OPTIONS FOR THE MANAGEMENT OF ELEPHANTS IN NORTHERN BOTSWANA

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INTRODUCTION

The northern region of Botswana (see map) contains one of the largest populations of elephants remaining in Africa. This population was estimated to be about l2,000 in the late l970s (Sommerlatte, l976) although this figure was believed to be an under-count (Work & Owen-Smith, 1986; Campbell, 1990). By 1994, the population had increased to over 70,000 (Said *et al.*, 1995) and was apparently expanding at a rate of 5% (Spinage, 1990; Calef, 1991a). An elephant hunting ban has been in place since 1983 (Campbell, 1990). Culling, poaching and human-elephant conflict have not been management factors and the demand for shooting elephants has been rare (Chadwick, 1991).

The elephant population is contained in a range of 80,000km^2 which includes about 18,247km^2 of the protected areas of Chobe National Park, Nxai Pan National Park and Moremi Game Reserve: The remaining areas fall within forest reserves and proposed Wildlife Management Areas. Elephant distribution during the dry season is restricted by the availability of surface water. During the hot, dry season, up to *75%* of the population may be confined within an area of 10,000 to 12,000km^2, mostly within 30km of the permanent water sources of the Kwando/ Linyanti and Chobe rivers (Craig, 1990; Calef, 1991a,b).

The impact which elephants have exerted, and continue to exert, in dry season concentration areas, has been a source of much concern (Child, 1968; Simpson, 1978; Sommerlatte, 1976; Moroka, 1984). The future of elephants in northern Botswana was debated (Hancock, 1990) but no management policies were adopted: Defining management policies to deal with the elephant over-abundance in Chobe is problematic because of the lack of scientific facts. Potential management options for the elephant population in northern Botswana, to reduce or contain severe impact on woodlands, may include one, or a combination of, (a) reduction culling, (b) culling directed at elephants in the age classes which cause the most damage, (c) stabilisation culling by removing the annual increment, (d) capture and translocation, (e) localised culling in areas associated with habitat degradation, (f) creation of elephant cropping zones adjacent to parks, (g) redistribution of elephants away from localities of concern, by disturbance culling, (h) alternative water provision, (i) creation of dispersal sinks and (j) non-interference.

