

CHAPTER 7: THE NEW POLICY FOR THE MANAGEMENT OF THE ELEPHANT POPULATION OF THE KRUGER NATIONAL PARK

INTRODUCTION

This chapter was compiled from the SANP's new elephant management policy for the KNP (Whyte *et al.* 1997) which was also published (Whyte *et al.* 1999) to achieve a wider dissemination.

The policy of culling elephant as part of the management strategy of the KNP has always been somewhat controversial. In late 1994 the issue was again debated when the reasons for culling and the ethical morality of killing elephants were raised by certain animal rights groups. This resulted in a public debate being held in Midrand on 4 May 1995, at which SANP undertook to review its policy for the management of elephant in the KNP. In accordance with this undertaking, a series of meetings and workshops were held in order to reconsider the policy and make recommendations on appropriate management for the future. The policy is the product of many hours of consultative debate between SANP and a wide diversity of interested and affected people and organisations.

The first of the workshops directed at developing a management policy was held in Skukuza on 8 February 1996 in conjunction with members of the African Elephant Specialist Group (AfESG). This was followed by a meeting two days later with delegates of the AfESG and the International Fund for Animal Welfare (IFAW). The new rationale was summarised in a document prepared by Hall-Martin & Novellie (1996).

On 30 October 1996 at a workshop held in Skukuza, a wide-ranging series of possible management options were listed and debated. The results of this meeting were reported by Whyte & Biggs (1997). The options debated were:

- i. The previous management policy was correct.
- ii. There are too many elephants.
- iii. There are too few elephants.
- iv. The KNP ecosystem needs natural fluctuations of elephants.
- v. The KNP ecosystem needs controlled fluctuations of elephants.

- vi. "Animal rights" (*Laissez-faire*) type of policy (no culling).
- vii. Community involvement/sustainable consumptive utilisation.
- viii. Maximising economic opportunities.

The resolutions accepted by this meeting were that:

- i. The National Parks Board mandate and primary responsibility within the KNP was to conserve *all* elements of biodiversity and not to manage selectively for the benefit of a single species such as elephant. Although elephants are considered important (even essential) ecosystem components, they are not *more* important than any other component.
- ii. Wildlife populations do not remain static through time and space, and consequently elephants should not be maintained at a stable unvarying population ceiling, but rather that fluctuation in numbers and density should be introduced to simulate ecosystem processes and enhance biodiversity.
- iii. In contrast with all other known animal species, elephant (and possibly rhino) do not respond to short-term climatic cycles. It was recognised that unimpeded population growth would have negative impacts on other wildlife in an unnaturally limited "conservation island", and therefore some form of population control would be necessary for elephant (and perhaps eventually rhino).
- iv. There is evidence of severe impact by elephant at current densities in certain areas of the KNP so that such areas may already have reached threshold levels of elephant density.

The implication therefore was that Option ii above (there are too many elephants) would be how the elephant population management issue should be approached in future. There was consensus that the consequences of unrestricted elephant population growth resulting in an ultimate self-induced population crash are not acceptable.

These resolutions were presented to the public during the debate held at Midrand on 12 November 1996. Very little comment was voiced by the meeting's participants, either to these

resolutions or the Hall-Martin & Novellie (1996) document, which was then accepted by the SANP as a mandate to proceed with defining the detail of this new policy proposal.

The first step in doing this was the convening of a workshop to discuss the maintenance of biodiversity in the KNP. A wide variety of scientific expertise, both national and international, was invited to participate in this workshop which was held between 11-13 February 1997. As it was accepted that an increasing elephant population was likely to have some negative consequences for KNP's biodiversity, the focus of the workshop was to establish "Limits of Acceptable Change" (LACs) in a wide spectrum of environmental variables. However, the concept of acceptable limits of change was soon rejected as it was felt that in many instances, the knowledge or understanding of the system was simply not adequate to know how much elephant induced change could be regarded as "acceptable". LACs were redefined as "Thresholds of Potential Concern" (TPCs; see definition on page 174). In the absence of such knowledge, a TPC could still allow environmental change up to a predetermined point at which managers must officially become concerned and the situation must then be reviewed. The outcome of such a review could either be a resetting of the TPC to allow for further change or else management of some form must be considered to prevent further change.

The new policy recommendation, as described here, was then formulated at a final meeting of the SANP staff held in Skukuza on 17 March 1997. The finalised policy document was presented on the Internet (<http://www.parks-sa.co.za>) for further public scrutiny, and on 31 October 1998 was also presented at a public meeting convened in Nelspruit. Almost unanimous public support was given at this meeting, the only objection coming from the animal rights group FALCON who felt that at least another 10 years was necessary before implementation, as new technologies may be forthcoming (such as contraception) to solve the problem in non-lethal ways (South African National Parks 1998). As there is no guarantee of this, and acknowledging the support of the majority of the people and organisations represented, the SANP Board approved the policy on 12 March 1999.

THEORETICAL BASIS OF THE NEW POLICY

The KNP is committed to a mission emphasising biodiversity in the widest sense (i.e. structure, function and composition across scales from genetic to landscape and even sub-continental),

and makes specific mention of fluxes as part of this. The theoretical basis of quantifying and managing for biodiversity and flux has its origin in the emergent heterogeneity paradigm (e.g. Christensen 1997; Fiedler *et al.* 1997), but still has many unknown dimensions in practice.

Driving variables in savannas include nutrients, moisture, fire, herbivory and others (e.g. Wiens 1997). Elephant herbivory is considered particularly significant, as in some studies, elephants at high densities have been shown to negatively affect biodiversity (Cumming *et al.* 1997, Western & Gichohi 1989). If there is variation in these driving variables over time and space, an ever-changing mosaic should be the outcome. The patches which result are seen as organised in a hierarchy of scales (Wiens 1997). If, for example, many levels of herbivory are naturally superimposed on a fire mosaic, then at certain scales even more diversity should result.

The intermediate disturbance hypothesis claims that the greatest species richness (and perhaps overall biodiversity) at one point in time and space is likely to result from intermediate levels of disturbance. At extreme levels of both low and high disturbance, there might indeed be fewer species, but certain species which are not favoured or are even absent at intermediate levels would very likely prosper. Thus, if the ecosystem can pass through various stages of disturbance in different places and at different times, the patchwork created might support the greatest overall diversity desirable in a natural system, though spatial variation can in many ways substitute for temporal variation and *vice versa*.

An equally important issue is the rate of change, as influenced by the pattern and intensity of disturbance - a rapidly increasing disturbance regime often has different ecological effects to a slowly increasing one, even if the final intensity is the same.

In recent years there has been increasing belief that most of the important changes in savannas are event-driven. They may occur only occasionally, when a certain co-occurrence of events (perhaps drought plus rapidly-rising levels of herbivory plus fire at a critical period, followed by good rain) brings about a particular shift from one state to another (perhaps an invasion of bush into grassland). Different ecological pressures then prevail which may stabilise the system in a new state for years or even decades. Current ecosystem theory takes cognisance of the likelihood of the existence of multiple stable states (Dublin 1995) as well as considering several

other models of ecosystem dynamics. These differing ideas about how systems function span a range from the classical homogeneity/stability paradigms through to the relatively revolutionary disequilibrium notions (Behnke *et al.* 1993). Each of these models appears to have had some validity at some location and scale over some time span, our current understanding falling short of integration of these into a unified theory. Holling (1995) and others assert that by finding a particular apparent "winning recipe for ecosystem management" at a locality (the more homogeneous, seemingly the more dangerous) and keeping it static for too long, invariably leads to catastrophic change when an extreme event occurs, usually because of lack of resilience.

Scaling is a historically underrated issue and its understanding forms the crux of much new insight. Elephant impacts may operate at various scales, and much of what is presented here assumes that animals with such large body sizes, home ranges, walking ability and propensity for fast-increase are likely to create landscape-scale effects. Equally they may, perhaps at lower densities, create a mosaic of medium-scale (100's of metres to 10 km) effects with patches of riverine vegetation being "stripped completely" and other patches nearby not being touched. At the individual tree level, different fine-scale sequelae of their feeding on some parts and not others of the tree, might lead to habitat diversity for different insects. Time scales are equally important: long-term views often place shorter-term fluctuations into the perspective of making up the natural flux.

