Chapter 4

The Influence of Veterinary Control Fences on Certain Wild Large Mammal Species in the Caprivi, Namibia[1]

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Introduction

This paper considers the effects of veterinary control fences on four wild mammal species and is based on consultancies conducted for the Ministry of Environment and Tourism, Namibia, from October 2002 to April 2003 to develop management plans for southern savanna buffalo (*Syncerus caffer caffer*), roan antelope (*Hippotragus equinus*), sable antelope (*Hippotragus niger niger*), and tsessebe (*Damaliscus lunatus lunatus*). Two background studies were done – one on buffalo (Martin 2002a) and one on roan, sable, and tsessebe (Martin 2003a). Following from these studies, management plans were prepared (Martin 2002b and 2003b).

Recent revisions to the taxonomy of the Artiodactyla (even-toed ungulates) have placed all of these species closer together (Macdonald and Morris 2001). All four species are in the family Bovidae (bovids) in a new suborder Ruminantia (ruminants). In the subfamily Bovinae (wild cattle and spiral-horned antelope), the southern savanna buffalo (*Syncerus caffer* Sparrman 1779, subspecies *S.c. caffer*) is one of four subspecies of African buffalo recognised by the IUCN Antelope Specialist Group (ASG 1998) in the tribe Bovini (wild cattle).

Roan, sable, and tsessebe are now all included in the subfamily Hippotraginae (the grazing antelope), which embraces three tribes. The tsessebe (*Damaliscus lunatus*, Burchell 1824, subspecies *D.l. lunatus*) is included in the tribe Alcelaphini (open woodland, moist grassland, and ecotonal grazers). Roan and sable antelope are in the tribe Hippotragini (savanna and arid land grazers). No subspecies of roan (*Hippotragus equinus*, Desmarest 1804) are currently recognised; four subspecies of sable (*Hippotragus niger*, Harris 1838) are thought to exist, although the validity of this classification is dubious (ASG 1998). The main subspecies *H.n. niger* occurs from Tanzania southwards in Africa. The third tribe, Reduncini, includes wetland antelope species such as the waterbuck, lechwe, and reedbuck.

In the IUCN Red List of Threatened Species (Hilton-Taylor 2000), all four species are classified as lower risk (conservation dependent), i.e., they are not threatened at the global, continental, or regional level. The species are of conservation concern at the national level in Namibia because, within their natural range, their numbers are far lower than in the recent past. They appear to be declining, and many of the subpopulations making up the national metapopulation are isolated from one another. However, because the areas in which buffalo, roan, sable, and tsessebe occur naturally in northeastern Namibia are spatially linked to larger populations in Botswana, these species would not qualify independently for any category of threat based on population numbers. Also, while numbers of roan, sable, and tsessebe have increased spectacularly on commercial farms in Namibia, most of these farms are located outside the range where the species formerly occurred in the country.