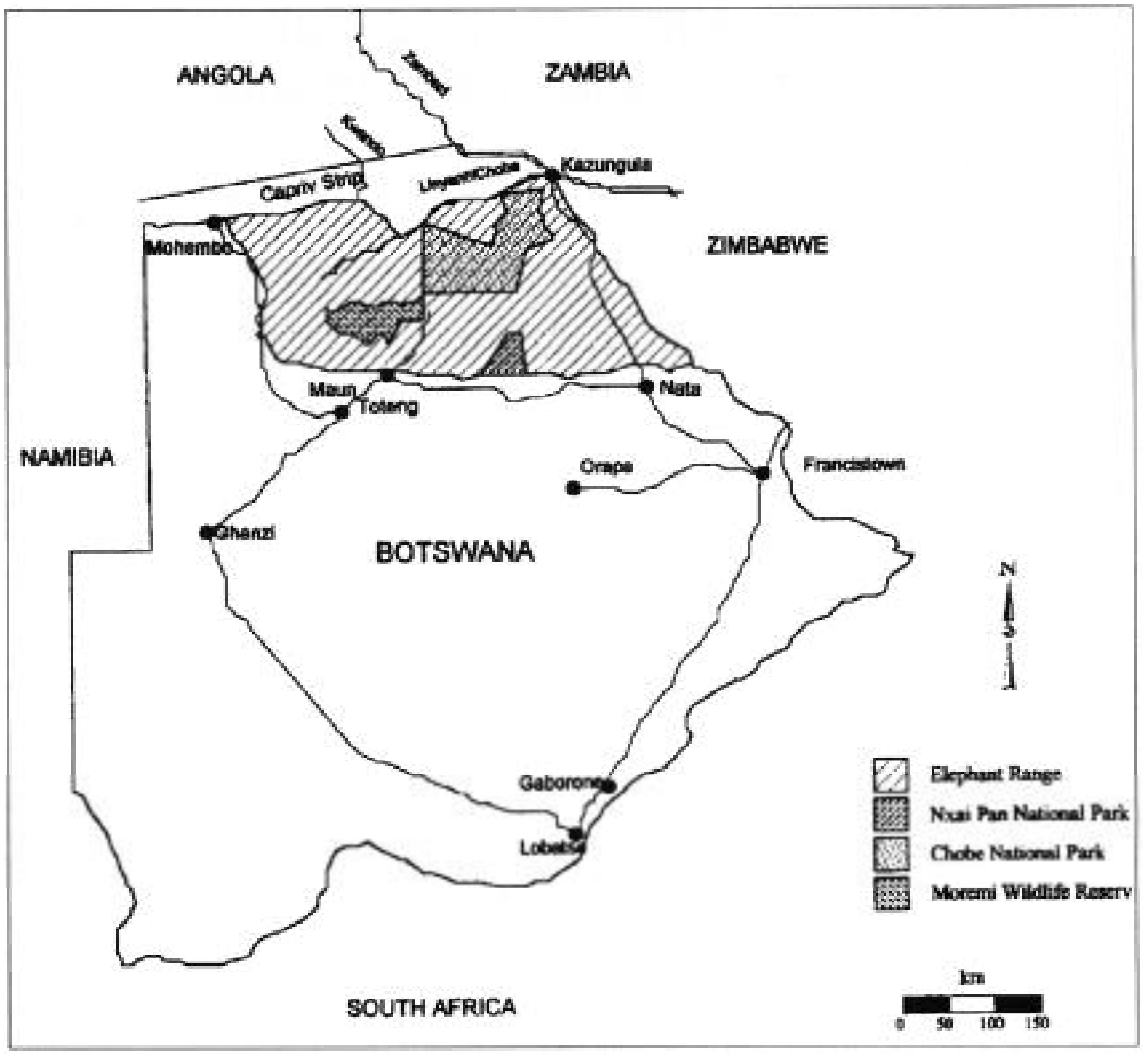
These management strategies were discussed in relation to the problem of elephant over-abundance in Ruaha National Park, Tanzania (Barnes, 1983), in Chobe National Park, Botswana (Work & Owen-Smith, 1986), in Zimbabwe (Martin & Conybeare, 1991), and more generally, by Owen-Smith (1988). We reconsider these alternatives for northern Botswana in the light of a recent three-year study on factors governing selective impacts of elephants on woody vegetation (Chafota, in prep.). There is still a lack of information to address some of the management strategies, but lessons learned from other conservation areas will be used as a guideline. It is emphasised that the effects of each management option adopted must be monitored and evaluated to check whether multiple objectives are met.

MANAGEMENT OPTIONS

Non-interference

The non-interference option entails allowing elephant populations to regulate themselves by natural density-dependent means. In northern Botswana, elephant numbers were reduced to low numbers by ivory hunting from the early 19th century to the late 1930s (Campbell, 1990). Thereafter, elephant numbers increased (Child, 1968; Campbell, 1990), facilitated by the creation of Chobe National Park in 1961 (Sommerlatte, 1976).

Legal hunting in northern Botswana ceased in 1983(Campbell, 1990) due to the low economic value



Map of Botswana showing elephant range and protected areas the northern region (based on Craig, 1990: Spinage, 1990: Calef, 1991a,b; Said et al., 1995).

of tusks, which were found to be small and fragile (Work & Owen-Smith, 1986; Seeletso, 1990). Since Botswana is sparsely populated by people, there has been neither much human-elephant conflict nor demand for shooting elephants by communal farmers (Work & Owen-Smith, 1986; Chadwick, 1991).