What does all this mean for management? Managers of natural systems are now entering an era where heterogeneity needs not only to be understood, but also implemented in some practical way. The outcome of this elephant management strategy is an attempt to meet this challenge, even if the scales at which the processes occur needs further understanding. The belief is, in the first place, that this management strategy will enhance biodiversity. Secondly, at the same time, it will provide an opportunity to learn by managing, a crucial element of adaptive management. Although much use will be made of the outcomes to learn more about future elephant management, it should not be seen primarily as an experiment - the options chosen are intended to meet the primary biodiversity objective of the KNP, rather than constitute any contrived or forceful experiment. Obviously, "unnatural over-heterogenisation" is possible, and is indeed practised by smaller ecotourism operations specifically to create habitat diversity for more

species than might naturally occur at these sites. It is not the intention of the SANP to take the management of the KNP to this unnatural level, indeed where this has happened (artificial waterholes can lead to heterogenisation or homogenisation, obviously depending on the context) it is being reversed. In the same vein, the SANP would like to vary rates of change (thus increasing diversity, also through the differential resilience of different species and systems to different rates) but in a natural regime. The word "natural", as also embodied in the mission statement, thus provides an important cornerstone of this action. The TPCs, which will be continuously refined as knowledge, experience and hopefully wisdom grow, provide an attempt to outline the "envelopes" of acceptability to management. They are meant to delineate thresholds beyond which (it is believed) the system will have exceeded its inherent elasticity, and from which it may not have the ability to return to a healthy state.

The occurrence of the kinds of events which bring about changes, even drastic-seeming changes, should not be suppressed if they are natural, as they may contribute significantly to system resilience in the long-run (Holling 1995). KNP management should thus be geared to allowing these to take place. Management has to be capable of tracking ecosystem changes to see that they fall within TPCs, and may need to nudge the system in the "correct" direction if sustained trajectories towards (and believed to be going to exceed) TPCs are predicted. More drastic intervention may be needed when TPCs have been grossly exceeded due to modern human influence, though if the adaptive management and TPC-monitoring system is effective, this may not often be necessary. An understanding of the scales at which these different processes related to elephant impact occur, is extremely difficult to achieve, and will demand much research and modelling. Certainly, the SANP is trying to adopt a longer-term view, though realising the importance of perhaps shorter-term considerations such as the immediate tourism value of this unique species, as well as moral and ethical considerations.

CURRENT THINKING AND APPROACH TO ELEPHANT MANAGEMENT

Principles

This proposed new elephant management policy rests on three fundamental principles on which there was consensus at the meeting of 30 October 1996. These are:

- i. In accordance with the new Vision Statement of the KNP, it is accepted that flux in ecosystems is natural and desirable as this contributes to biodiversity, and that this is

probably also true for the elephant population.

- ii. It is accepted that elephants are important agents of disturbance and as such create heterogeneity and thus contribute to biodiversity (Intermediate Disturbance Hypothesis). This was demonstrated in Amboseli National Park by Western & Gichohi (1989). This means that in the absence (or very low densities) of elephants, biodiversity will be negatively affected as no disturbance occurs. Excessive disturbances at high densities will also affect biodiversity negatively (these high and low end-points may also be shown to be desirable as it is believed that certain species will benefit from the conditions thus created, provided that they do not occur over a large area for too long).
- iii. It is also accepted that elephant populations that are confined but not managed, will increase in number to a level where negative impacts on the system's biodiversity will result.

In recognising the above three principles, the following corollaries have to be considered:

- i. To *maintain* an elephant population at a *high* level will require the culling and/or translocation of a larger number of individuals than when maintaining it at a lower level (this may have moral or ethical considerations).
- ii. The *reduction* of an elephant population from a high level to a lower level will require the culling and/or translocation of a larger number of individuals than when maintaining it at a lower level (this may have moral or ethical considerations).
- iii. Wherever possible, management of the elephant population should be conducted by non-lethal means (translocation, contraception, etc.) but that where these methods prove inadequate, culling must remain an option for use.
- iv. When culling is necessary, only the most humane method available should be used.

Options for controlling elephant numbers other than culling

When or wherever elephant population control is considered necessary, the priority will always

be to do so by non-lethal means. It is stressed that these options are not likely to fulfil the requirements needed to manage the KNP elephant population successfully. Where these options are not feasible, culling is currently the only practical option available to do so.

i. Translocation (live transfer)

Before the development of methods to translocate adult elephants, juvenile animals were captured at culling operations for translocation. Up to 1994, 1 339 juveniles were translocated in this way from KNP to other conservation areas. By 1994, methods enabling the live transfer of adult elephants had been developed and since then, 300 elephants in family units have also been translocated. With the advent of this technology, it is now believed that the translocation of juvenile animals is inhumane and therefore undesirable. This latter option will no longer be practised - only animals in intact family units will be transferred live out of the KNP.

Over the long term, the limited market for live animals will not provide the option of removing all excess elephants from the KNP through live transfer.

ii. Contraception

Chapter 6 reviewed the current state of contraception technology. This showed that it cannot yet offer a satisfactory method of population control in elephants (Whyte & Grobler 1997; Whyte *et al.* 1998).

Opposition to the contraception option has also been voiced by communities adjacent to KNP as they hold the belief that sustainable utilisation of the population should be practised. However, SANP should continue to support research on contraception technology with the hope that it will ultimately provide an additional practical and affordable option for the control of the KNP (and other) elephant populations.

THE NEW POLICY FOR MANAGING THE KNP ELEPHANT POPULATION

The new elephant management policy will differ from the old one in that the elephant population will be managed according to measured impacts on biodiversity rather than on absolute numbers of elephants. Different management options will be practised in different zones and aspects of biodiversity will be monitored. This management option will continue

until there is clear evidence that the prevailing density of elephants is having a negative impact on some aspect of biodiversity which warrants concern. This point will be known as a "Threshold of Potential Concern" (TPC), which can be defined as those upper and lower levels along a continuum of change in a selected environmental indicator which, when reached, prompts an assessment of the causes which led to such an extent of change, and results in either:

- i. management action to moderate such cause(s), or
- ii. re-calibration of the threshold to a more realistic or meaningful level.

Such TPCs are initially established at somewhat arbitrary levels on "best-available-knowledge-and-experience". It is absolutely necessary when deciding to use such TPCs that it must be accompanied by monitoring at appropriate intervals, and that there must be considerable understanding of the factors causing change in the parameter being monitored.

TPCs have the advantage that management has definite proactive objectives or parameters within which to manage a system, in contrast to previous practices which reactively managed events or processes to minimise or avoid crises. Nevertheless, TPCs should be constantly challenged as to their appropriateness or validity, and adaptively modified as knowledge and experience increase.

The appropriate TPCs for the management of the KNP elephant population have been set "widely" which will allow for considerable fluctuation in the populations of the respective management zones. The TPCs for elephant are given (in their current form) at the end of this elephant management policy proposal.

A zoning system for management of elephant impact

The KNP will be divided into six zones which will receive different treatments in terms of the management of their respective elephant populations (see Figure 24). These zones are:

- i. two botanical reserves,
- ii. two high-density elephant zones,
- iii. two low-density elephant zones.

In the high-density elephant zones the population will be allowed to increase (no culling or live removals) until there are indications that one or more of the Thresholds of Potential Concern (TPCs) have been reached or exceeded. It is expected that the elephant population of these zones will increase at 7% per year (see Chapter 5). In the low-density elephant zones the population will be decreased (through culling or live removals) until there are indications that low densities of elephants have induced change to a point that one or more of the TPCs have been reached or exceeded. This decrease will be achieved through the reduction of the populations in these zones by 7% per year. As the numbers of elephants in these zones are also expected to increase at 7% per year, it will mean the setting of a removal quota of 14% of the total recorded during the census to achieve a 7% reduction. In the Botanical Reserves medium densities are to be maintained. "Medium density" is here considered to be the density prescribed in the previous Masterplan (Joubert 1986) which was 0.35 elephants per km² (7 000 elephants in 20 000 km²). Should one or more of the defined TPCs be reached or exceeded in these zones, then elephant numbers should be systematically reduced to negate this.

It is hoped that it will prove feasible for the management actions applied in the high- and low-density zones to be alternated, so that once a TPC has been reached or exceeded in any of the management zones, the alternate action will then be applied. High-density areas can then be treated as low-density zones and their populations systematically reduced while the elephant populations of the low-density zones can simultaneously be allowed to increase. While it is accepted in principle that this managed form of flux in the elephant population may prove to be beneficial and contribute to the maintenance of biodiversity in the KNP, it is felt that this should be demonstrated before it becomes permanently embodied in the elephant management policy.

There is some concern that increased elephant densities in the allocated zones may affect biodiversity in a way that is not reversible by a subsequent reduction in the elephant population. Theoretically a high elephant population may induce a decline in the population of some tree species, which may then not recover under the pressure of even a much lower elephant population. A more cautious approach will be followed - once the effects of an increased elephant population are better understood, this part of the policy should be reviewed.

