The Elephant Management Dilemma

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Elephants can contribute significantly to the maintenance of biodiversity in African savannas. Such contributions include the following:

- They are important dispersers of some plant species' seeds, and in some cases passage through an elephant's gut may even facilitate germination.
- In the late dry season some trees sprout new leaves before the arrival of the first rains. Elephants sometimes push such trees over making these nutritious leaves available to lesser browsers who otherwise may be experiencing severe food shortages.
- Trees killed by debarking become available to invertebrates such as wood borers and termites which themselves serve as major food resources for reptiles, birds and other insects.
- Trees felled by elephants are important refuges for many invertebrates, reptiles and small mammals.
- Elephants dig for water in dry river beds making this important resource available to other species that would otherwise not be able to survive in such arid environments.
- Elephants open up woody habitats facilitating species that favour more open habitats

In the absence of elephants, such benefits are lost. Biodiversity is suppressed as habitats tend towards thicker woodlands, and grassland species are compromised. The presence of elephants is therefore important in African savannas. As elephant numbers and densities increase from very low levels, many species benefit, and at intermediate densities, biodiversity benefits most. But as elephant densities increase further, they tend to over-utilise certain favoured food plants, and eventually biodiversity is also compromised as woodlands are gradually converted to grasslands and the survival of woodland species is increasingly compromised.

The fundamental question facing managers of free ranging elephants is therefore a simple one, but not an easy one. Should protected areas be managed for elephants or for biodiversity?

Elephants are social animals and they live in societies made up of permanent families which in turn make up larger social entities known as "clans". Female elephants never leave their mothers as long as both are still alive, but young males leave their natal families at puberty (about 14 years of age). Elephant families therefore consist of an older female (the matriarch) and her daughters and their respective offspring. These bonds are life long, and management practices which disrupt such families are considered very inhumane.

What are the available management options?

Translocation

Translocation, when families can be moved intact, is considered a humane option. It is very expensive, but usually funding can be accessed through willing NGOs. The far greater problem is that markets are now saturated and new destinations are extremely limited. Private and public protected areas which received translocated elephants are already experiencing elephant-related problems and nobody wants excess elephants.

The newly created Limpopo National Park adjacent to Kruger National Park (KNP) in Mozambique was considered a major opportunity for translocation of considerable numbers of elephants. This Park is about 4,000 miles^2 in extent but still has about 22,000 people living in it, and the Mozambique government does not yet want elephants for fears of escalating human elephant conflict.

Contraception

Though many different contraception techniques exist, only two have been tested in the wild. The first one used hormones (oestrogens) to regulate breeding. This method was quickly terminated as the metabolised

oestrogen passed in the urine signalled to males that the females were in oestrus when in fact they were not. This led to disruption of families and greatly elevated mortality rates in the small calves.

The second technique uses a vaccine known as the Porcine Zona Pelucida (pZP) vaccine. This is a far more humane technique as there are no influences on behaviour. The vaccine is made from the follicular fluid extracted from the ovaries of pigs harvested at commercial abattoirs. Antibodies produced in response to proteins in the vaccine attach to the ova released during oestrus. These prevent penetration of the ovum by sperm and thus also conception. The vaccine is generally considered a humane one, but there are some financial and logistical constraints in large populations, and also some ethical questions which still require some debate.

Financial and logistical constraints

This vaccine can be delivered remotely by dart syringe from a helicopter which facilitates its use in wild populations. However, a single vaccination does not raise antibodies to a level which achieves a contraceptive effect. Two boosters are required at three week intervals after the initial inoculations. Thereafter, annual or at least bi-annual boosters are required to maintain contraceptive levels. This considerably elevates both financial and logistical considerations.

It has been shown from computer models that to achieve stabilization of an elephant population, 75% of breeding females must be under treatment. In a natural population this gives a rule of thumb proportion of 40% of the total population. The current elephant population in the KNP is 12,500 which means that about 5,000 adult females would need to be included in the above vaccination regime. Logistically and financially this becomes almost unachievable. Larger populations such as those in Botswana and Zimbabwe could not be managed in this way.

An elephant population can not be reduced over the short term through contraception. To achieve any reduction would require that almost all breeding females must be treated and natural mortalities would then gradually lower the population. Elephants can achieve an age of around 60 years, and natural mortality rates are very low. Meaningful reduction of the population would thus take many years to achieve.