The impact of elephants on woody vegetation in northern Botswana was first reported by Child (1968) and later by Sommerlatte (1976), Simpson (1978), Moroka (1984), Coulson (1992) and Wackernagel (1993). Despite the concern shown by these researchers, no management action was taken. Although not explicitly stated, the chosen management option in Botswana has therefore been effectively one of non-interference. Fears associated with this approach are the possibility of irreversible habitat change and loss of biodiversity (Martin & Conybeare, 1992; Jones, 1993; Lindsay, 1993). Owen-Smith (l988) listed the concerns arising from vegetation changes induced by expanding mega-herbivore populations. These were: (a) radical modification of certain habitat types leading to perhaps the loss of species which depend upon them; (b) elimination of certain sensitive plant species; (c) reduced vegetation cover leading to accelerated erosion and decline in the overall productivity of the ecosystem; (d) depression of the resource base for mega-herbivore populations themselves and (e) loss of aesthetic features of landscape, such as mature trees.

Elephant-habitat interaction and regulatory mechanisms

Despite many years of elephant management, research and debate, the interaction between elephants and trees is still relatively poorly understood in ecological terms (Lindsay, 1990): Elephant populations have continued to increase despite vegetation changes which are perceived as adverse: Ultimately, food supply may limit populations, but not until the vegetation has been considerably altered. Time lags commonly arise when herbivore populations respond to changing resource supply, which may lead to oscillations rather than stability (Caughley, 1976). The response of elephants to nutritional deficiencies could be a progressive reduction in calf recruitment, as documented in Uganda (Laws, l 968) or catastrophic mortality as observed in Tsavo, Kenya (Corfield, 1973; Parker, 1983).

Lindsay (l990) suggested that an elephant population crash or irreversible vegetation change was unlikely in Botswana, although the conversion of woodlands to an open, patchy mosaic, might occur. For Hwange National Park, Zimbabwe, Conybeare (1991) concluded that vegetation change could be reversed if elephant numbers were reduced, otherwise there would be a progressive decline of tree density throughout the dry season range. In Chobe National Park, Botswana, elephants subsist largely on the shrubs *Baphia massaiensis, Bauhinia petersiana* and *Diplorrynchus condylocarpon* (Chafota, in prep:): Shrubs may show profuse regrowth following elephant use, as documented elsewhere by Jachmann and Bell (1985) and McShane (1989).

The range of the Botswana elephant population extends into Zimbabwe and Namibia, and possibly into Zambia and Angola (Lindsay, 1990; Said *et al.*, l995), although movement into the latter two countries still needs to be documented. Re-distribution is apparently occurring in response to changing food and water availability and protection from poaching, thus reducing the likelihood of localised population crashes:

Elephants have had a severe impact on canopy trees in localised zones near permanent water, for example, along parts of the Chobe river front (Child, 1968; Sommerlatte, 1976; Simpson, 1978; Moroka, 1984): Observations suggest that tree-felling may occur episodically in association with events such as droughts, frosts and fire (Chafota, in prep.). Accordingly, no local equilibrium between elephants and woodlands may be attained in these areas. Nevertheless, both elephants and trees may persist on a regional scale, provided that elephants are free to move. If movements are suppressed, a stage may be reached whereby one or a combination of factors may prevent recovery of woodlands (Dublin *et al.*, 1990).

Effects of vegetation impacts on wildlife species

The vegetation changes induced by high elephant densities may result in loss of habitat for other wildlife species. Of course, some species may benefit from the opening of woodlands. Species likely to be affected adversely are those dependent on closed woodlands or thickets, especially along river fronts. Simpson (1978) suggested that the destruction of riparian woodlands by elephants along the Chobe river would be detrimental for bushbuck *(Tragelaphus scriptus ornatus).* Addy (1993) confirmed that the bushbuck population had declined in the region most severely impacted by elephants. Nevertheless, indications were that bushbuck were not in danger of extinction because adequate cover remained in the form of woody species not favoured by elephants:

Reduction or stablisation culling

Culling has been justified as a cautious option by managers faced with uncertainty about the ecological consequences of the vegetation changes induced by elephants. However, this uncertainty cannot be resolved if elephant densities are held at low levels indefinitely. In Kruger National Park, vegetation changes perceived as detrimental have not been prevented despite placing a low ceiling on the elephant population (Viljoen, 1988).