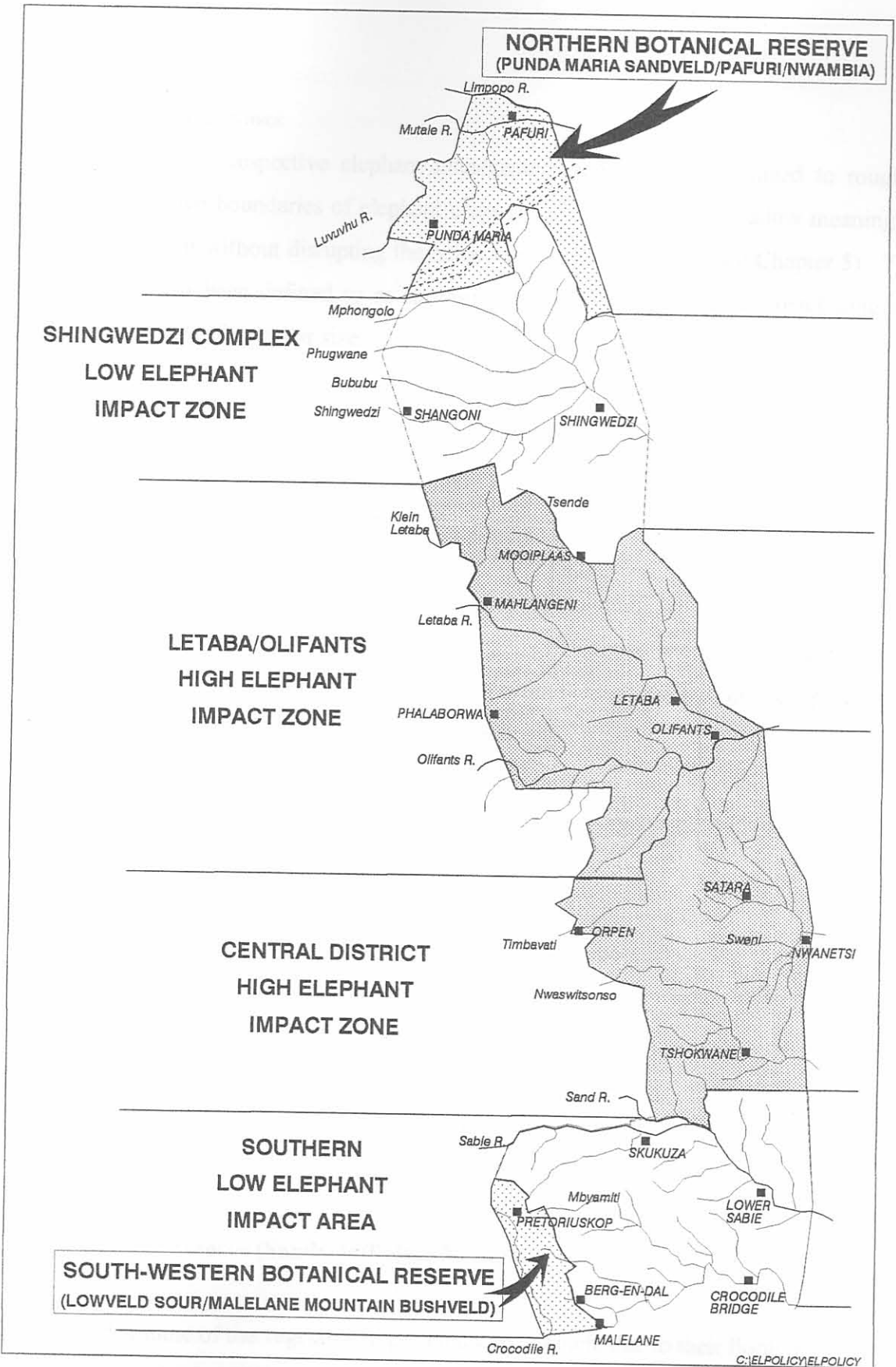


Figure 24: The zonation of the Kruger National Park for elephant management as proposed in the new elephant management policy (Whyte et al. 1999)

Elephant management zones

The boundaries of the respective elephant management zones were designated to roughly conform to the known boundaries of elephant clans (Figure 17). This is to allow meaningful elephant management without disrupting the home ranges of these clans (see Chapter 5). The boundaries have also been defined so as to ensure that the four major zones (excluding the botanical reserves) are of a similar size.

The two high-impact zones have been placed adjacent to one another in the centre of KNP to establish a large core area of "no-management". The two low-impact zones then lie between the high-impact zones and the botanical reserves to obviate the problems of a hard edge between high densities of elephants and the botanical reserves. Once TPCs have been exceeded and the management actions in the respective high- and low-impact zones have been reversed, it is accepted that these problems will become a reality and will have to be addressed. But it may transpire that the elephants' home-ranges will remain intact through the management processes, and that little movement will occur across these boundaries.

The management of the Botanical Reserves will result from TPCs especially formulated for these areas (Pienaar *et al.* In prep.).

It may be expected that by reducing numbers in the two low-impact zones, the total number of elephants in the KNP will not be greatly influenced by the increases in the other two zones, keeping the total population at a manageable level. However, this is not expected to be the case as modelling of the responses of these zones to the planned management actions shows that the total KNP population will probably increase dramatically (see section on "Implementation of the Policy" below).

Northern Botanical Reserve (Sandveld/Pafuri/Nwambia)

Rationale

This area includes some of the vegetation types/landscapes which, due to their floral uniqueness in the KNP (Gertenbach 1983), should not be placed at risk of excessive elephant impacts (Pienaar *et al.* In prep.; Zambatis *et al.* 1997). The landscapes and vegetation types concerned

are the *Colophospermum mopane* forest (Landscape 15 (Gertenbach 1983)), the *Adansonia digitata*/*Sterculia rogersii* area and the Nwambia sandveld communities. Whyte *et al.* (1996) have suggested that elephants may be partially responsible for a decline in the baobab population of this area.

Boundaries

The southern boundary extends from Dothole eastward along the Manangananga Firebreak to Magamba; then northward along the Shingwedzi/ Pafuri tarred road (HI-8) to Klopperfontein; then eastward along the Masokosa road to Masokosa Pan; then southward along the military service road; then turning eastward to the eastern boundary along the firebreak between Burning blocks 41 and 42. The other boundaries are constituted by the eastern, northern and western boundaries of the KNP. According to the KNP GIS system, the area of this zone is 1 552 km².

Elephant management

Although van Aarde *et al.* 1999 found that elephant densities declined in KNP after they exceeded 0.37 elephants/km², densities in the botanical reserves are to be initially maintained at a density of 0.35 elephants/km². This is the density that was prescribed in the earlier Masterplan for the Kruger National Park (Joubert 1986) at which it was felt that minimum impacts of elephants had been experienced. These densities will be monitored annually during aerial censuses and elephant movements in and out of the area will be monitored through the ongoing movement study using radio-collared animals. The number of elephants in the area should not exceed the prescribed density of 0.35 elephants per km² (i.e. 550). However, should one or more of the defined TPCs (see Table 16; Pienaar *et al.* In prep) be reached or exceeded, then elephant numbers should be systematically reduced (or increased) to negate this, as understanding indicates.

South-western Botanical Reserve (Lowveld Sour/Malelane Mountain Bushveld)

Rationale

This area also includes some of the vegetation types/landscapes of floral uniqueness in the KNP (Gertenbach 1983), which should not be placed at risk of excessive elephant impacts (Pienaar, Biggs, Venter & Whyte In prep.; Zambatis *et al.* 1997). These landscapes are the Lowveld

Sour- and Malelane Mountain Bushveld (Landscapes 1 and 2).

Boundaries

The northern and eastern boundaries of this zone extend from Thlothloma on the western boundary eastward along the northern and eastern boundaries of Burning block 35; then along the northern and eastern boundaries of Burning block 57; then southward along the eastern boundary of Burning block 90; then following the western boundary of Burning blocks 103 and 87 as far south as Malelane Restcamp. The western boundary of the zone follows the western boundary of the KNP from Thlothloma southward to the Sigaas River mouth, and the southern boundary of the zone is the Crocodile River between Sigaas River mouth and Malelane. According to the KNP GIS system, the area of this zone is 700 km².

Elephant management

Elephant densities are to be maintained at a density of 0.35 elephants/km². These densities will be monitored annually during aerial censuses and elephant movements in and out of the area will be monitored through the ongoing movement study using radio-collared animals. The number of elephants in the area should not exceed 250. However, should one or more of the defined TPCs (Pienaar *et al.* In prep.) be reached or exceeded, then elephant numbers should be systematically reduced (or increased) to negate this, as understanding indicates.

Letaba/Olifants High Elephant Impact Zone

Rationale

It is the expectation of KNP managers that fluctuations in elephant numbers (as with all other biotic elements) will benefit natural ecological processes and other components of biodiversity, though this will require confirmation through the monitoring program (Pienaar *et al.* In prep). Elephant numbers in this zone will not be controlled. The intention is to allow elephant numbers to increase over a period of many years until one or more of the defined TPCs are reached or exceeded (as more than one may be reached concurrently). Following this, the zone may revert to a "low-density elephant zone" with systematic reduction of elephant numbers, thus inducing the desired population flux and the varying environmental impacts associated with it.

