

HEADACHES AND HEARTACHES: THE ELEPHANT MANAGEMENT DILEMMA

I.J. Whyte, Senior Scientist, Kruger National Park.

Published as:

WHYTE, I.J. (2001). Headaches and Heartaches - the elephant management dilemma. In: *Environmental Ethics: Introductory readings*. Eds. Schimidtz, D & Willot, E. pp293-305. New York: Oxford University Press.

The dilemmas of managing elephants in reserves are generally poorly understood. The different attitudes to basic management philosophies have led to many acrimonious debates and deep rifts have developed between some of the respective proponents. While those from the anti-culling lobby have condemned the killing of elephants, the non-interference policies are not without their own ethical dilemmas. It is not the purpose of this article to try to favour either one of these two points of view, but to try to set the situation in Kruger National Park against the background of other national parks in Africa. The intention is to get to the heart of the elephant dilemma so that readers themselves may understand the issues and have some empathy with elephant managers and the decisions with which they are faced.

Before the advent of firearms, the elephants of Africa were probably not greatly influenced by Man. But as firearms began to proliferate, and the ability to easily kill large elephants increased, the populations gradually started to decline. Initially this was due to the demand for ivory in Europe and Asia and because there was no control over the off take. This situation persisted and in spite of the establishment of reserves and national parks throughout Africa, many (if not most) elephants roamed outside of these parks and remained vulnerable. The numbers of elephants on the African continent in earlier times are not known, but by 1979 they had been reduced to an estimated 1.3 million. By this time the range states (countries which have elephant populations) north of Zimbabwe and Namibia were in the grip of a poaching epidemic which reduced the continental population to 609 000 by 1989.

Concern over this dramatic trend resulted in the banning by CITES (Convention on the International Trade in Endangered Species) of international trade in elephant products in 1989. Although one study four years later concluded that in most countries the ban had not halted the illegal offtake, it is widely believed that the ban had achieved much in reducing the poaching. The worst of the poaching was experienced in the countries to the north of the Zambezi and Cunene rivers. South of this, although increased poaching was experienced, this was not at a scale which significantly reduced elephant numbers. In Kruger the first case of elephant

poaching was recorded in 1975. Since then the incidence has been sporadic except during the years 1981 - 1985 when a sharp increase in the incidence was experienced. During this time, 193 were shot. Active anti-poaching measures solved the problem to a large degree and elephant poaching has occurred only sporadically since. In total only 285 are known to have been poached in the park's history. Populations in the southern range states have continued to grow and by 1995 were estimated at 170 800, with the possibility that there could be as many as 228 000. This has had the result that northern range states generally favour the ban while southern countries do not. Wildlife departments could benefit enormously from the financial returns that the sale of elephant products could bring, and any form of elephant management in these countries is now impeded by financial constraints. So while the northern African range states welcome the ban as protection for their populations, most southern African range states are seeking ways of limiting theirs. But why limit elephant numbers? Why manage elephants at all? Why not just let them be?

The problem

In many African countries today, elephant populations are confined to national parks and reserves. This is also true of most other wildlife species, both plant and animal. In South Africa nature reserves and national parks are conservation "islands" whose boundaries are hard-edged up against the activities of people. In these conservation islands, it is usually the wildlife manager's job to try to protect all of these species (maintenance of biodiversity), but some reserves have been proclaimed for the protection of particular species and biodiversity may be less important. But there are some countries such as Kenya who can still claim that as much as 70% of their wildlife exists outside of national parks. Wildlife managers in these countries have their own set of problems, usually concerned with interactions between man and wild animals, and the dilemmas of conserving elephants in closed systems have not yet really become conservation priorities. Large parts of east Africa, particularly in Kenya and Tanzania, is Masai country, and the Masai were semi-nomadic pastoralists who traditionally had little interest in wildlife. They saw wild animals as "God's cattle" and their whole lives were centred around their own herds of cattle and goats. Competition with wildlife was confined to incidents where people or their livestock were killed or injured by animals, but by and large they could co-exist in harmony. But this situation is changing slowly for two main reasons. Dramatic human population increases and hunger for land no longer affords people a nomadic life style, or their herds free access to rangeland, and many are switching from pastoralism to agriculture. Agriculture is rarely tolerant of wild animals as crops planted by people are a highly attractive to the larger herbivores. In the early 1990's the African Elephant

Specialist Group considered human/elephant conflict to be the greatest current problem facing elephant conservation. These clashes will gradually force wild animals into sanctuaries. Secondly, college education of the Masai youth means that they have tasted the offerings of civilisation and are no longer satisfied with the pastoralist's simple life style. They want jobs, houses, and access to electricity and running water, and to the trappings of the modern world, none of which are compatible with pastoralism.

These two forces will probably ensure that the wildlife in these countries will also eventually occur only in reserves, and the problems of maintaining biodiversity in these reserves will be brought into sharper focus.