The elephant management policy for Botswana which was recommended in 1990 was to maintain the population at its 1990 level by removing the annual increment (Seeletso, 1990; Lindsay, 1993). For several reasons, this policy was never implemented. Concerns were that (a) the 1990 population level was arbitrary and already high (over 60,000), (b) further vegetation change would still occur, and (c) the optimum number of elephants had not been established.

In northern Botswana, the following considerations must be taken into account before culling is implemented:

- Severe woodland destruction has already occurred along much of the Chobe river front, and would not be reversed unless local elephant densities were reduced drastically. Such action would adversely affect the attraction of Chobe National Park for tourists.

- The elephant population range extends across international boundaries. Elephants culled in Botswana may be replaced by elephants dispersing from Zimbabwe and Caprivi, or even further afield.

- The impacts of uncontrolled fires, frost, and droughts on the dynamics of woodlands may be as great as that of elephants, and more extensive. The regeneration stages of all woody species, including those which are utilised little by elephants (e.g. *Baikiaea plurijuga, Guibourtia coleosperma* and *Burkea africana),* are adversely affected by annual, recurring fires which spread over vast areas of northern Botswana.

- Sensitive woody species (notably *Berchemia discolor, Acacia erioloba, Acacia tortilis, Acacia nigrescens* and *Acacia luederitzii)* are restricted primarily to the riparian woodlands along the Chobe and Linyanti rivers. Justification for a large-scale cull, just to induce recovery of these tree species, is questionable.

- Localised culling could simply cause elephants to move elsewhere and exacerbate vegetation impacts in other regions.

- The economic and logistical issues associated with culling at the scale needed are huge. If poorly conducted, culling could have adverse consequences for Botswana's image and for tourism.

- Mature elephant bulls have a greater impact than cows on canopy trees (Chafota, in prep). However, destroying just adult bulls may result in adverse effects on breeding, age, sex distribution and social organisation of the population (Martin & Conybeare, 1992).

Elephant cropping adjacent to parks

Rather than being culled within national park boundaries, elephants could be harvested economically in the adjoining Wildlife Management Areas or on communally occupied land (Seeletso, 1990). Killing could be done by citizen hunting, safari hunting, or by organised rural communities living adjacent to these areas.

However, the disturbance associated with hunting or cropping may cause elephants to seek sanctuary within national park boundaries, thereby increasing pressure on the vegetation in the park. The number of elephants removed from the population through this means is likely to be much less than the annual increase.

Augmenting water supplies

Populations of water-dependent herbivores, like elephants, are limited by the amount of food accessible near water during the dry season. In the long term, the augmentation of water supplies would raise the ceiling which the elephant population could reach. Elephants staying away from river fronts because of the availability of dry season water elsewhere would eventually be replaced at the river front by increasing elephant sub-populations remaining dependent on the rivers for their dry season range.

Child (l968) recommended supplying water points on a rotational basis to reduce elephant concentrations in sensitive areas during the dry season. Sommerlatte (1976) suggested that water points needed to be placed in habitats resistent to elephant impact, such as *Baikiaea plurijuga* woodlands. Work and Owen-Smith (1986) pointed out that vegetation growing in such regions may have limited potential to recover, if severely damaged, because of low nutrient status of the soil. Water underlying nutrient-poor sand may be less attractive to elephants, because of its low mineral content (Weir, l972). By rotating the water points, vegetation damage merely spreads over a wider area.