Boundaries

The northern boundary of the zone will extend eastward from Busizi on the western boundary of the KNP along the northern boundary of Burning blocks 124 and 125; then southward along the eastern boundary of Burning blocks 124 and 129; then eastward along the southern boundary of Burning block 123 as far as the tarred road (HI-6); then southward along the tarred road (HI-6) as far as Mopani Restcamp; then eastward along the tourist road (S49) to the Nshawu Firebreak; then northward and eastward along the Nshawu Firebreak as far as the KNP's eastern boundary.

The southern boundary of the zone extends eastward from Mangadyane on the western boundary (just north of Orpen) along the firebreak on the northern boundaries of Burning blocks 33, 34 and 30 as far as the Timbavati River; then northward along the Timbavati River to the Olifants River; then eastward along the Olifants River. The western and eastern boundaries of the zone are the western and eastern boundaries of the KNP. According to the KNP GIS system, the area of this zone is 4 883 km².

Elephant management

In this area elephant numbers will not be reduced either through culling or live removals. Numbers are expected to increase at a mean rate of approximately 7% per year. Monitoring of defined components of biodiversity (Table 16; Pienaar *et al In prep.*) will occur to determine the impacts of this increasing elephant density. The increase will be allowed to continue until one or more of the defined TPCs has been reached or exceeded. Appropriate management actions will then be debated by the KNP Standing Committee for Nature Conservation and all other interested or affected parties, with all the relevant data and reports under consideration.

It is hoped that the proposed trans-frontier conservation area (TFCA) in Mozambique (Braack 2000) will become a reality and that the removal of the fence on this zone's eastern boundary will allow a natural expansion of these elephants into Mozambique (Braack 2000).

Elephant densities will be monitored annually during aerial censuses and elephant movements in and out of the area will be monitored through the ongoing movement study using radio-collared animals.

Central District High Elephant Impact Zone

Rationale

As with the Letaba/Olifants High Elephant Impact Zone, it is expected that fluctuations in elephant numbers (as with all other biotic elements) will benefit natural ecological processes and other components of biodiversity, therefore elephant numbers in this zone will not be controlled. The intention in this zone is also to allow elephant numbers to increase over a period of many years until one or more of the defined TPCs are reached or exceeded, following which this zone may revert to a "low-density elephant zone" with systematic reduction of elephant numbers, thus inducing the population flux desired by managers and the expected varying environmental impact associated with it.

Boundaries

The northern boundary of this zone is a common boundary with the Letaba/Olifants High Elephant Impact Zone's southern boundary; the southern boundary of this zone is a common boundary with the Southern Low Elephant Impact Zone's northern boundary. The eastern and western boundaries of the zone follow the eastern and western boundaries of the KNP. According to the KNP GIS system, the area of this zone is 4 149 km².

Elephant management

In this area, elephant numbers will not be reduced either through culling or live removals. Numbers are expected to increase at a mean rate of around 7% per year. Monitoring of defined components of biodiversity will occur to determine the impacts of this increasing elephant density. The increase will be allowed to continue until one or more of the defined TPCs has been reached or exceeded. Appropriate management actions will then be considered.

Elephant densities will be monitored annually during aerial censuses and elephant movements in and out of the area will be monitored through the ongoing movement study using radio-collared animals.

Shingwedzi Complex Low Elephant Impact Zone

Rationale

As with an increasing elephant population, it is expected that declining elephant numbers will

also adversely affect biodiversity as the positive benefits of elephant impacts on heterogeneity are reduced. Elephant numbers will be systematically reduced at a rate of approximately 7% per year. By reducing the number of elephants at a consistent rate of 7% per year the actual number to be removed gradually declines each year so that the effects of the decline will diminish gradually.

It is hoped that the removal of the eastern boundary fence once the proposed TFCA has been established in Mozambique, will allow for some natural movement out of this zone which will reduce the number elephants to be artificially removed (either through culls or translocations).

The reduced elephant density in this zone will also act as a buffer between the Letaba/Olifants High Elephant Impact Zone and the Northern Botanical Reserve.

Boundaries

The northern boundary of this zone is a common boundary with the Northern Botanical Reserve's southern boundary; the southern boundary of this zone is a common boundary with the Letaba/Olifants High Elephant Impact Zone's northern boundary. The eastern and western boundaries of the zone follow the eastern and western boundaries of the KNP. According to the KNP GIS system, the area of this zone is 4 026 km².

Elephant management

Elephant densities will be reduced in this zone by 7% per year until one or more of the defined TPCs has been reached or exceeded. Appropriate management actions will then be considered. Elephant densities will be monitored annually during aerial censuses. Quotas for culling or live removals will be determined after the annual census result has become available. Elephant movements in and out of the area will be monitored through the ongoing movement study using radio-collared animals.

Southern Low Elephant Impact Zone

Rationale

As with the Shingwedzi complex low-density elephant zone, elephant numbers will be systematically reduced at a rate of approximately 7% per year. By reducing the number of

elephants at a consistent rate of 7% per year the actual number to be removed gradually declines each year so that the effects of the decline will diminish gradually.

Boundaries

The western boundary of this zone is a common boundary the South-western Botanical Reserve. The southern boundary extends eastward along the Crocodile River from Malelane to the Mozambique border; the eastern border of the zone then extends northward along the Mozambique border to the Rietpan Firebreak; the northern border extends along the Rietpan Firebreak westwards to the Nwatindlopfu River; then southward along this river to its confluence with the Sabie River; then westwards along the Sabie River to the KNP's western boundary. According to the KNP GIS system, the area of this zone is 3 436 km².

Elephant management

Elephant densities will also be reduced in this zone by 7% per year until one or more of the defined TPCs has been reached or exceeded. Appropriate management actions will then be considered. Elephant densities will be monitored annually during aerial censuses. Quotas for culling or live removals will be determined after the annual census result has become available.

Elephant movements in and out of the area will be monitored through the ongoing movement study using radio-collared animals.

THRESHOLDS OF POTENTIAL CONCERN FOR ELEPHANT IMPACT

Rationale

Table 16 lists TPCs for the high and low elephant impact zones, but not for the botanical reserves which need their own specific TPCs addressing plant community viability and optimum chance for rare species survival. The so-called "whole-park" measures given here thus refer to the whole KNP excluding the botanical reserves. TPCs for the botanical reserves have not yet been formulated (Pienaar *et al.* In prep.).

Any one TPC reached is meant to act as a significant warning sign on its own, and although evaluated in overall context with the rest, must be taken seriously in its own right.

The TPCs assume that any action then taken will significantly alter the predisposing

environment which allowed that TPC to be reached. If at some stage in the future a very high density elephant population has evoked a TPC, the manner in which the populations are to be reduced will be of particular importance. Theoretically, there are many ways in which a large elephant population can be reduced. It might, if it were logistically possible, be reduced by 50% per year (fast removal), which may be necessary after a high-density phase to prevent further exceeding of the TPC. They might also be reduced by as little as 7% or less (slow removal). The TPCs given here presuppose fast removal. If slow removal is chosen, it will be important to tone down the TPCs somewhat to take into account the continued almost-as-high impact which will follow for many years after the peak is reached.

The relationship between the percentages given for within-zone and for the whole park TPCs (Table 16) may at first seem incongruous, given that the areas of the high and low zones are approximately equal (i.e. one might expect never to reach the whole-park TPCs). However, it is possible that only one of the two high (or for that matter low) zones may show severe changes, justifying the operational use of 30% (i.e. less than half of the 80%) as a TPC.

The list in Table 16 focuses on TPCs believed to be directly related to elephant, but other categories of TPCs (e.g. riparian health) may be exceeded due to elephant influence. These would obviously qualify as valid TPCs in their own right but are still in the formulation phase (Pienaar *et al.* In prep.).

Decision-making

Recommendations to the KNP Director as to appropriate actions for the management of elephants in the respective zones should be made by the KNP Standing Committee for Nature Conservation. The Standing Committee should co-opt appropriate senior management and research staff to appraise the results of the respective biodiversity monitoring projects and the annual elephant census results. Such appraisal should be done on an annual basis.