As a general rule of thumb, the smaller the conservation "island", the greater the degree of management it will require as some of the essential ecological processes will be missing. An example of this is that many small parks can not accommodate the larger predators, and in the absence of the population checks which these predators impose on prey populations, man has to take over this role. But if the "island" is large enough (and the Kruger National Park is one of these) the vast majority of its component species and ecosystem processes will require no management at all. Throughout time, they have co-evolved to form a complex matrix of competition, inter-dependence and above all, survival. This is the way it should be and managers should interfere with these processes only when it is unavoidable.

In nature, nothing is static. Rainfall and temperature are the engines of ecological processes, and these are never constant. There are years when rainfall is abundant and others of drought. In most of Africa these conditions are cyclic and there are periods of above average rainfall followed by periods below average. In Kruger, records show that rainfall cycles are of about 20 years in duration - ten dry years followed by ten wet ones, though it is usual to experience one or more dry years during the wet part of the cycle and vice-versa.

Different species respond differently to the prevailing conditions, some increasing during the wetter years, but some also favour the dry conditions and their populations flourish during the drier parts of the cycle. In Kruger wildebeest and zebra favour the drier years when the grass has been grazed and trampled to create more open conditions. These animals rely on their good eyesight to avoid predators, so when the grass becomes long and rank during the wetter years, lions have enough cover to get up close and make their kills more easily.

But most species prefer the wetter times and have developed ways of reducing the threat of predators in long grass. When food is abundant, buffalo congregate in

large herds and the adult bulls are aggressive to predators and protective of the females and calves. But when droughts come, each buffalo must compete with the others for the meagre grass that is available. Food shortages force them to split off in smaller groups to allow more effective foraging. Being in a weakened physical condition, these small groups are much more vulnerable to lions. A single large herd of buffalo will find itself in only one lion pride's territory at any one time, but when a herd splits, more prides have access to the herd and individuals are in poorer physical condition, rendering them less able to defend themselves against these predators. Furthermore, water is in short supply and buffalo have to drink. Lions wait at the water and in their more vulnerable condition, buffalo can be killed almost at will. Many cases have been recorded of lions making multiple buffalo kills during these times. It is a predator's instinct to kill, and each time the buffalo herd approaches the water, the lions kill another. During the severe droughts of 1992/3, Kruger's buffalo population declined by more than 50% from nearly 30 000 to less than 15 000.

Kudu have other strategies for avoiding lions in long grass. They have excellent eyesight, smell and hearing and live in small groups who forage silently. During droughts they lose condition and are forced to forage in habitats they would normally avoid. As with buffalo, they are forced also to drink at the few remaining waterholes, which is where the lions are waiting. In most cases these population fluctuations are driven by the short-term (20 year) climatic cycles.

But elephants do not conform to this pattern. In today's imperfect world, Africa is no longer what it was before the advent of technological man, and the continent-wide ecological processes which used to operate, can now no longer do so. Most of these processes are lost in the mists of time and can now only be speculated upon. The population cycles of elephants is one of these. Elephants had few natural enemies in those times, so how were their populations regulated? Of course, no population can continue to grow forever, as eventually they will exceed the resources upon which they are dependant. There must come a time when conditions are less favourable and the population will enter a phase of decline. Did elephant populations build up over centuries in local "events" to the point that food became limiting and then die out to a much lower level? Or did they move away when food became scarce? If so, where did they go? And what would have happened to the elephants already occupying the area to which they moved? Did disease play a role? Was primitive Man capable of limiting elephant numbers? These are all questions which nobody can answer and maybe nobody ever will with certainty.

What is known is that elephants have the intellect and constitution to exploit a wider range of food resources than any other animal (except Man). When grass

and browse are not available, they can eat twigs and branches or use their tusks to prise bark off trees, and even push trees over to reach the leaves in the canopy or to expose the roots. So natural limitation of elephant numbers will only begin to occur once even these resources have been depleted, at which time the environment will have been subjected to severe impacts. In this process, the question is what would have happened to the other species - both plant and animal - occupying these habitats? Some may have even been eliminated locally. In the old Africa, this would not have been a problem as these species would likely have occurred elsewhere and recolonisation could have taken place, even though it may have taken hundreds of years. In evolutionary time, this is nothing. Some species that could not adapt may have been pushed to extinction, but this is nature's way - adapt or die!

The old Africa has gone forever. No longer can species range far and wide, and no longer can most terrestrial life forms naturally recolonise areas where they have been extirpated, and so elephants, with their ability to drastically modify habitats, are a threat to many species within these reserves. A reserve like Kruger, which is large enough to allow minimum management of most species, is still too small to accommodate elephant population fluctuations without environmental damage. And thus, if the objective of a national park is the long-term conservation of all the indigenous biota occurring there, then something will ultimately have to be done to limit elephant numbers.

History of the Kruger National Park elephant population

Elephant populations throughout Africa were decimated by the early hunters whose writings were more concerned with the thrill of the hunt than of natural history. In the Lowveld areas of South Africa where Kruger is situated, all the elephants had been shot out before the park was proclaimed in 1898. Nobody knows how abundant elephants were in this area, or how they utilised their range, but there is evidence from some sources which suggests that elephant numbers were never very high in the Kruger area before the advent of the white man and his guns.