Dispersal sinks

The dispersal sink (or vacuum zone) option was proposed by Owen-Smith (1974, 1981) initially for the management of the white rhino population in the Hluhluwe-Umfolozi Park in South Africa. It was later generalised for mega-herbivores, including elephants (Owen-Smith 1983, 1988). The concept is based on the observation of Laws (l968), that dispersal is the only mechanism which can adjust the population densities of long-lived animals to short-term fluctuations in resources. Accordingly, these species can reach density levels which exceed those supported by resources, if dispersal is prevented by fences, settlements, hunting or other boundary restrictions. This option avoids arbitrary assignment of permissible population levels within conservation areas. The expectation is that animals will disperse when resources in the core area become inadequate.

Dispersal sinks are created by removing all or most of the animals of the target species from designated zones, either within or adjoining the protected area. Ideally, these zones should encompass the extent of one to two

home ranges, i.e. perhaps 500 to 1,000km^2 for elephants. Animals settling within these "vacuum zones are culled periodically, by whatever means. Periods between culls within any one sink should be long enough so as not to condition animals to avoid these zones, i.e. perhaps five to ten year intervals for elephants.

Unless suitably placed, vacuum zones may not attract animals from the population core. Their effectiveness is questionable for mobile populations where animals do not occupy fixed home ranges, as may be the case for the Botswana elephants. The rate at which animals settle within vacuum zones may be inadequate to halt population growth, unless densities in the core area are sufficient to cause food-stress. Nevertheless, an important function of the sink areas would be to serve as a safety valve by providing an area which elephants can occupy during crisis periods, such as severe drought. Moreover, these areas also retain habitats unaffected by high elephant densities, thereby protecting animals and plant species sensitive to habitat changes induced by elephants.

CONCLUSIONS

It is evident that all management options are problematic. A policy of non-intervention is difficult to justify when the population range extends well beyond park boundaries, bringing elephants into conflict with people who occupy adjoining areas. With inhibitions on dispersal as a result of these settlements, elephants could attain densities high enough for severe vegetation degradation to spread over extensive areas. The persistence of other species may become threatened as a result.

We believe that the management authority should employ a combination of actions. Utilisation of surplus elephants outside park boundaries by local people, by acceptable means, should be encouraged. Disturbance culling may be required to alleviate pressure on sensitive habitats where rare plants or animals are threatened. Areas adjoining parks where elephants are exploited commercially could serve as dispersal sinks. The frequency of cropping and the methods used would need to be controlled, so as not to drive elephants back into the park area. Within park boundaries, and perhaps in parts of the adjoining range, the elephant population should be left unculled, so that tourists continue to experience impressive concentrations of relaxed elephants. Additional water points could be used to increase the area attractive to tourists during the dry season, provided these are placed sensitively. Water could also be used to draw elephants into dispersal sinks or other areas outside parks where animals are exploited economically. An effective fire management policy should be part of the strategy to control elephant distributions.

The overall objectives for management of the elephant population must be clearly stated, and a system of monitoring and evaluation put in place to check whether the objectives are being met. Severe vegetation impacts must be accepted as inevitable in some part of the elephant range. The distribution and extent of habitat transformation may need to be controlled to ensure that biological diversity is not sacrificed.

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SESSION TITLE: DISCUSSION ON REPORT BY DUBLIN, MILLIKEN AND BARNES *Four Years After the CITES Ban: Illegal Killing of Elephants, Ivory Trade and Stockpiles*

Chair: Brian Huntley
Rapporteurs: Ruth Chunge, Lamine Sebogo

Of the members who answered a questionnaire at the close of the meeting, the majority requested that the minutes of this session should not be published.

SESSION TITLE: NATIONAL, REGIONAL, CONTINENTAL AND INTERNATIONAL NEWS AND VIEWS

Chairs: Holly Dublin, Bihini Won wa Musiti
Rapporteurs: Lamine Sebogo, Andrea Turkalo

During this session, updates were given on the status of the African Elephant Database and the African ElephantBibliography, as well as country reports from each region.