Table 16: Thresholds of Potential Concern for Elephants in the Kruger National Park

| Criterion | Measure | Within-zone TPC | Whole-park TPC |
|--|---|---|--|
| Vegetation heterogeneity at coarse (mega) scale | Coverage (km ²) of landscape scale units (e.g. Gertenbach 1983) determined every 5 years. Result compared to any previous time, including historical. | 80% change (cumulative) in the area of any landscape scale classification unit | 30% change (cumulative) in the area of any landscape scale classification unit |
| Vegetation structure at community scale using size classes for a range of indicator woody species | Assume, e.g. 4 size classes. Then homogenisation is 90% dominance of any 2 size classes. | 80% of all plots homogenous. Sensitive landscapes examined independently as well. | 30% of all plots homogenous. Sensitive landscapes examined independently as well. |
| Woody canopy cover at community scale | % woody (within stratified landscapes, e.g. riparian) as determined from aerial photographs, done every 3 years | 80% decline in canopy cover; specified increase with asymptote (see graph) | 30% decline in canopy cover; specified increase with asymptote (see graph) |
| Rare, sensitive or characteristic (of the Lowveld) woody species (only in relation to elephant utilisation – short list) | Population size and structure fed into pv model | None, prepared to accept local loss or definite trend towards local loss of certain species (provided same species not declining seriously in lo/hi zones at the same time. i.e. species should NOT survive only in botanical reserves.) | 99% probability of population persistence for next 100 years |
| Birds as surrogates for structural riparian health | Presence of species using reed beds, mudflats, litter, lower stratum, middle stratum, upper stratum | Because all perennial rivers are in or border on current high elephant areas, there is need for an in-zone TPC - when species from any category are no longer represented on any particular perennial river. Recolonisation thus assumed between zones. | Perennial rivers dealt with as within-zones issue per river; for seasonal rivers there will be a whole-park TPC, namely : when species from any category no longer represented in park as a whole - recolonisation from perennials rivers assumed. |

| Criterion | Measure | Within-zone TPC | Whole-park TPC |
|--|--|--|--|
| Birds as functional class representatives in riparian corridors (what about outside riparian corridors as well, with own TPC's?) | Frugivores, granivores, insectivores (bark foragers, hawks, leaf-gleaners), piscivores, raptors, nectarivores Frugivores, Gramnivores etc. | See above | see above |
| Invertebrate functional class representation | Ground and grass insects and spiders, tree dwelling insects and spiders, dung beetles, termites (harvester and macrotermes mounds), millipedes, pollinators. | When any class disappears from any zone (see proviso in whole-park TPC). Assumes recolonisation. | provided there are not serious concomitant decline of same classes in alternate zones. |
| Erosion/piosphere | RS classification – bare ground index | When affected area > unaffected area (ie. index >50%) or when affected area < 5% (latter to guarantee some eroded habitat in any zone) | when aggregated whole-park bare ground index less than 2.5% or > 25% |

THE IMPLICATIONS OF IMPLEMENTING THE NEW ELEPHANT MANAGEMENT POLICY

INTRODUCTION

In order to assess the implications of implementing the new elephant management policy on the elephant population, a spreadsheet model was developed to simulate the trends in the respective zones and also for the KNP as a whole.

METHODS

A simple spreadsheet model was constructed to calculate the number of elephants to be removed from each zone based on the management strategies listed for each of the six elephant management strategies described earlier. The starting point was the data derived from the aerial census of 1999. The populations in the botanical zones were reduced to and held at the prescribed density, those in the low-impact zones were reduced by 7% per year, while those in the high-impact (unmanaged) zones were increased by 7% per year. The projections were based on four assumptions which were:

- i. that the elephants recorded in the respective management zones will remain in these zones and will not move into adjacent zones;
- ii. that population growth rates will remain a constant 7% per year;
- iii. that to achieve a 7% reduction in a population which is growing at 7% per year, a total of 14% of the animals recorded in that zone should be removed each year;
- iv. that the management programs are implemented in the year 2000.

RESULTS

Scenario for the immediate future (year 2000)

The number of elephants to be removed from the respective zones' populations is given in Table 17. Since the prescribed limits for the botanical zones were exceeded by far, a large number of animals must be removed from these two zones. It is assumed that all of the excess elephants in the botanical reserves are removed in the first year while in the low-impact zones a 7% reduction is made. This gives a total of 963 elephants to be removed in the first year. This large quota results in a small decline after the first year. Thereafter, once the excess in the botanical zones has been removed, the numbers to be removed annually decline rapidly and the KNP population begins to increase (Table 18).

Table 17: Population reduction quotas for the respective elephant management zones of the Kruger National Park in the year 2000 if the new elephant management policy were to be implemented.

| Management Zone | Total counted in 1999 | Limit | Total to be removed | Bulls to be removed | Br. Herds to be removed |
|----------------------------|-----------------------|-------|---------------------|---------------------|-------------------------|
| Northern Botanical Reserve | 901 | 550* | 351 | 53 | 298 |
| Northern Low Impact | 1720 | | 241 | 36 | 205 |
| Northern High Impact | 2665 | | 0 | 0 | 0 |
| Central High Impact | 1524 | | 0 | 0 | 0 |
| Southern Low Impact | 2001 | | 280 | 42 | 238 |
| Southern Botanical Reserve | 341 | 250* | 91 | 14 | 77 |
| Total | 9 152 | | 963 | 144 | 819 |

* The limits for the botanical reserves are specified in the management policy.

** The respective quotas for bulls and breeding herds are 15% and 85% as these are the ratios at which they occur naturally.

Projections for the future

If the assumptions given above were to hold true, the population trends and the trends in the numbers of elephants to be removed can be projected into the future. These are given in Figure 25 and Table 18. Once the excess elephants have been removed from the botanical zones, the number to remove drops significantly in the second year (from 963 to 540). In subsequent years the management option for each zone is maintained until a hypothetical TPC is reached in the year 2020 (Figure 25). By this time the number to be removed has declined to just 170, while the KNP population as a whole has increased to almost 19 000.

Once a TPC has been reached, the management options for the high- and low-impact zones is reversed and once again the number of elephants to be removed increases dramatically due to the high numbers of elephants in the high impact zones which now need to be reduced.

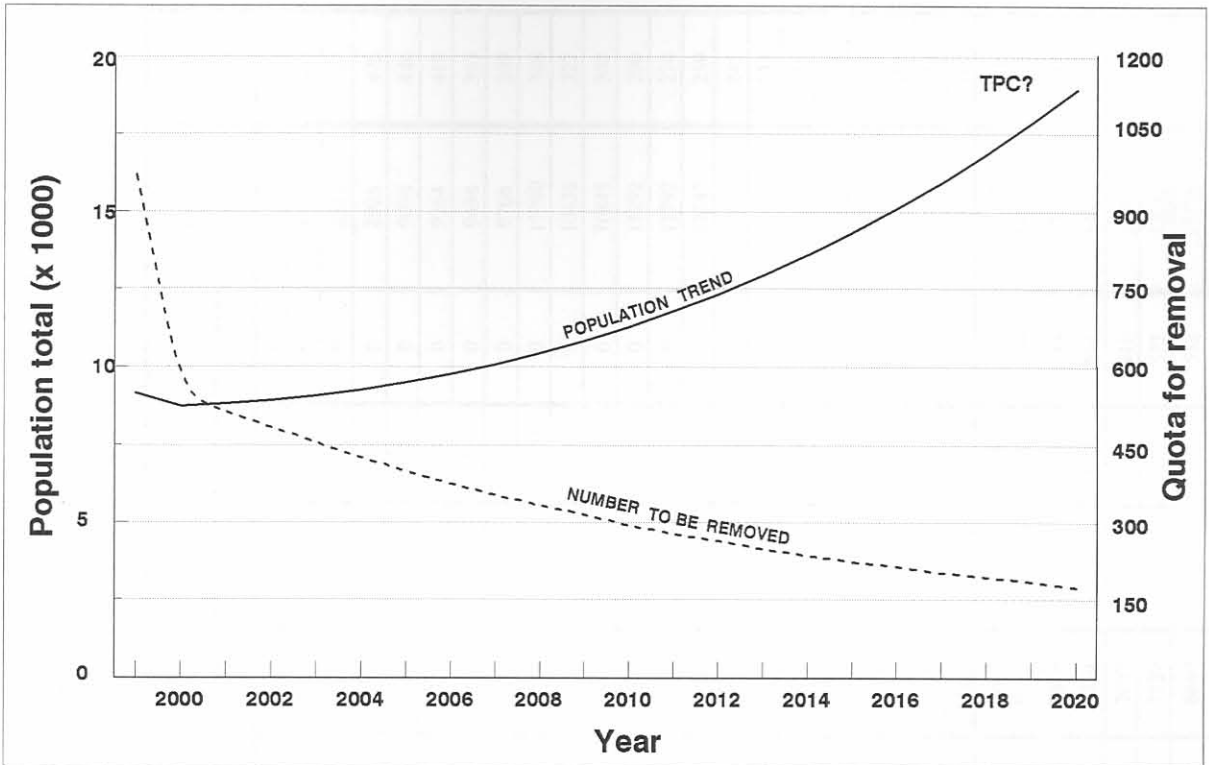


Figure 25: Expected elephant population trends and numbers to be removed from the population after the implementation of th new elephant management policy. The assumptions are that the population is growing at 7% per year, and that the elephants remain in the respective management zones.