The San (Bushmen), whose characteristic rock paintings are still visible in rock shelters in both the south-western and northern areas of the KNP, were associated with the latter part of the Late Stone Age between 7 000 B.C. and 300 A.D. Elephants must have occurred in the KNP area during this time as one of the paintings in a shelter along the Nwatindlopfu River shows a group of five of these animals. Of the 109 shelters containing rock art so far discovered in the KNP area, this is the only one featuring elephants. One other shelter with elephant paintings

has been found in the area, some 30 kms to the west of the KNP.

It would be expected that a large, dramatic and dangerous animal like the elephant would feature prominently in Bushman folk lore. Elephants were a popular theme for paintings elsewhere in southern Africa as they provided a lot of meat and were associated with water and rain which the Bushmen artists were keen to influence. Bushmen were capable of hunting elephants by "ham-stringing" as was shown in a painting near Molteno in the eastern Cape. San art is believed to have been of considerable spiritual significance to the artists, depicting the spiritual experiences of shamans during states of altered consciousness induced by ritual dances. San art was not narrative of their lifestyles nor "menus" representative of their diet, and that the incidence of different species in their art may not be reflective of their relative abundance. But elephants have been shown to be of "special symbolic importance" to San peoples elsewhere in South Africa. Human figures with trunks and even with heads of elephants have been painted. Given then that elephants were of considerable cultural significance to the San people, their relative scarcity in the rock art of the KNP and surrounding area may indicate that these animals were relatively rare during the San era.

There is also a lack of evidence of old elephant utilisation of baobab trees. Elephants strip off the bark of these trees for food and scars persist for hundreds of years. One baobab in Kruger, carries the inscription "BRISCOE 1890" carved in its bark. This carving, now 110 years old, is still as clearly visible as if it was carved only a year or two ago, and will probably persist for another 100 years or more. If elephants were utilising baobabs 100 or even 200 years or more ago, it could be expected that the scars would still be clearly visible. Yet more than 50% of trees in the far north of the park show no sign of utilisation by elephants. Baobabs outside the Park show no signs of old elephant damage, but clearly show the impacts of earlier people who cut "panels" of bark from the trees for domestic use.

A third clue comes from the writings of early travellers to the area who made little mention of these animals. Francois de Cuiper and his party were the first to visit the area in 1752. His mission from Delagoa Bay (now Maputo in Mozambique) was to establish trade with the interior in gold, ivory and copper. They saw few elephants and were informed by the indigenous people that if they wanted ivory and gold, they would have to go far to the north to the area now known as Zimbabwe. Copper could be obtained from the area that is now Phalaborwa. This last information has proved to be correct, so the information on ivory was probably also correct. Louis Trichardt on his trek through Kruger in 1838 also made no mention of elephants in his diaries, though he mentioned an elephant hunt once they arrived in Lorenzo Marques. João Albasini was the first white settler in the

Kruger area. He arrived in Delagoa Bay in 1831 and established himself as a hunter and trader in Mozambique and the eastern Transvaal. He formed a company in Lorenzo Marques whose objective was to hunt elephants and increase the trade in ivory. This lasted only six months and he then established himself as a hunter and trader in the Phabeni area in the southern part of Kruger. After two years there he abandoned the store and moved to Ohrigstad. Though no records exist, the outcome of these ventures hint of an elephant population at too low a density to sustain viable hunting and trade.

Of the later hunters who left any written record, it is perhaps significant that none who hunted elephants (eg. Selous, Finaughty) did so in the KNP area while those that did hunt there (Vaughn Kirby, Glynn) did not shoot any elephants.

A final speculative clue may come from the floral and faunal diversity which still exists in the Kruger today. Over two thousand plant species have been recorded, some of which are known to be vulnerable to elephant. If there had been successive episodes of high densities of elephants over time, this complex diversity may have been much reduced.

Why elephant densities may have been low is not known, but one theory speculates that perhaps numbers could have been held in check by early man. If densities were low, and man had the means to kill elephant calves, say using poisoned arrows, they would not have to kill many to impose limits on their population growth. But however many elephants that there may have been, they were shot out by hunters, and by 1903 James Stevenson-Hamilton, the park's first warden, reported that there were no elephants to be found. They responded quickly to the new sanctuary, and by 1905 his staff had found evidence of their occurrence near the confluence of the Letaba and Olifants rivers which is located roughly midway between the Park's northern and southern boundaries. From there they gradually recolonised the whole Park. Diaries of the earlier Rangers recorded the first sightings of elephants in new localities. The recolonisation process to the northern and southern extremities of the Park occurred at about the same rate. Northward to the Luvuvhu River took until 1945 (40 years to cover 290 kms) while the spread southward to the confluence of the Crocodile and Sigaas rivers, was slightly slower, taking until 1958 (53 years to cover 280 kms).