Ethical considerations

As has been described, elephants live in large pyramidal families with the matriarch at the apex, and the younger calves forming the broad base. In between there are many young females which provide care and supervision of the calves and there are many opportunities for learning and play. This structure is the social basis of elephant life. Over time, contraception would alter a family's structure to a more upright, linear one which would still have a matriarch, but the lower ranks would be considerably reduced. How would this altered family structure affect elephants' social lives?

pZP contraception prevents conceptions, and elephant females who fail to conceive will return to breeding condition (oestrus) in 15 weeks. While under treatment, this recycling will continue. Elephant reproductive organs were not evolved to cope with this and captive elephants have shown that constant recycling can lead to development of pathologies of the genital tract.

Range expansion

Range expansion is a desirable outcome from an ecological perspective – bigger is better. These days however, there is little land unoccupied in Africa that can still be designated to conservation. Elephants' requirements, particularly access to water, compete with those of humans. Range expansion for elephants would require removal of people from suitable areas. This would rarely be possible in present-day Africa. Limpopo National Park is currently facing these problems.

These problems apply also to the establishment of corridors which could connect other protected areas for the creation of meta-populations. Such meta-populations have been proposed as a possible management option for elephants in which elephants could move freely between populations, and mortalities in one population would be offset by immigration along such corridors. Most managers consider this to be an unlikely and unfeasible option.

Culling

Culling is a fourth option that has been shown to be effective in the KNP, but is it ethically acceptable? Many people find culling abhorrent as elephants are considered by some to be sentient animals because of their strong sense of family, and they show an awareness of death, and compassion for other elephants. Do humans have the right to kill such animals? But the converse also needs consideration – is it ethical to do nothing about rising elephant numbers and impacts, and allow the losses of other species when it is within our means to prevent it?

Herein lies the dilemma. To manage for elephants requires no further consideration of management options. But this decision will not be an easy one as losses of species will undoubtedly occur from the protected area over time. The acceptance of these losses will tax the consciences of managers!

On the other hand, to manage for biodiversity objectives will require limiting the elephant population in some way. To manage for biodiversity will equally tax the consciences of managers as they will have to consider management options which may be unpleasant, even abhorrent to some!

There is no middle of the road option which will cater for both an unlimited elephant population and for the maintenance of biodiversity.

The Elephant Conundrum Population control : Inaction leads to disaster

W R Allen

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As observed by Dr Richard Laws FRS, noted population biologist, in 1988, "animal populations within the boundaries of the sanctified ghettos called Game Parks tend to increase up to, and then beyond, the limits of food supply. In this context, the elephant is second only to man in its capacity to inflict long-term irreversible damage on its environment".

Within the six nations that comprise Southern Africa, Zimbabwe and Botswana have elephant populations of 150,000 and 100,000 respectively. In Hwange Park alone in north-west Zimbabwe, the population exceeds 50,000 to give an elephant density of >3/km^2, the widely accepted norm being 0.5/km^2. Tremendous habitat damage is plainly visible throughout the park, especially around the 64 artificial water points installed in the 1920s and still filled today by 80-year-old breakdown-prone Paxman diesel engines. Unusually large numbers of elephant congregate around the increasingly fouled water holes in the dry period with consequent stress on the females and their youngsters in the daily trek between edible forage and drinkable water.

Of the 5 potential passive management options for the elephant, no action will result in an anticipated population explosion to >500,000 animals in the six Southern African nations by 2020, extensive fencing may contain elephants within protected areas but not effectively exclude them from crops and communal land farms, and optimistic range expansion in the region, as well as requiring considerable benefits for communal farmers, would house a maximum of 75,000 elephants, only one third of the anticipated increase over the next 12 years. Amongst the active management options, translocation is very stressful and is logistically and financially prohibitive. Furthermore, all the small Southern Africa parks are now full of elephant.

Contraception, by means of immunisation against zona pellucida protein (PZP), is feasible in small parks with individually recognisable populations of elephants, but is totally impracticable in the larger parks where the need is rapidly to reduce, not just simply contain, an already gross overpopulation situation. It also has the potential to cause major disturbances in family structures and behaviour patterns.

Large scale professional culling, as carried out in Hwange Park in the 1980s, or regular cropping as practiced annually in Kruger National

Six months to die

Elephant damage

Park in South Africa until 1994, is the only viable and practical option effectively to reduce large elephant populations. It is efficient and humane, it has great utility potential in terms of meat, skins and ivory to produce food and local income, it preserves the habitat and it forestalls the great suffering and waste associated with drought-driven "die-offs". The cessation of culling in Zimbabwe in 1989, and South Africa in 1994, and the failure to activate a planned large-scale culling operation in Botswana in 1991, have led to the frightening overpopulation problems these three countries face today. The dreadful disaster that struck Tsavo Park in Kenya in the early 1970s when over 30,000 overcrowded elephants and countless thousands of rhino tortuously starved to death from overpopulation and mismanagement by foreign interests, and simultaneously caused the desertification of 8.000 square miles of former Commiphora woodland, looms on the horizon once more.