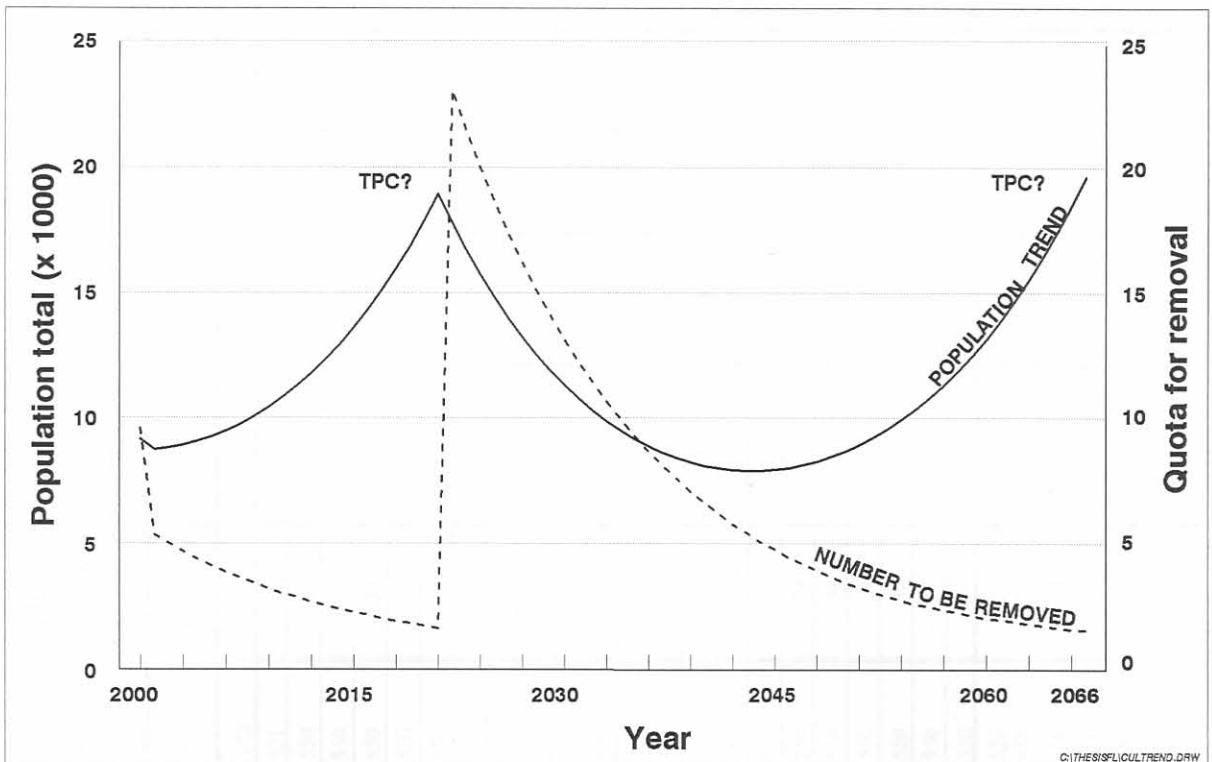


Figure 26: Expected elephant population trends and numbers of elephants to be removed from the population before and subsequent to reaching a TPC. The assumptions are that the population is growing at 7% per year, and that the elephants remain in the respective management zones.

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Table 18: Expected elephant population trends in the Kruger National Park and its respective elephant management zones subsequent to the implementation of the new elephant management policy.

| Year | Northern Botanical Reserve | | Southern Botanical Reserve | | Northern Low-impact | | Southern Low-impact | | Northern high-impact | | Southern high-impact | | Total population | Total quota |
|------|----------------------------|-------|----------------------------|-------|---------------------|-------|---------------------|-------|----------------------|-------|----------------------|-------|------------------|-------------|
| | Total | Quota | Total | Quota | Total | Quota | Total | Quota | Total | Quota | Total | Quota | | |
| 1999 | 901 | 351 | 341 | 91 | 1720 | 241 | 2001 | 280 | 2665 | 0 | 1524 | 0 | 9152 | 963 |
| 2000 | 550 | 39 | 250 | 18 | 1600 | 224 | 1861 | 261 | 2852 | 0 | 1631 | 0 | 8743 | 540 |
| 2001 | 550 | 39 | 250 | 18 | 1488 | 208 | 1731 | 242 | 3051 | 0 | 1745 | 0 | 8814 | 507 |
| 2002 | 550 | 39 | 250 | 18 | 1383 | 194 | 1610 | 225 | 3265 | 0 | 1867 | 0 | 8925 | 475 |
| 2003 | 550 | 39 | 250 | 18 | 1287 | 180 | 1497 | 210 | 3493 | 0 | 1998 | 0 | 9074 | 446 |
| 2004 | 550 | 39 | 250 | 18 | 1197 | 168 | 1392 | 195 | 3738 | 0 | 2137 | 0 | 9264 | 418 |
| 2005 | 550 | 39 | 250 | 18 | 1113 | 156 | 1295 | 181 | 3999 | 0 | 2287 | 0 | 9494 | 393 |
| 2006 | 550 | 39 | 250 | 18 | 1035 | 145 | 1204 | 169 | 4279 | 0 | 2447 | 0 | 9766 | 369 |
| 2007 | 550 | 39 | 250 | 18 | 962 | 135 | 1120 | 157 | 4579 | 0 | 2619 | 0 | 10080 | 348 |
| 2008 | 550 | 39 | 250 | 18 | 895 | 125 | 1041 | 146 | 4899 | 0 | 2802 | 0 | 10438 | 327 |
| 2009 | 550 | 39 | 250 | 18 | 832 | 117 | 968 | 136 | 5242 | 0 | 2998 | 0 | 10841 | 308 |
| 2010 | 550 | 39 | 250 | 18 | 774 | 108 | 901 | 126 | 5609 | 0 | 3208 | 0 | 11292 | 290 |
| 2011 | 550 | 39 | 250 | 18 | 720 | 101 | 838 | 117 | 6002 | 0 | 3432 | 0 | 11792 | 274 |
| 2012 | 550 | 39 | 250 | 18 | 670 | 94 | 779 | 109 | 6422 | 0 | 3673 | 0 | 12343 | 259 |
| 2013 | 550 | 39 | 250 | 18 | 623 | 87 | 724 | 101 | 6872 | 0 | 3930 | 0 | 12949 | 245 |
| 2014 | 550 | 39 | 250 | 18 | 579 | 81 | 674 | 94 | 7353 | 0 | 4205 | 0 | 13610 | 231 |
| 2015 | 550 | 39 | 250 | 18 | 539 | 75 | 627 | 88 | 7868 | 0 | 4499 | 0 | 14332 | 219 |
| 2016 | 550 | 39 | 250 | 18 | 501 | 70 | 583 | 82 | 8418 | 0 | 4814 | 0 | 15116 | 208 |
| 2017 | 550 | 39 | 250 | 18 | 466 | 65 | 542 | 76 | 9008 | 0 | 5151 | 0 | 15966 | 197 |
| 2018 | 550 | 39 | 250 | 18 | 433 | 61 | 504 | 71 | 9638 | 0 | 5512 | 0 | 16887 | 187 |
| 2019 | 550 | 39 | 250 | 18 | 403 | 56 | 469 | 66 | 10313 | 0 | 5897 | 0 | 17882 | 178 |
| 2020 | 550 | 39 | 250 | 18 | 375 | 52 | 436 | 61 | 11035 | 0 | 6310 | 0 | 18955 | 169 |
| 2021 | 550 | 39 | 250 | 18 | 401 | 0 | 466 | 0 | 10262 | 1437 | 5869 | 822 | 17798 | 2314 |
| 2022 | 550 | 39 | 250 | 18 | 429 | 0 | 499 | 0 | 9544 | 1336 | 5458 | 764 | 16730 | 2156 |
| 2023 | 550 | 39 | 250 | 18 | 459 | 0 | 534 | 0 | 8876 | 1243 | 5076 | 711 | 15744 | 2009 |
| 2024 | 550 | 39 | 250 | 18 | 491 | 0 | 571 | 0 | 8254 | 1156 | 4720 | 661 | 14837 | 1872 |
| 2025 | 550 | 39 | 250 | 18 | 526 | 0 | 611 | 0 | 7677 | 1075 | 4390 | 615 | 14003 | 1745 |
| 2026 | 550 | 39 | 250 | 18 | 562 | 0 | 654 | 0 | 7139 | 999 | 4083 | 572 | 13238 | 1627 |
| 2027 | 550 | 39 | 250 | 18 | 602 | 0 | 700 | 0 | 6640 | 930 | 3797 | 532 | 12538 | 1517 |
| 2028 | 550 | 39 | 250 | 18 | 644 | 0 | 749 | 0 | 6175 | 864 | 3531 | 494 | 11899 | 1415 |
| 2029 | 550 | 39 | 250 | 18 | 689 | 0 | 801 | 0 | 5743 | 804 | 3284 | 460 | 11317 | 1320 |
| 2030 | 550 | 39 | 250 | 18 | 737 | 0 | 857 | 0 | 5341 | 748 | 3054 | 428 | 10789 | 1231 |