Numbers increased steadily during this time and concern over the evident impact they were having was shown as early as 1942. In that year an early park ranger by the name of Steyn made the following tongue in cheek comment in his annual report: *"With regard to the question of the control (culling) of elephants in certain areas where it may become necessary, the following idea has come to mind, i.e. to use a 10 or 12 ton armoured car to remove them from any region. This will*

naturally only be possible after the present war and I leave the details to the imagination of the reader".

Early estimates of population size were made by Park rangers based on their observations, but without the modern aids like helicopters, these estimates were clearly severe underestimates. The concerns intensified until 1967 when the first comprehensive aerial census was conducted and the population estimate of 6 586 proved to be nearly 3 times larger than the 1964 estimate of 2 374. The decision was then taken to limit the population to around 7 000 and culling was initiated.

This figure concurred with those of biologists working elsewhere in Africa at around that time. The elephant population density in Murchison Falls National Park in Uganda was 5 elephants per square mile and it was felt that this considerably exceeded the carrying capacity. In Tsavo National Park, Kenya, the early recommendation was that one per square mile was the right number (this recommendation was never implemented). The 7 000 for Kruger, which has an area of 20 000 square kilometres (8 000 square miles), was just below this. This number gave an average area of 2.7 square kilometres per elephant. As this policy was implemented to prevent the loss of biodiversity from the Kruger's ecosystems, it was undoubtedly successful as no species are known to have been lost from the Park.

So how was the Kruger elephant population managed to maintain it at the prescribed level of around 7 000? A unique technique was developed for the censusing of Kruger's elephant population, which is the most intensive and accurate census of elephant conducted anywhere in the world, though recent intensive fixed wing census techniques in Tsavo using multiple teams and GPS (Global Positioning System) technology probably give comparable results. The Kruger census is conducted annually during August and September to capitalise on the late dry season conditions. At this time of year the animals tend to congregate in the vicinity of watercourses and waterholes, and visibility is at its best due to the trees having shed their leaves. A helicopter is preferred as it can fly at extremely low speeds and can hover as well. In large, loose aggregations of elephants, the pilot can manoeuvre the aircraft systematically from group to group at low level until all have been exactly counted. In contrast, fixed-wing aircraft are forced to maintain forward speed which necessitates circling of the groups which is confusing to observers. Because of the helicopter's manoeuvrability, a flight pattern which follows the watercourses is flown. Kruger is particularly suitable for this as its undulating savanna terrain is drained by a well spaced network of watercourses which are clearly visible from the air. The pilot begins by flying along one bank of a major watercourse, keeping close enough to it to allow careful scanning of this denser vegetation but yet far enough from it to allow adequate

scanning of the ground as far as the watershed. He then turns up each tributary and sub-tributary, following it up one bank to its source and back down the other bank. In this way each drainage system is systematically covered before moving on to the next. The watercourses give the pilot visual cues as to where to fly and systematic ground coverage thereafter is almost automatic. The census is conducted at an altitude of about 200m above ground depending on the terrain and visibility. The whole census is completed in 18 days and about 130 hours of flying time. Research has shown that census totals have never exceeded 7% of the expected result. Once the census result was known, a committee (known as the Standing Committee for Wildlife Management) made up of the senior nature conservation staff of the Kruger met to decide on an appropriate culling quota to conform with the elephant management policy. This quota is then achieved either through capture and translocation to other conservation areas where they can be accommodated, or through culling.

But whereas the Kruger managers decided to limit elephant population growth, a *laissez faire* (non-interference) policy was adopted in east Africa. This policy's roots almost certainly originated from compassion for the elephants themselves. To sit quietly in the close proximity of a herd of elephants who are going quietly about their business is an emotional experience that can not easily be described to anyone unfamiliar with these animals. Their sheer size alone induces a feeling of awe, and you will not have to sit for long before their intelligence, playfulness, compassion and tolerance become evident. All of these attributes of elephants combine to instil in those lucky enough to have experienced them, a feeling of empathy which intensifies the longer that exposure to elephants lasts. These emotions are not comfortable bedfellows with the concepts of killing these wonderful animals. Elephants are also considered to be a "keystone species" - one upon which other species are dependant for their own survival. Elephants open up areas of thick woodland affording habitats to species favouring those of a more open character. They also pass seeds through the gut to be deposited in seedbeds of fertile dung assisting germination.

But to stand under the canopy of a massive old baobab tree (*Adansonia digitata*) and to ponder a little on the age of such old giants, is an emotional experience of a different kind, but one which in its own way is no less soul stirring than that which may be gained from elephants. It is perhaps also their size which makes the initial impression, but the aura of age is tangible. The age that these trees may attain is not known as the pithy wood shows none of the rings which allow the determination of age in other tree species. The "Briscoe" baobab is not a particularly large tree suggesting that it is not one of the older ones, yet it was more than a hundred years ago since the carving was carried out. The tree can have changed little in the intervening 109 years so some of the older ones must be

many hundreds if not thousands of years old!