If we wish to let elephants and other large mammals in Southern Africa live decently and safely, we simply must manage their populations properly and preserve their habitats. Hence, we must strive to convince the governments of these countries to disregard the well-meaning but anthropomorphic and ill-conceived clamour of the so-called animal protectionist movements, who argue against any sort of realistic intervention. In the long run, to cull is to be kind.

In discussion the following points were made:

Although the elephant population may need to be managed locally, there is no compelling evidence presented for the need for a general reduction in elephant numbers in the Kruger National Park. The loss of trees was attributed to the large elephant population, although trees continue to decline even at lower elephant densities which may suggest that some other factor is also involved. It has been shown that it is impossible to maintain a pristine habitat even when elephant are at a low density. There were no elephants in the Kruger National Park when it was declared a Game Reserve hence the change to the current situation is probably attributable to the initial introduction of elephants. Tsavo has shown a dramatic recovery of habitat which is attributed to 30,000 elephants being culled by poachers. The Amboseli Park habitat will not recover while elephants are still present. The Conservation Areas consist of separate isolated entities and cannot recover from the damage done by elephants. There is no possibility of maintaining a natural landscape in National Parks. If this is required then culling is essential and must be undertaken humanely. Different management strategies, including culling, will be required if game parks are to be able to recover biodiversity in the longer term. There is a parallel to be found with deer in the Scottish Highlands where there are no woodlands left in the areas occupied by deer in the wild.

This paper has been submitted in response to those delivered at the meeting

Elephant Survival Needs Good Science and Clear Thinking

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Elephants face many challenges to survive and conservationists must make use of the best available knowledge. Two papers were presented, by Dr Whyte and Professor Allen, apparently to address this subject, but their arguments seemed instead to narrow in on one particular issue: is there any alternative to culling "surplus" animals? The answer in both papers, each in their own way and in combination, was that "elephants must be culled, and soon". I was disappointed that the speakers missed the opportunity for a balanced review of more important issues in elephant conservation, in particular the need to find innovative ways for elephants to co-exist with people in increasingly populated landscapes. In reality, the apparent problem of "too many elephants" is just part of this bigger picture of "not enough space" and solutions must support creative policies with good science, rather than alarmist rhetoric.

Dr Whyte's paper was based on field experiences, reported with varying degrees of accuracy, and led the listener, via some interesting natural history, towards the ineluctable conclusion that elephants almost always cause unacceptable damage to habitats, their numbers must be controlled and the urgency precludes most methods apart from culling. Professor Allen's paper was more direct, making much of the apparent suffering endured by elephants which

die during food shortage, dismissing alternative population control methods and, in the end, calling on British parliamentarians to lobby Africans to cull early and often. His presentation included quotes from Peter Beard, a New York fashion photographer turned amateur wildlife expert, and Norman Borlaug, an agriculturist instrumental in the Green Revolution, neither blessed with experience in the science or practice of conservation of wild ecosystems. Pithy sound-bites they may have been, but they added little to the advancement of knowledge.

Both papers did a disservice to their audience, by presenting opinions, however strongly held, as scientific truth. The fact is that there are no compelling reasons to drastically and urgently reduce elephant numbers, although their management certainly needs careful, site-specific attention. The science of elephant conservation has been most recently debated in South Africa, where the Government has led a highly consultative process, culminating in a Science Round Table, which sought advice from a wide range of scientific opinion – including Dr Whyte and myself. The findings of this group, reached by ***full consensus***, have been summarised by Owen-Smith *et al* (2006). The main conclusions, which have implications for elephants everywhere in Africa, are:

1. There is ***no*** compelling evidence supporting the need for immediate, large-scale reduction of elephants in Kruger National Park.

2. In some protected areas, including Kruger, elephant population density, distribution and population structure ***may*** need to managed ***locally*** to met biodiversity and other targets.

The group concluded that there was no scientific basis to set the "carrying capacity" of Kruger for elephants at 7,000 in the 1960s, against which the current level of 13,000 should be judged. Perceived damage to trees was the original justification for the target, yet big trees declined even with numbers held very low for 30 years. To keep woodlands "pristine" would have required ***extremely*** low elephant densities, since the benchmark for the supposed ideal state of vegetation in Kruger was set in the early 1900s, when there were few if any elephants following their Africa-wide extirpation by the ivory trade of the 1700-1800s. In addition, since elephants avoid areas of human settlement, the parts of Kruger that were occupied intensively by people – who were moved out to create the park – would have had few elephants for centuries.