| Year | Northern Botanical Reserve | | Southern Botanical Reserve | | Northern Low-impact | | Southern Low-impact | | Northern high-impact | | Southern high-impact | | Total population | Total quota |
|------|----------------------------|-------|----------------------------|-------|---------------------|-------|---------------------|-------|----------------------|-------|----------------------|-------|------------------|-------------|
| | Total | Quota | Total | Quota | Total | Quota | Total | Quota | Total | Quota | Total | Quota | | |
| 2031 | 550 | 39 | 250 | 18 | 789 | 0 | 918 | 0 | 4967 | 695 | 2840 | 398 | 10313 | 1149 |
| 2032 | 550 | 39 | 250 | 18 | 844 | 0 | 982 | 0 | 4619 | 647 | 2641 | 370 | 9886 | 1072 |
| 2033 | 550 | 39 | 250 | 18 | 903 | 0 | 1050 | 0 | 4296 | 601 | 2457 | 344 | 9506 | 1001 |
| 2034 | 550 | 39 | 250 | 18 | 966 | 0 | 1124 | 0 | 3995 | 559 | 2285 | 320 | 9170 | 935 |
| 2035 | 550 | 39 | 250 | 18 | 1034 | 0 | 1203 | 0 | 3715 | 520 | 2125 | 297 | 8876 | 874 |
| 2036 | 550 | 39 | 250 | 18 | 1106 | 0 | 1287 | 0 | 3455 | 484 | 1976 | 277 | 8624 | 816 |
| 2037 | 550 | 39 | 250 | 18 | 1184 | 0 | 1377 | 0 | 3213 | 450 | 1838 | 257 | 8412 | 763 |
| 2038 | 550 | 39 | 250 | 18 | 1266 | 0 | 1473 | 0 | 2988 | 418 | 1709 | 239 | 8237 | 714 |
| 2039 | 550 | 39 | 250 | 18 | 1355 | 0 | 1576 | 0 | 2779 | 389 | 1589 | 223 | 8100 | 668 |
| 2040 | 550 | 39 | 250 | 18 | 1450 | 0 | 1687 | 0 | 2585 | 362 | 1478 | 207 | 8000 | 625 |
| 2041 | 550 | 39 | 250 | 18 | 1551 | 0 | 1805 | 0 | 2404 | 337 | 1375 | 192 | 7935 | 585 |
| 2042 | 550 | 39 | 250 | 18 | 1660 | 0 | 1931 | 0 | 2236 | 313 | 1278 | 179 | 7905 | 548 |
| 2043 | 550 | 39 | 250 | 18 | 1776 | 0 | 2066 | 0 | 2079 | 291 | 1189 | 166 | 7911 | 514 |
| 2044 | 550 | 39 | 250 | 18 | 1901 | 0 | 2211 | 0 | 1934 | 271 | 1106 | 155 | 7951 | 481 |
| 2045 | 550 | 39 | 250 | 18 | 2034 | 0 | 2366 | 0 | 1798 | 252 | 1028 | 144 | 8026 | 452 |
| 2046 | 550 | 39 | 250 | 18 | 2176 | 0 | 2531 | 0 | 1672 | 234 | 956 | 134 | 8136 | 424 |
| 2047 | 550 | 39 | 250 | 18 | 2328 | 0 | 2709 | 0 | 1555 | 218 | 889 | 125 | 8282 | 398 |
| 2048 | 550 | 39 | 250 | 18 | 2491 | 0 | 2898 | 0 | 1446 | 202 | 827 | 116 | 8463 | 374 |
| 2049 | 550 | 39 | 250 | 18 | 2666 | 0 | 3101 | 0 | 1345 | 188 | 769 | 108 | 8681 | 352 |
| 2050 | 550 | 39 | 250 | 18 | 2852 | 0 | 3318 | 0 | 1251 | 175 | 715 | 100 | 8937 | 331 |
| 2051 | 550 | 39 | 251 | 18 | 3052 | 0 | 3550 | 0 | 1163 | 163 | 665 | 93 | 9232 | 313 |
| 2052 | 550 | 39 | 252 | 18 | 3266 | 0 | 3799 | 0 | 1082 | 151 | 619 | 87 | 9567 | 296 |
| 2053 | 550 | 39 | 253 | 18 | 3494 | 0 | 4065 | 0 | 1006 | 141 | 575 | 81 | 9944 | 281 |
| 2054 | 550 | 39 | 254 | 18 | 3739 | 0 | 4349 | 0 | 936 | 131 | 535 | 75 | 10363 | 266 |
| 2055 | 550 | 39 | 255 | 18 | 4000 | 0 | 4654 | 0 | 870 | 122 | 498 | 70 | 10827 | 253 |
| 2056 | 550 | 39 | 256 | 18 | 4280 | 0 | 4980 | 0 | 809 | 113 | 463 | 65 | 11338 | 241 |
| 2057 | 550 | 39 | 257 | 18 | 4580 | 0 | 5328 | 0 | 753 | 105 | 430 | 60 | 11898 | 229 |
| 2058 | 550 | 39 | 258 | 18 | 4901 | 0 | 5701 | 0 | 700 | 98 | 400 | 56 | 12510 | 219 |
| 2059 | 550 | 39 | 259 | 18 | 5244 | 0 | 6100 | 0 | 651 | 91 | 372 | 52 | 13176 | 209 |
| 2060 | 550 | 39 | 260 | 18 | 5611 | 0 | 6527 | 0 | 605 | 85 | 346 | 48 | 13900 | 200 |
| 2061 | 550 | 39 | 261 | 18 | 6004 | 0 | 6984 | 0 | 563 | 79 | 322 | 45 | 14684 | 192 |
| 2062 | 550 | 39 | 262 | 18 | 6424 | 0 | 7473 | 0 | 524 | 73 | 299 | 42 | 15532 | 184 |
| 2063 | 550 | 39 | 263 | 18 | 6873 | 0 | 7996 | 0 | 487 | 68 | 278 | 39 | 16448 | 177 |
| 2064 | 550 | 39 | 264 | 18 | 7355 | 0 | 8556 | 0 | 453 | 63 | 259 | 36 | 17437 | 171 |
| 2065 | 550 | 39 | 265 | 19 | 7869 | 0 | 9155 | 0 | 421 | 59 | 241 | 34 | 18501 | 165 |
| 2066 | 550 | 39 | 266 | 19 | 8420 | 0 | 9796 | 0 | 392 | 55 | 224 | 31 | 19648 | 159 |

This also results in a decline in the overall population which persists for about 20 years (Table 18 and Figure 26). At this time, the number of elephants in the "new" high-impact zones has built up to a level where the 7% increase exceeds the number to be removed from the "new" low-impact zones and population begins another growth cycle. This will continue until another TPC is reached sometime in the future.

Possible future options

At the time of writing, the demand for live elephants was very limited and the expectation is that the SANP will only be able to annually dispose of about 30 animals from breeding herds and 30 bulls through live transfer. As contraception is not yet available as a tool for elephant management, culling will have to be the method used to dispose of the majority of the quota. While this limits the opportunities for the management of the KNP elephant population by non-lethal means at present, this situation will in all likelihood change once the proposed new TFCA with Mozambique has been established (Braack 2000). This could allow for the removal of the fence between these two national parks (although the bovine tuberculosis (BTB) problem in KNP would have to be taken into consideration), and will offer considerable opportunities for natural recolonisation and translocations, particularly once the annual quotas have declined after a few years (Table 18). It is conceivable that all of KNP's excess elephants could be managed non-lethally in this way. While this may seem to be the best option, it will be extremely expensive and would require extensive donor funding. It must however be remembered that the TFCA will only offer a temporary solution, as there will also be a limit to the number of elephants that it could accommodate.

EVALUATION OF THE NEW POLICY

It is clear that SANP made a sincere effort to develop this new policy in the most transparent manner, as it invited and involved people from interested and affected parties in the development (workshopping) process. The result has been that, in its current form, the policy has satisfied a wide diversity of opinion from academics to some animal welfare groups. While I was an integral part of the development process (Whyte *et al.* 1997; Whyte *et al.* 1999) and fully support its earliest implementation, I believe that some problems will arise in future which are

likely to ensure that this policy will not be a long-standing one.