Baobabs are also a keystone species and a little examination of some of these trees will reveal their significance in the environment. The convolutions in the trunks of these benevolent old giants form cracks and holes which provide shelter to many small animals and birds and offer ideal sites to rear their young. To some species, the presence of baobabs is critical - in Kruger the only known nesting sites of both the Batlike Spinetail (*Neafrapus boehmi*) and the Mottled Spinetail (*Telecanthura ussheri*) are in hollow baobabs. Thus without these trees, these birds would simply not occur in the area. Mosque Swallows (*Hirundo senegalensis*) and Cape Parrots (*Poicephalus robustus suahelicus*) also favour these trees for breeding and any decline in the number of baobabs would also have its effects on the populations of these birds also. Barn owls (*Tyto alba*) would occur at much lower densities if the nesting holes offered by baobabs were not available, and Whiteheaded Vultures (*Trigonoceps occipitalis*) favour baobabs for building their nests as well.

So, quite apart from their aesthetic appeal, both elephants and baobabs play important but different ecological roles - the elephant in its capacity to accelerate nutrient cycling and alter their environments, and the baobab because of its importance to many species of animals as a source of food and shelter. But elephants also feed on baobabs, stripping the bark off and even chipping away the pithy wood with their tusks. In extreme cases the trees may become so weakened that they eventually topple and die. Most tree species die when ring-barked, but baobabs have a remarkable capacity to regenerate bark. They are therefore resistant to utilisation by elephants up to a point, but one of the major causes of mortality in baobabs is drought, particularly once they have had excessive amounts of bark removed by elephants which probably accelerates moisture loss. Anyone visiting the northern parts of Kruger will not fail to notice that most baobabs have suffered considerable bark removal. During aerial censuses of the Kruger elephant population, dead baobabs are also recorded and this has showed that over the past few years, more than 200 have died due to the combined effects of drought and elephant utilisation.

But baobabs are not the only plants which are vulnerable to utilisation by elephants. The knobthorn (*Acacia nigrescens*) is another keystone species as it is favoured by a wide number of raptors and other birds for nesting. Wahlberg's (*Aquila wahlbergi*) and Tawny (*A. rapax*) eagles, Whitebacked vultures (*Gyps africanus*) and some of the small goshawks (*Accipiter* species) also favour the mature knobthorns, while quelea finches (*Quelea quelea*) and Wattled starlings (*Creatophora cinerea*) are communal breeders favouring stands of the stunted forms of this species. They breed in thousands (even millions) in these stands and are a staple food of migrant Steppe and Lesser Spotted eagles. Luckily the

knobthorn is a very common species but few mature knobthorns in Kruger are free of some form of elephant utilisation and many have been ring-barked resulting in the death of the tree. Absence of knobthorns would have severe consequences for all of these species. Marula trees (*Sclerocarya birrea*) are often debarked or pushed over and even the branches up to the thickness of a man's forearm are eaten. Numbers of marulas have also declined over the years. Other plant species at risk are fever trees (*Acacia xanthophloea*), kiaat (*Pterocarpus angolensis*) and star chestnut (*Sterculia rogersii*). These are just a few of the species favoured by elephants but where elephant densities increase to the point where food availability becomes limiting on the elephant population, nearly all plant species are at some degree of risk. In some parks elsewhere in Africa, this has meant loss of species from systems with unlimited elephant populations.

In Amboseli National Park (Kenya) for example, an extremely high density of elephants (one elephant per 0,42km²) has led to a decline in the woodland in the park resulting in the extirpation (local extinction) of both lesser kudu (*Tragelaphus imberbis*) and bushbuck (*Tragelaphus scriptus*). Other species favouring woodland such as gerenuk (*Litocranius walleri*), giraffe (*Giraffa camelopardalis*), baboons (*Papio* species) and monkeys (*Cercopithecus* species) have also declined inside the Park. In Tsavo National Park (Kenya), dense woodland was changed into open savanna and baobabs are now very rare where they were once common.

The Tsavo story is an interesting one. The huge elephant herds that modified Tsavo's landscapes this way are now severely depleted - by poachers, not managers! Apart from being one of Africa's most famous national parks, it gained initial fame through the book, "The man-eaters of Tsavo" which tells the story of two lions which killed at least 28 labourers and even held up the construction of the railway in 1898. J. H. Patterson, the author of this book was a keen observer and he described the nature of the bush as "interminable nyika... the whole country covered in low stunted trees... the only clearing being the narrow track of the railway". Elephants are hardly mentioned in the book. In 1903, the writer/traveller Mienertzhagen found "very few" elephants in the thick Tsavo bush, but by 1970, this had changed and human developments outside had compressed the population into the park - an area roughly the same size as Kruger. Aerial surveys in that year estimated the population to stand at 45 000. These elephants had a huge impact and by 1974, a severe drought had reduced the population to 36 000. Nine thousand elephants had died and at the same time, 4 000 black rhino also died of starvation. The carcasses of these animals offered an opportunity to local people and corrupt staff to establish an illegal trade in the horns and tusks. Having become established, this trade turned to the poaching of live elephants and rhinos and by 1989, the Tsavo elephant population had been reduced to just 6 000. Thirty thousand elephants had been poached and black rhinos had been all but

extirpated. Tsavo today is an open savanna which has favoured the grassland species, and the removal of the trees has had some other interesting consequences.

Fountains have appeared where they were not known to occur before - the moisture which once was sucked up by the trees and transpired into the atmosphere, now seeps into the drainage lines. These changes are perceived by some as benefits to the Tsavo ecosystem induced by high densities of elephants, and their role in this transformation has often been lauded. But an unanswered question remains - what would Tsavo look like today had the 30 000 elephants not been removed from the system by the poachers?

The poaching has now been contained and the most recent census of Tsavo's elephants in 1999 yielded a total of close to 8 000.

Management options

Given this background, the obvious basic question about elephant management in any confined reserve is whether or not to limit elephant numbers. If the management authority decides that the maintenance of biodiversity is the objective, what options are available? In order to limit the population growth of **any** species (and cynically, this applies even to humans), there are only three possible options. These are translocation, contraception and culling or a combination of these. Others such as hunting are just variations of one or more of these options. In western society, non-lethal means of population limitation would clearly be preferable to the killing of elephants, but there is a strong body of opinion in Africa which supports the sustainable use of wild animals (even elephants) to provide benefits to local people and communities. Who is right? Westerners who live far removed from the problems or local people who often suffer terrible depredations from living close to elephants and see the killing of the animals as a desirable solution? For them, if the problem animals are removed, the meat becomes available and revenues can even be generated. In some areas such as in Zimbabwe, problem or excess animals are hunted by professional hunters in schemes known as CAMPFIRE (Communal Areas Management Programme For Indigenous Resources). These hunters pay for the privilege and the money is given back to the people for community development projects.

If non-lethal means are to be employed, only two options are available - translocation or contraception. Translocation would usually be the first choice, as this has the additional advantage of establishing other elephant populations elsewhere, but in southern Africa today, saturation point has almost been reached. Most conservation areas already now have elephants and their managers understand the consequences of too many elephants and do not wish to increase their populations any further. There is now hope however, that a very large conservation area will be established on Kruger's eastern boundary in

Mozambique. There are no elephants in this area and so, if and when this should occur, it will provide a considerable opportunity to dispose of excess elephants.

There is a common perception that once the game proof fence between Kruger and the proposed park has been removed, elephants will immediately move off into Mozambique, alleviating the need to limit the population in Kruger. But studies of elephant movement in Kruger have revealed that they show a remarkable degree of fidelity to their home ranges. These home ranges have an average size of about 1 200 square kilometres. Factors which may be expected to stimulate movements, such as rainfall in nearby areas and culling, have little effect on their movements. They may be induced to move to other parts of their home range, but they do not leave. This is certainly because these ranges are the areas where they are most comfortable. The old matriarchs know the area well - where the water is in dry season, where food availability may be best - information and experience that they have built up over their long life times. They also have the ability to extract sufficient nutrition from the available vegetation even during severe droughts, so there is no real necessity to move.

The recolonisation of Kruger after its proclamation was a slow process and there is no reason to believe that the reverse process - the recolonisation of Mozambique - will be any quicker. So if the new park in Mozambique is to offer Kruger a non-lethal means of limiting its elephant numbers, it will probably have to be by translocation, not natural recolonisation. But translocation is very expensive and it should be remembered that translocations are still not the ideal solution. They provide temporary respite, but ultimately such areas acquiring Kruger's excess elephants will one day be faced with exactly the same problems and dilemmas as the problems are merely transferred.

Contraception is the second non-lethal option. This is not yet a tool in the elephant management toolbox as it is still very much in the research phase. This research is being encouraged by South African National Parks with the hope that this may one day provide another practical option. Two methods have received attention so far, the first being through hormonal control using oestrogens. This project has been terminated in Kruger on humane grounds as there was strong evidence that the hormones were drastically affecting behaviour of the vaccinated cows and attendant bulls. Females were induced into a state of "false oestrus", and bulls were attempting to mate with them while they were not receptive. This led to harassment of the cows by the bulls to the point that they got separated from their families and even from their small calves. Three of the calves died during the research period. The other project achieves contraception through PZP (Porcine Zona Pellucida) vaccination of adult elephant females. This vaccine is made from the ovaries of pigs obtained from commercial slaughterhouses. The vaccine

stimulates the animal's immune system to produce antibodies which bind to the outer membrane (zona pellucida) of the elephant cow's egg cells and prevents penetration of sperm. This method has no behavioural consequences and is continuing. But in an area the size of Kruger with a population of 9 000 elephants, even this method will not provide the solution for logistical reasons. Computer modelling has shown that to stabilise an elephant population, approximately 70% of all breeding females have to be under treatment at any one time. In Kruger this means between 3 000 and 4 000 females. These animals will require repeated dosages, which means that each will have to be individually radio-collared to enable location when the animal's booster shots become due. The expense would be astronomical, and there just are not that many radio frequencies available to us. However, there are some new developments which give hope for the future.

But a negative consequence of limiting an elephant population through contraception would be a decline in the sizes of matriarchal (family) units. Young cows stay with their mothers for as long as the mother remains alive. The normal elephant family is thus a large extended one consisting of the old matriarch, her surviving daughters, and all of their respective offspring. A cow may have as many as eight or ten calves in her life of which half could be expected to be female. A family could thus be comprised of five or six adult females with calves of varying ages in a group size of around 15 or more. This is an important social structure among savanna elephants in which young animals learn essential lessons in life, particularly with regard to birth, death, mating behaviour and rearing of young. If the objective of a contraception program was aimed at stabilizing numbers in the population, each cow would theoretically only be allowed to have two offspring, one of which could be expected to be a male. The outcome of this would be that the average group would thus consist of only the old female, a single daughter and possibly one or two calves. Given the social importance of the family, would this enforced change in elephant society be ethically acceptable to us?"

Culling is currently the only remaining long-term alternative, and here there are also a few options. Anaesthetic drugs would be ideal but they can not be used for such purposes as the meat may subsequently not be used for human consumption. The leaving of such contaminated carcasses in the field for scavengers is therefore also questionable. The only drug that has been approved which allows for later human consumption of the meat is succinylcholine chloride (scoline) whose component compounds occur naturally in mammalian bodies. Scoline is a neuro/muscular blocking agent which paralyses the animal by preventing the brain's impulses from reaching the muscles. This was used in Kruger to cull elephants in the past as it had the clear advantage of obviating wounding and provided a far greater safety margin for staff and scientists attending such culls.

However, research conducted in Kruger showed that the use of this drug on elephants was inhumane as the heart muscle remained largely unaffected by the scoline. The locomotory muscles were the first to be affected followed by those controlling breathing (the diaphragm). This meant that the animal was fully conscious but paralysed and unable to breathe, and therefore died of suffocation if it could not be brain shot immediately after becoming recumbent. The use of scoline was then discontinued and the method now used is a sharpshooter using live ammunition from a helicopter at close range.

Previous and current policies

The policy of limiting the Kruger elephant population to a level around 7 000 was maintained until 1994 when it was challenged by an animal rights group. A decision was then taken to place a moratorium on culling until the policy had been reviewed. This review is now complete and the new policy awaits the final go-ahead. In the mean time, the population has increased to an estimated 9150 at the last (1999) census. In essence this new policy focuses less on numbers of elephants than on the impacts that they are having. The park has been divided into six zones. The two in the northern and south-western extremities have been designated as botanical reserves which will be managed to limit elephant impacts on the rare or ecologically important plants to sustainable levels. These species include baobabs, star chestnut (*Sterculia rogersii*), mopane (*Colophospermum mopane*) forest and sandveld communities in the north, and the species with affinities to higher rainfall such as kiaat (*Pterocarpus angolensis*), tree aloe (*Aloe bainesii*) and mountain syringa (*Kirkia wilmsii*) in the south-west. The rest of Kruger will be divided into four zones of roughly equal area. Two of these will be high elephant impact zones where no elephant population limitation will be practised, and the other two will be low elephant impact zones. In these two zones elephant populations will be decreased through translocations and/or culling. While the policy aims at reducing elephant impacts in these zones, it is stated that the priority will be to do so as far as is possible by non-lethal means. As many animals as there is a market for will be translocated and, should contraception become a feasible option, this will also be implemented, but where these options can not be used, then culling will have to be conducted. But will this work? Will the elephants respect the boundaries and stay in the designated zones? Some feel that they are smart enough to move from the low-impact zones to the safety of the high-impact zones. Others feel that once numbers build up and food becomes scarce, they will move out of the high-impact zones to where food is more readily available. The movement study has shown the high degree of fidelity that elephants have for their home ranges, so the boundaries of these zones were drawn up to roughly follow the boundaries of these ranges. Kruger managers are thus confident the zonation will hold up under the strain of the different management options, but only time will tell.

The rationale behind this new policy is that in terms of biodiversity, it is expected that there will ultimately be negative consequences in habitats with elephant densities which are either too high or too low. As elephant densities increase, so will their impacts, but also, as densities decline, habitats and biodiversity are expected to become impoverished through bush encroachment, declining rates of plant germination etc. Programs monitoring many different aspects of biodiversity are being initiated in these zones to detect changes which may be related to changing elephant densities. These will include the monitoring of such aspects as trends in the numbers of mature trees, and changes in the structure of communities of various life forms such as plants, birds, frogs, reptiles, small and large mammals. Many other aspects such as rates of soil erosion, water quality and vegetation cover will also require monitoring. The complex inter-relationships of elephants and fire on the woody vegetation (trees) needs to be carefully determined (changes induced by fire should not be confused with those by elephants). All of these will need to be repeated in all or most of the 12 different landtypes (major vegetation zones) as elephant impacts may differ between them.

For each of these aspects, limits to the amount of change that are considered acceptable will be set. These limits are known as "Thresholds of Potential Concern" or TPC's. For example, an 80% allowable change in the number of mature trees in a landscape may be set as a TPC. If and when the monitoring program detects that such an 80% change has occurred, the TPC is "evoked" and the authorities must become "officially concerned". The situation must be then considered in depth with all stakeholders present and all the data and evidence and information on the table. The outcome of this may be either a decision that 80% change is not yet serious enough to warrant management of elephants and that the TPC should be changed to say 85% or 90% change. The alternative is that the 80% TPC was valid and that management should be implemented. These TPC's will be purposely set wide to accommodate a large degree of change that should take many years to trigger.

The two high- and two low-impact zones are to be interchangeable and once TPC's have been triggered, the high-impact zones should become low-impact zones and vice versa allowing heavily impacted areas a period of recovery. This will also induce high and low density cycles on the elephant population which over the past 30 years has been held stable.

Other research will focus on the elephants themselves. The movement study will be particularly important as the policy will only be successful if high- and low-impact zones can in fact be maintained. If elephants move out of the high-impact zones, all that the new policy will achieve is the culling of excessive numbers of

elephants in the high low-zone and the hoped for high-impacted zone will never be achieved. Census and distribution information will be a major part of this. Differences in terms of population dynamics between these zones will also need to be monitored. It is suspected that fertility rates in elephants may decline as population densities increase. This would be important information which may yield invaluable insights on the future management of the population. Impacts of elephants on vegetation will also be monitored through computer analysis using image-processing techniques on aerial photos of Kruger's vegetation. Field studies of particular plant species have already started and will be maintained as elephant densities change under the new policy.

This new policy will not be a model which will work for every other national park which holds elephants. Ecosystems differ widely as do conservation priorities, and each should have its own rationale for the management of its populations, whether it be some form of limitation of numbers or one of non-interference. Much will be learned from the implementation of Kruger's policy which should be of significant interest to all elephant managers.

Summing up - The dilemma

This brings us finally to the headaches and heartaches that are experienced by **all** managers of elephants. A decision has to be made before elephant damage occurs as to whether the area for which they are responsible will be managed as an elephant reserve or whether the maintenance of biodiversity will be the priority. The two approaches are mutually exclusive. The decision to manage as an elephant sanctuary is a valid one which should be taken out of respect for the elephants themselves. Elephants are wonderful animals with which most people easily empathise, and there should be areas where they can live out their lives free from the stresses of the various management options. Amboseli is probably a good case in point. The wonderful research that has been conducted there by Cynthia Moss and her colleagues has taught us most of what we know about the complexities of elephant behaviour. There is still much to learn about long-term elephant cycles and Amboseli may be the best place to study these. The Addo Elephant National Park in South Africa is another. This park was created as a sanctuary for the last remaining elephants in the Cape region and this should probably always remain the conservation priority.

But a decision not to limit growth of an elephant population has to be taken consciously by the management authority, in the full awareness of the consequences - they must be aware that ultimately, other species will begin to disappear from the system due to over-utilisation or habitat changes induced by

elephants . In some cases this may even mean extinction. Ultimately also, when times of drought come (as they inevitably will in Africa), they must be prepared for the die-offs of elephants which will occur. These will be disturbing and emotional times.

But if the maintenance of biodiversity is the priority, something will have to be done (usually culling) to limit the numbers and densities of elephants before biodiversity is affected. This is also not an easy decision - the killing of elephants is never one that can or should be taken lightly. But here there lies yet another moral dilemma. At what level should the population be held? To maintain a population at any particular level requires the removal from the population of a number of animals equal to the population's annual increase. The average increase in an elephant population has been calculated at a rate of 6.2% per year. To maintain a population at around 7 000 would require the annual removal of about 450 individuals. However, if managers should decided to allow the population to increase to a level around 20 000 and maintain it there, this would necessitate the removal of around 1 300 individuals per year! As we have seen, when such numbers are involved, the only option for the removal of most of them would be through culling. If you agonize over the morality and ethics of culling elephants, then the issue will be greatly compounded by having to cull a much larger number. Is it not better to keep a population small at the level where few animals need to be culled or better still, at a level where most excess animals could be translocated rather than culled?

There is no middle of the road on issue of elephant management - a choice has to be made for either one of these options: to cull or not to cull? If the choice is for the latter of these options (which is a valid one depending on the conservation priority for the designated area), there is no going back once extensive damage has occurred. When plant and/or animals species have been lost, it may (through the management of the elephant population) be able to maintain the remaining biodiversity, but the restoration of the system to its former richer state of biodiversity and function will scarcely be possible. The dilemma is in weighing up the sacrifice of individual elephants against the sacrifice of species. Either way, the decision taken will always trouble the consciences of those involved in the process. You should not have cold feet if you enter the elephant management arena, and be prepared to be castigated for your opinions and your decisions whichever side of the debate they may lie.

If the decision was yours, what would you do?