Claims of ecological disasters elsewhere have been greatly exaggerated. Tsavo East National Park in Kenya has been portrayed, by Professor Allen among others, as the scene of a devastating population crash and habitat holocaust. Tsavo East is subject to periodic dry spells and, following elephant increases during the 1950-60s, there was a decline of some 20% during a severe drought in the mid-1970s (hardly a "crash", since 80% survived), a change in vegetation from shrub thickets to open bushland and a shift in the wildlife community from woodland species towards grazers. The much steeper decline in the later 1970s and 1980s, attributed by, for example, Peter Beard to over-population, was actually due to fierce poaching by Somali bandits, fuelled by the late 20th century ivory rush. Much woody vegetation has now recovered, accompanied by returns of woodland wildlife species. Evidence from paleoecology shows alternating periods of woodland and grassland dominance over the past 1400 years (Gillson 2004), indicating that dynamic change is the rule, not a recent problem.

In Chobe National Park (Botswana) and Hwange NP (Zimbabwe), woodland changes are localised near water, either rivers in Botswana or artificial waterpoints in Hwange. Norwegian and African researchers recently concluded that, as in Kruger, these woodlands had expanded "unnaturally" during the ivory trade and are now being re-shaped by the returning elephants. Ironically, in a recent drought, managers in Hwange, who had been calling for reduction of elephant numbers, were bemoaning the natural deaths of elephants through food limitation.

Amboseli National Park, Kenya, (where I have been part of the 30-year elephant research programme) has experienced loss of its *Acacia* woodlands, but salinity was the main cause. Woodlands survived along swamp fringes and outside the park on different soils, where salinity is low and elephants administered only the *coup de grace* to already diminished woodlands. Research cited by Dr Whyte on fenced exclosures (Western & Maitumo 2004) is misleading, since the experiments were located in the swamp margins, not the saline areas. In fact, the experiments show that the *Acacia* woodland change is rapidly reversible, and elephant impacts are entirely temporary. Historical records show that the *Acacia* woodlands were a recent development, dating from the early 1900s. Exactly the same effect of soil chemistry, rather than elephants, on *Acacia* death has been seen in Ngorongoro, Tanzania (Mills 2006).

In none of these supposed "disaster areas" has overall biodiversity actually suffered, despite claims by some authors. The parks are all parts of larger ecosystems, and impacts in all cases were localised and temporary.

In addition to the ecological arguments, the SA Science Round Table noted that the model guiding conservation has undergone a dramatic change in recent years – see reviews by Pickett *et al* (1997) for a general discussion and du Toit *et al* (2003) for its application in South Africa. Under this "paradigm shift", the rigid Balance of Nature model has been replaced by the acceptance of heterogeneity in space and time. Intensive management is still appropriate in agricultural landscapes and those that have been deeply, fundamentally modified by human activity, such as most of Britain, but in ecosystems that retain significant functional elements at different trophic levels, it is better to identify and work with ecological processes, rather than imposing arbitrary stability with blanket "command-and-control" measures. The alternative, of suppressing change and homogenising habitats, makes ecosystems more vulnerable to loss of species and reduces biodiversity.

In Kruger, widespread provision of waterpoints is now seen as responsible for damaging effects on populations and habitats, by evening out animal distributions and spreading impacts. The new approach also encourages density-dependent wildlife population regulation, including food-limited mortality, and managers have abandoned the control of wildlife populations at fixed "carrying capacity". Periodic droughts, as in

Hwange and Tsavo, have a further important role to play in the self-regulating mortality of juvenile and adult elephants. The Round Table saw this as a process to be encouraged, rather than prevented as advocated by Prof Allen.

"Adaptive management" or learning-through-doing, is now seen as the best way to find out what works in wild ecosystems, where future outcomes remain uncertain. Trying different approaches in different areas of elephant range, and accepting that results of ecological experiments take time, are important aspects of an experimental approach to discovering how to work with, rather than against, ecosystem processes. Landscape-level planning looking at the whole ecosystem, including corridors for dispersal between protected areas, is an important means for encouraging population and habitat heterogeneity.

Finally, the Round Table recognised that social issues are important, but distinct from the scientific issues in elephant management. Ethical issues may be debated on their own merits, with sympathy for elephant intelligence and sociality, or intervention to "save" elephants from dying naturally, becoming an important talking point. Economic considerations are clearly necessary, and again, should be evaluated on their own terms. In summary, it is essential to distinguish the different strands of argument over elephant management, and to keep the question over whether or not to cull in its proper place as one, rather blunt, tool hardly deserving the overblown argument that it all-too-often receives.

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