Assumptions in the policy which may not be valid

Biodiversity implications

There is as yet no evidence to support the assumption that fluctuating levels of elephant density will promote the long-term maintenance of biodiversity in the “conservation islands” which most national parks have now become. The intermediate disturbance hypothesis has, to a certain degree, been substantiated in the case of elephant disturbances (Western and Gichohi 1989), and while it is probably true that at the extremes of either increasing or decreasing levels of elephant disturbance, other species would be favoured, the question arises: Which are these species and where will come from? Are they species which already occur in low densities in KNP which would be favoured by the changes, or are they indigenous species not normally occurring but which could expand their ranges into KNP to capitalise on the changed habitat conditions? In the case of bird species this latter may be possible but for most other species, natural colonisation or recolonisation may have become an insurmountable problem in the modern age.

Where a plant species has been significantly reduced in population size through elephant utilisation (such as baobabs in Tsavo East (Leuthold 1977)), or as might be the case when a TPC is reached in KNP, it may not be able to recover even when elephant numbers have been reduced. The elephants remaining may still be able to eradicate the few that are left. And where species have been eliminated from ecosystems by extreme elephant habitat modification as has been the case with bushbuck (*Tragelaphus scriptus*) and Lesser kudu (*Tragelaphus imberbis*) in Amboseli National Park, Kenya (Western & Gichohi 1989), recolonisation may be impossible (even if elephant numbers declined dramatically) as a source population in close enough proximity may not exist. Instead of favouring biodiversity, species could thus be lost which is directly contrary to the stated objectives of the policy.

Elephant home ranges

The elephant movement study in KNP showed that matriarchal groups have a high degree of fidelity to their home ranges (see Chapter 5). Based on this, and the knowledge acquired on the dimensions of their respective home ranges, the boundaries of the respective management zones were assigned. But the assumption that this situation will persist as relative densities change subsequent to the implementation of the new policy may be flawed. There are two further possible outcomes:

- that elephants will move from the high- to the low-impact zones as resources diminish in the high-impact zones;
- that elephants will move from the low- to the high-impact zones to escape the traumas of management.

In the first case, elephants moving out of the high-impact zone will neutralise the objectives of the policy. All that will have happened is that “source-sink” zones have been created where elephants moving out of the high-impact zone must be culled in the low-impact zones. This would also mean the removal (by culling or otherwise) of much larger numbers of elephants. “High- and low-impact zones” will thus not be an attainable objective, requiring the formulation of an entirely new policy.

In the second case, elephants moving from low- to high-impact zones will work in favour of the policy’s objectives, as the hoped-for densities in the respective zones will be achieved more easily, requiring minimal numbers to be culled (this is a stated objective of the policy). A potential drawback of this however is that TPCs will be reached sooner, shortening the elephant population fluctuation period, and thus minimising the “recovery time” for vegetation in the low-impact zones.

Foreseen problems with the Policy*Dissimilar time scales between the reaching of TPCs in high- and low-impact zones*

It is likely that the negative consequences for biodiversity arising in the low-impact zones from too few elephant will be a longer-term processes than those arising in the high-impact zones

from too many. The elephants' positive roles for biodiversity may include seed dissemination, control of bush encroachment and making of browse available to other browsers through pushing over trees and breaking of branches. In the absence of elephants, seed dispersal for some species may be compromised, bush encroachment may occur and browse shortages may become limiting for some browsing species. But all of these processes are likely to take many years before they reach TPC levels resulting in the necessity to switch management regimes in the high-impact zones before the low-impact zones are "ready". The reversal of the strategies (high-impact becoming low-impact and vice-versa) will then follow the same trend - TPCs will be reached in the new high-impact zones well before those in the new low-impact zones. These zones will thus never be afforded the desired rest periods. This will ultimately result in park-wide TPCs being exceeded. What then? Once again a new policy will need to be formulated.

High impact zones versus biodiversity and agriculture

The reversal of the strategies (High-impact becoming low-impact and vice-versa) will also mean that high-impact zones will directly adjoin both botanical reserves as well as the agricultural areas along the Crocodile River. As elephant numbers build up, they are likely to place increasing pressure on both, resulting in increased management of the elephants which will be contrary to the objectives of the policy.

Capacity to cull or translocate large numbers of elephants

The capacity of the Game Processing Plant (abattoir) is limited to about 850 – 1000 elephants per year. At current levels the demand for live elephants is unlikely to exceed more than 100 per year. As populations build in the high-impact zones, the number of elephants which will have to be removed once a TPC is reached, may exceed this capacity. This may force managers into a situation where management actions (population reduction) must be instituted before the TPC is reached, as it would be tactically disastrous to allow the elephant population to reach "unmanageable" proportions. This consideration may affect the option of management through TPCs.

Expected positive outcomes

Monitoring programs and TPCs as a form of management

The management of natural areas through TPC controlled monitoring and management programs is a new concept pioneered for this policy. The system need not be applied only to elephant management, but in all areas where expected ecological impacts or changes may be anticipated. Any successes achieved by this concept as outlined in this policy will almost certainly lead to a much wider usage of the concept in SANP and other conservation organisation elsewhere in Africa.

The value of the learning process

The real value of this policy will lie in what will be learned about actual impacts of increasing (and declining) elephant populations on biodiversity through the monitoring program. This will be of particular interest to all elephant managers in Africa. No policy can be “cast in stone” and it is inevitable that this one will be modified or even completely reformulated through lessons learned.

How may the policy change in future?

It seems certain that the dissimilar time scales between the reaching of TPCs in high- and low-impact zones as discussed above will ultimately necessitate another reformulation of the policy. If this should be the case, it would be wise for management to reconsider the policy at the time the first TPC is reached. Consideration of the fact that the switching of the strategies in the high- and low-impact zones respectively may lead to park-wide TPCs being reached or even exceeded, with the corresponding threat of possible losses of species from the system. A reformulation of the policy will probably be necessary. I foresee two possible outcomes, depending on what has been learned.

Modification of the current policy

A logical refinement of the policy may be to retain the respective management zones as they

have been defined without the switching of management strategies. i.e. allow the elephants permanent access to these zones without management. Some of the elephant related TPCs could be disregarded but the monitoring programs would be continued. Advantages of this reformulation would be:

- The current high-impact zones are mainly the mopani areas which probably contribute least to the KNP's biodiversity.
- The communities and species of particular concern are already in the botanical reserves. The low-impact zones would act as "intermediate refuges" for species intolerant of high elephant densities. All known species are represented elsewhere in the KNP in either the botanical reserves or low-impact zones.
- The reaching of park-wide TPCs from high densities of elephants would be precluded.
- The trends as indicated in Table 18 show that the number of elephants to be removed (quota) declines continuously. If the assumptions hold, then in 22 years this quota is reduced to as little as 170 animals. This number could easily be handled through translocations and (if necessary) minimised culling.
- The heavily impacted elephant zones would serve as prime tourist areas, as well as "points of reference" – examples of the scope of elephant "damage" as justification for their management elsewhere.
- Should the TFCA in Mozambique become established and the eastern boundary fence be removed, the high-impact zones will adjoin the area in Mozambique allowing for natural recolonisation and a natural reduction in KNP elephants. The switching of management strategies would place one high-impact zone far removed from Mozambique, precluding this opportunity.

A reversion to a policy similar to the old one

The Intermediate Disturbance Hypothesis has to a certain degree been substantiated for elephant disturbances (Western and Gichohi 1989). It may be that the previous policy (Joubert 1986), which held elephant numbers at a relatively low density will prove to be more successful at maximising biodiversity than one promoting elephant population fluctuations. In the 28 years

that this policy was adhered to (1967-1994), no species is known to have been extirpated from KNP through elephant related impacts. A reversion to this or a similar policy may therefore be considered.

There are several aspects which may have contributed to the decline in the population and finishing of the management policy:

1. The decline in the population of elephants in KNP may be due to a number of factors:

2. The decline in the population of elephants in KNP may be due to a number of factors:

3. The decline in the population of elephants in KNP may be due to a number of factors:

4. The decline in the population of elephants in KNP may be due to a number of factors:

5. The decline in the population of elephants in KNP may be due to a number of factors:

6. The decline in the population of elephants in KNP may be due to a number of factors:

7. The decline in the population of elephants in KNP may be due to a number of factors:

8. The decline in the population of elephants in KNP may be due to a number of factors:

9. The decline in the population of elephants in KNP may be due to a number of factors:

10. The decline in the population of elephants in KNP may be due to a number of factors:

11. The decline in the population of elephants in KNP may be due to a number of factors:

12. The decline in the population of elephants in KNP may be due to a number of factors: