in the broader communities of the Musina region. Furthermore, it is the expressed desire of the Chairman of the Foundation, Mr Leif Skov, to make some form of public access to the MNR possible, albeit on a limited scale and possibly for selected groups only, to develop the environmental education potential of the MNR and to encourage post-graduate research on all aspects of the natural surroundings. As stated in the vision and mission statements the ultimate objective of the MNR is also to become a meaningful roleplayer in the social and economic interests of the region.

It is envisaged that the increase and scope of the responsibilities and activities of the MNR will inevitably also require a reassessment of the administrative structures. Increased interaction with other interested and affected parties in the region, public relations exercises, demands of the hospitality services, ecological research and management, security, general infrastructure development and maintenance and mechanical maintenance will probably necessitate restructuring.

A factor which will also require further consideration in future is the desirability of retaining the MNR in two discreet halves or whether the fences should be dismantled to create one integrated reserve. In the present circumstances the retention of the two halves may be in the best interests of the MNR. The situation could, however, change in future and especially with the possibility of the addition of new land (eg Middelbult, Trotsky and Stoffel).

To meet the anticipated future demands some consideration should be given to an administrative structure that could best deal with the challenges. In this respect, consideration could be given to the inclusion of the following: a general manager, an ecologist, an area manager (game ranger), a workshop manager and a secretary. It is believed that an efficient and goal orientated approach could be guided by such a team.

***Lines of authority***

Under the present circumstances the lines of authority run directly between the Chairman (and nominated members of his staff) and the two managers, with the involvement of auxiliary advisors (eg legal, ecological) as and when required.

## Involvement of researchers and other groups

***Background***

The MNR occupies a particularly interesting geographical area. Ecologically it falls in the transitional zone between the arid areas to the west (Botswana) and the higher rainfall areas of the southern Lowveld (Kruger National Park). It has considerable variation in its

topographical features, rich diversity in its geological formations and faunal and floral communities reflecting its transitional position.

In terms of its archaeological history the Musina area has also been the centre of rich and varied cultures. The MNR has a large collection of rock art and other artefacts of the San culture, artefacts from the Stone Age era's and rich archaeological records of the Iron Age. It also falls along a major trade route and adjoins one of the earliest tin and copper mines from the Iron Age era.

The MNR has already had requests from schools, bird clubs and various photographic and research groups to gain access for educational and research purposes. As far as possible these groups have been encouraged and accommodated.

To further its own interests and to gain greater insight into the interactions and interdependencies of the various components of the ecosystems as basis for determining management needs and priorities the MNR has a vested interest in research. Inventory type surveys of all the natural assets are required, together with a clear understanding of the dynamic properties of natural processes.

***Policies applicable to research and related projects***

- The MNR is committed to fully exploit opportunities to gain as much information on and insight into all aspects of the socio-cultural history and ecological composition of the area as possible. This commitment is based on the desire to gain a better understanding of the past, for the sake of posterity, and to provide a scientifically sound basis for the rational management of the MNR.

- In terms of research, priority shall be given to anthropological studies and to inventories and system-related ecological research.

- Photographic projects of a strong public relations nature will be supported.

- Environmental education opportunities, especially for school groups, will be encouraged.

- To adhere to the guidelines set out above the following procedures shall apply in terms of applications to undertake projects in the MNR:
  . all applications, with detailed motivations – and, where applicable, all budgetary requirements - for the project, need to be in writing;
  . applications must be forwarded to the ecological advisor who will be responsible for the evaluation of the application, obtaining clearance from the Chairman of the Foundation and MNR managers and monitoring of the project in terms of progress and expenditure.