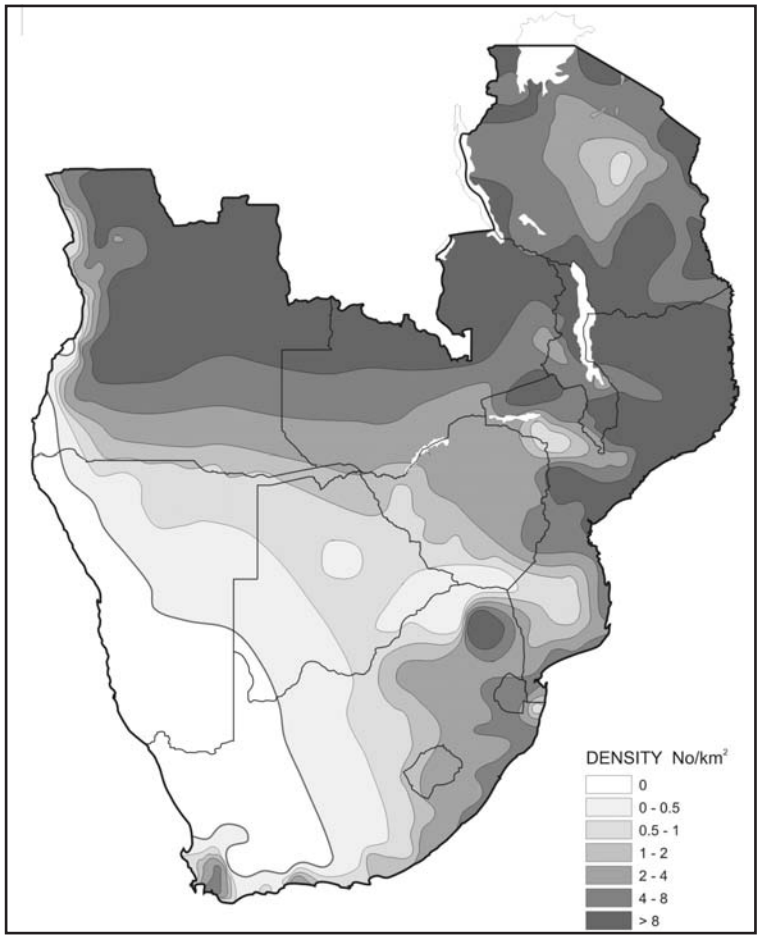
One of the main purposes of these studies and management plans is to contribute to the establishment of transfrontier conservation areas (TFCAs) in the central area of southern Africa where Angola, Botswana, Namibia, Zambia, and Zimbabwe share common boundaries. The attainment of functioning TFCAs is not envisioned as being either a rapid or a simple process; the long-term goal is being approached incrementally, with the first step being the building of linkages between Botswana and Namibia involving a number of joint species management programmes. Ultimately, these should facilitate larger transboundary conservation projects.

Historical Distribution and Status

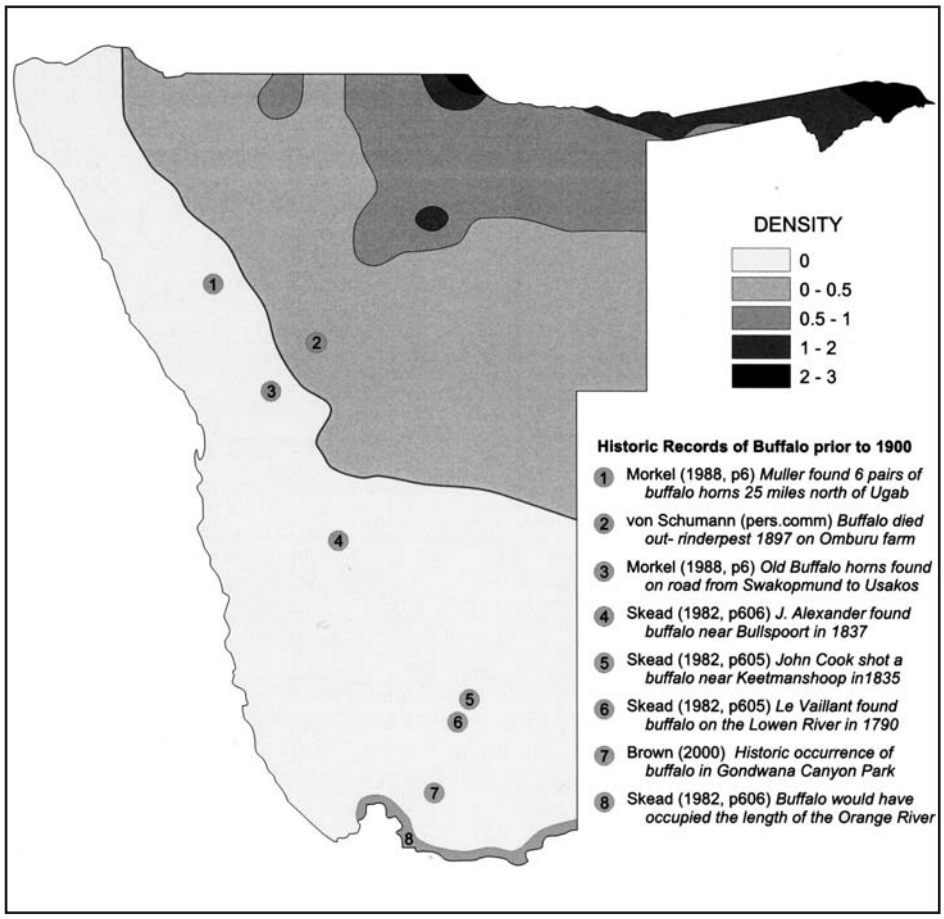
Several hundred years ago, the range of buffalo in Africa extended to most areas with an annual rainfall exceeding 250mm (Stewart and Stewart 1963). Prior to the great rinderpest epidemic at the turn of the 19th century, buffalo were widely distributed throughout southern Africa – except in South Africa, where they had been largely eradicated from the southern part of their historical range (Map 1). A relict population persisted in what is now Addo National Park in the Cape Province.

In Namibia, buffalo originally occurred throughout the northeast of the country above the 250mm rainfall isohyet and even in lower rainfall areas (Map 2). After the rinderpest pandemic, buffalo began to recolonise their former range and, by 1963, were recorded in most of the area they had originally occupied (Map 3). This trend was reversed after 1960 (see next section on veterinary control fences) and, except for two foot and mouth disease-free buffalo herds in the main body of

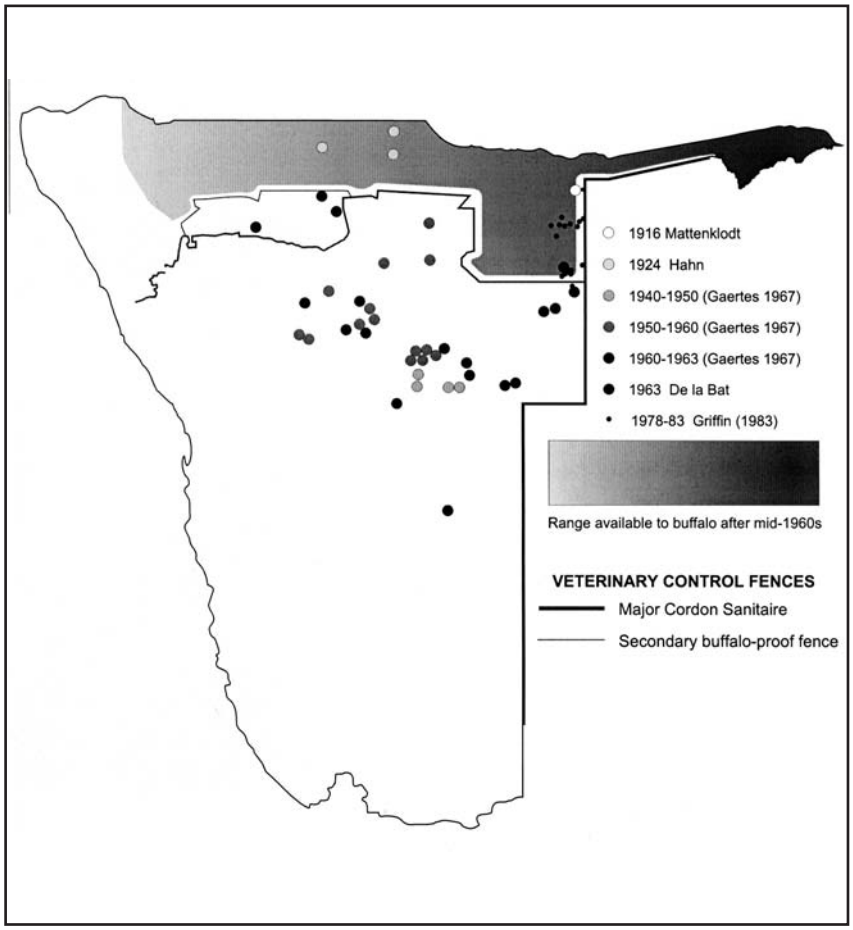
[1] See abstract on p.xxi.



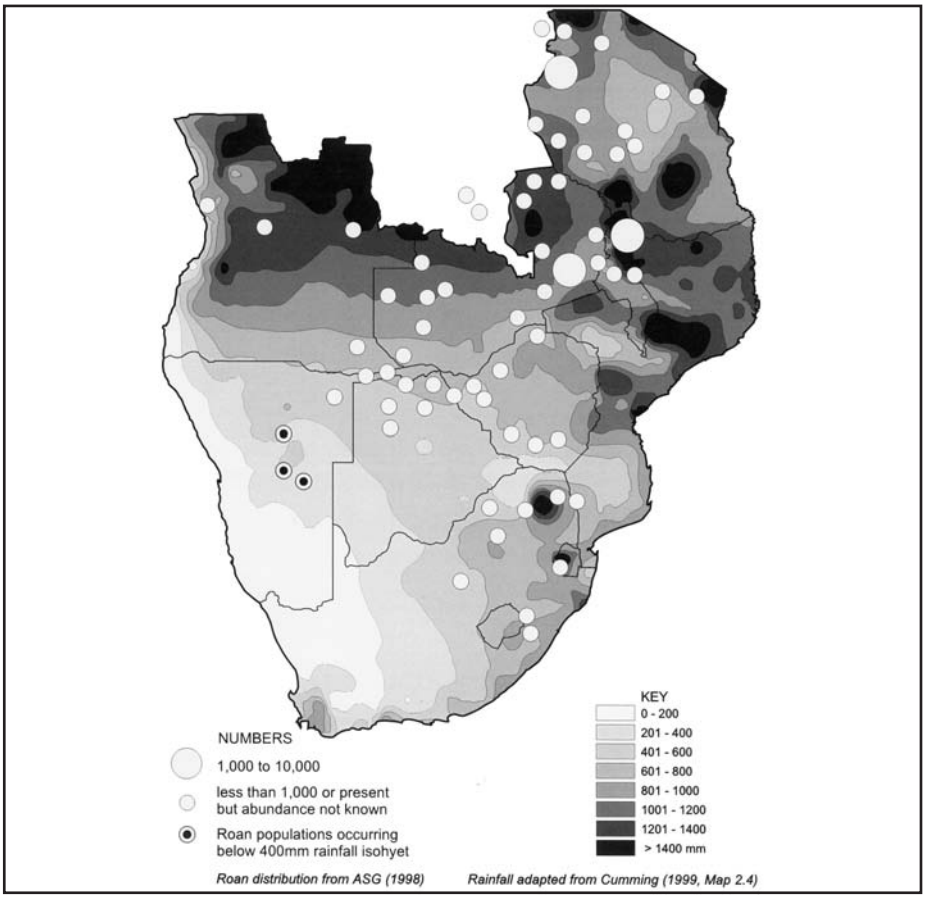
Map 1. Buffalo in southern Africa – early historic range and potential density (based on rainfall)



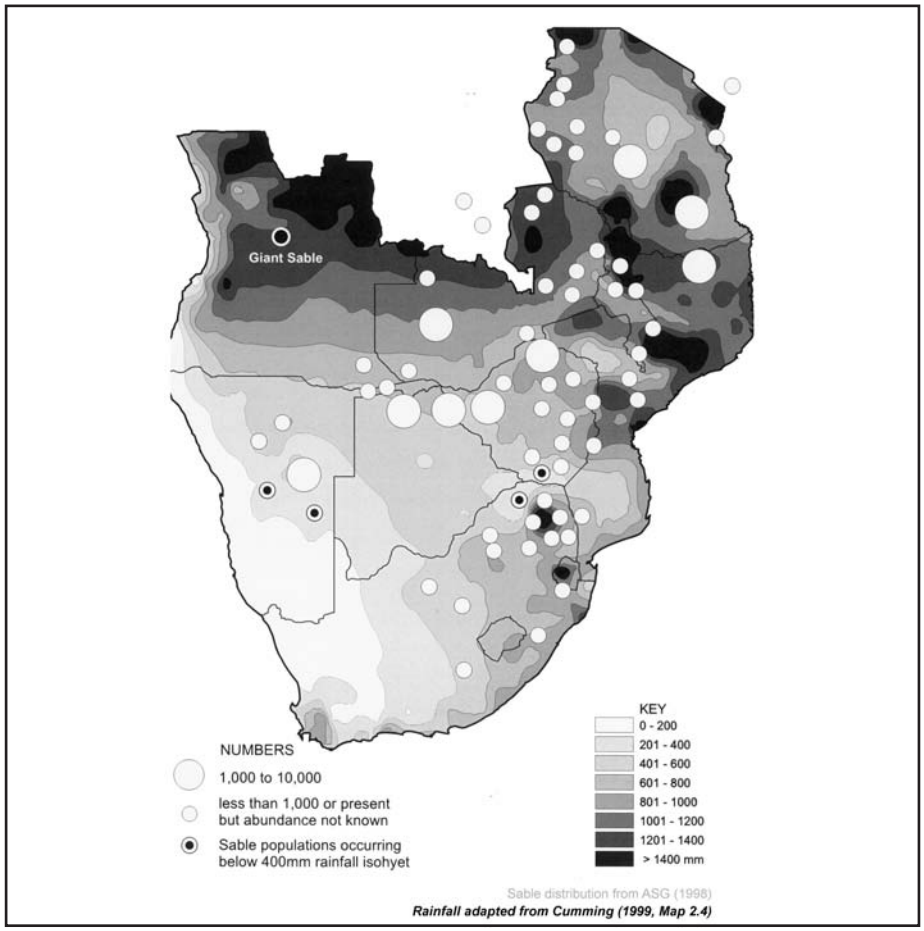
Map 2. Pre-rinderpest range of buffalo in Namibia together with potential density based on rainfall



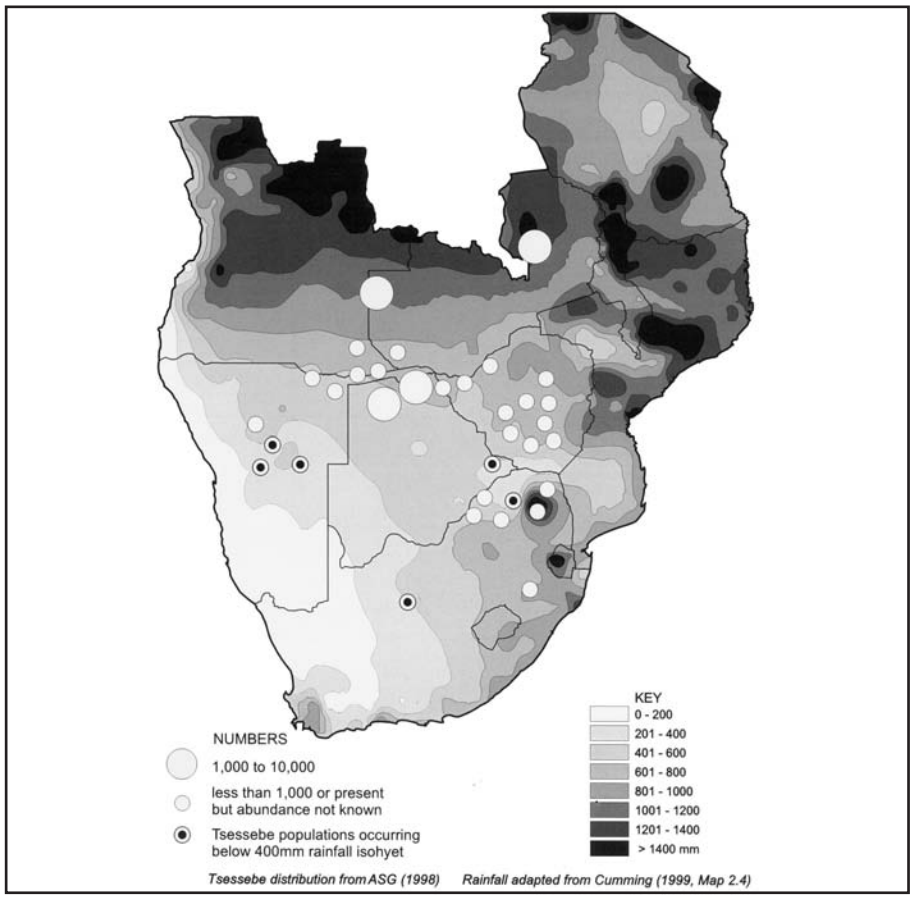
Map 3. Reported buffalo occurrences in central Namibia 1900–1963 and the reduced range available to buffalo after 1963



Map 4. Mean annual rainfall and roan antelope occurrence in southern Africa

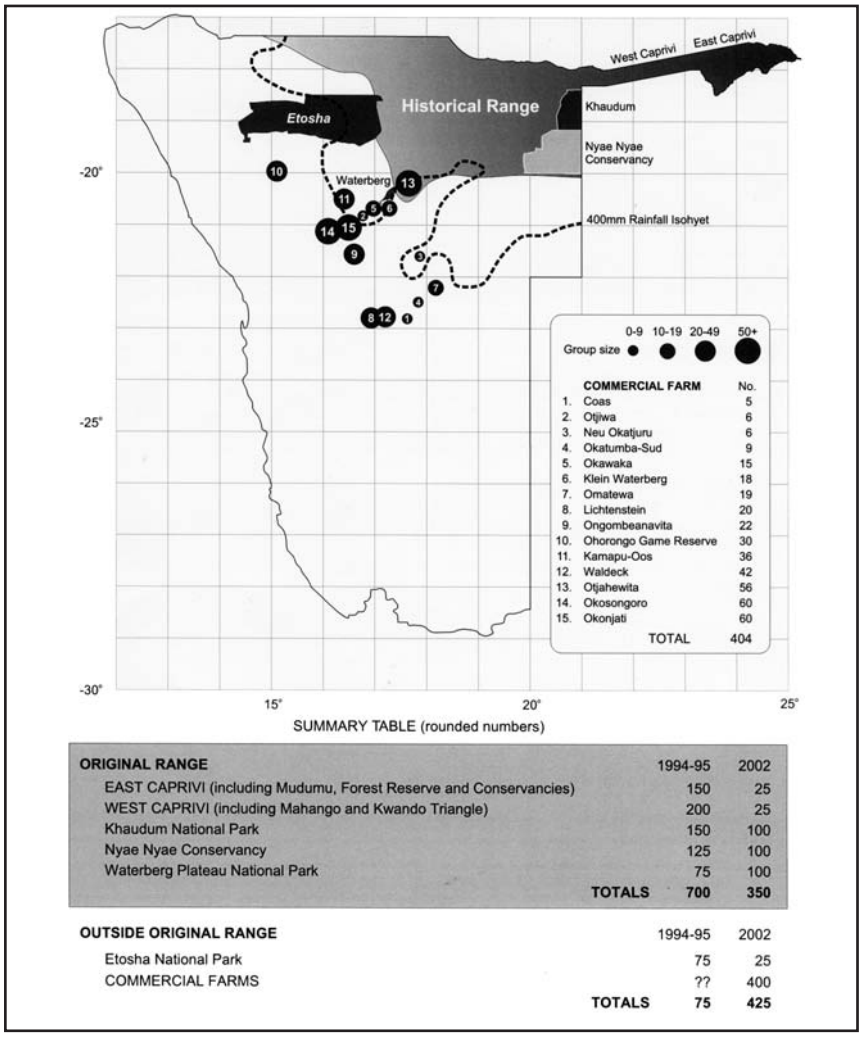


Map 5. Mean annual rainfall and sable antelope occurrence in southern Africa



Map 6. Mean annual rainfall and tsessebe occurrence in southern Africa

Map 7. Roan antelope – original range, present distribution and current status



SUMMARY TABLE (rounded numbers)

ORIGINAL RANGE	1994-95	2002
EAST CAPRIVI (including Mudumu, Forest Reserve and Conservancies)	150	25
WEST CAPRIVI (including Mahango and Kwando Triangle)	200	25
Khaudum National Park	150	100
Nyae Nyae Conservancy	125	100
Waterberg Plateau National Park	75	100
TOTALS	**700**	**350**

OUTSIDE ORIGINAL RANGE	1994-95	2002
Etosha National Park	75	25
COMMERCIAL FARMS	??	400
TOTALS	**75**	**425**

the country, the range for buffalo is now restricted entirely to the Caprivi. In 1994–1995, the estimates for the Caprivi population were some 3,000 (ULG 1994, Rodwell *et al*. 1995).

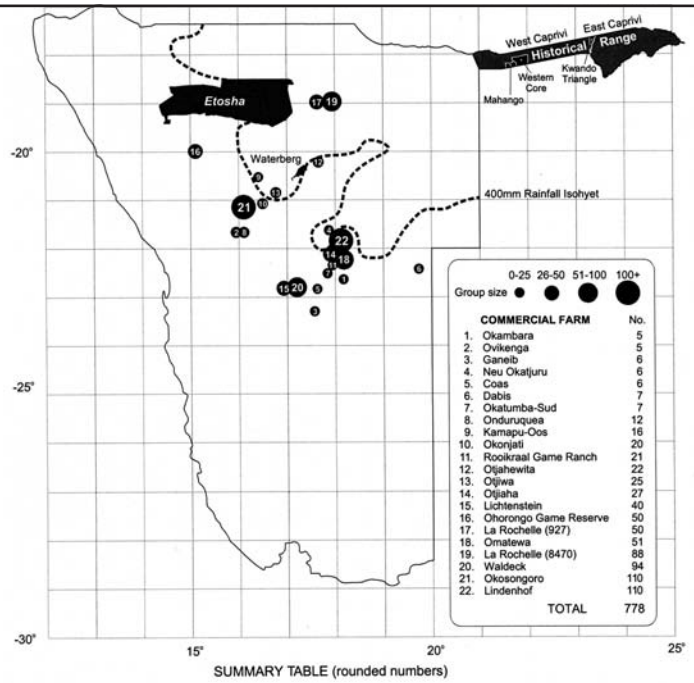
Roan, sable, and tsessebe do not occur naturally in areas where annual rainfall is much less than 400mm (Maps 4, 5 and 6). In Namibia, their historical distribution was limited to the extreme northeast of the country (Maps 7, 8 and 9), with the highest densities in the Caprivi (Shortridge 1934). New populations of all three species have been established in state-protected areas and commercial farms in the north of the country, but many of these populations are in areas where the rainfall is lower than 400mm and their long-term prospects must be regarded as parlous.

Despite erratic air survey data from 1980 to 2000, it is apparent that the roan, sable, and tsessebe populations in the Caprivi were relatively abundant until 1995. Some 500 roan were estimated in the Caprivi and Khaudum Game Reserves in 1994–1995, sable numbers were over 1,200 in fairly constant densities across the full extent of the Caprivi, and tsessebe numbered at least 200.

Veterinary control fences

From 1960 to the present, veterinary control fences have been built and continually modified in Botswana, Namibia, South Africa, and Zimbabwe. The fences relevant to this study, together with their dates of construction, are shown in Map 10 and described in detail in a consultancy report prepared by Scott Wilson Resource Consultants (2000). The early fences were mainly directed at the control of foot and mouth disease but, as veterinary research progressed in the latter half of the twentieth century, it became apparent that numerous other diseases affecting cattle had to be considered (Morkel 1988).

Obtaining much quantitative data of the effects on wildlife of the early fences is difficult. In Botswana, the first cordon fence (the "Kuke fence") was constructed in 1958, and there are numerous qualitative accounts of losses in wildebeest, hartebeest, and zebra populations. The fence along the international boundary between Botswana and Namibia was constructed in the early 1960s and disrupted wildlife movement between the two countries. In arid land ecosystems, these movements play a critical role in species survival.

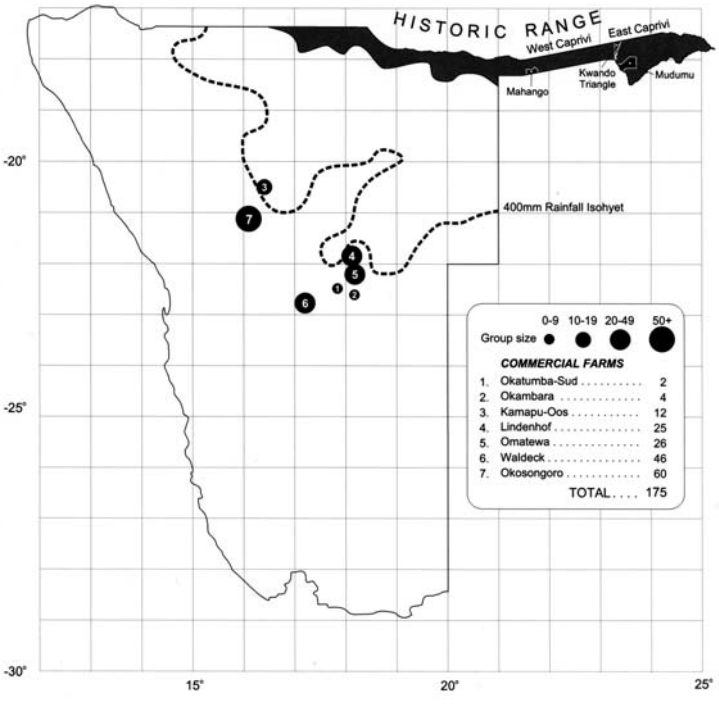


SUMMARY TABLE (rounded numbers)

ORIGINAL RANGE	1994–95	2002
EAST CAPRIVI (including Mudumu, Forest Reserve and Conservancies)	600	0
WEST CAPRIVI (including Mahango, Wester Core and Kwando Triangle)	600	225
TOTALS	**1,200**	**225**

OUTSIDE ORIGINAL RANGE	1994-95	2002
Waterberg Plateau National Park	75	125
Etosha National Park	50	75
COMMERCIAL FARMS	??	800
TOTALS	**125**	**1,000**

Map 8. Sable antelope – original range, current distribution and current status. In the early part of the 20th century, sable antelope were found only in the Caprivi (Shortridge 1934).



SUMMARY TABLE (rounded numbers)

ORIGINAL RANGE	1994–95	2002
EAST CAPRIVI (Mudumu National Park only)	125	0
WEST CAPRIVI (Mahango National Park and Kwando Triangle only)	100	50
TOTALS	**225**	**50**

OUTSIDE ORIGINAL RANGE	1994-95	2002
COMMERCIAL FARMS	??	175

Map 9. Tsessebe – original range, present distribution and current status

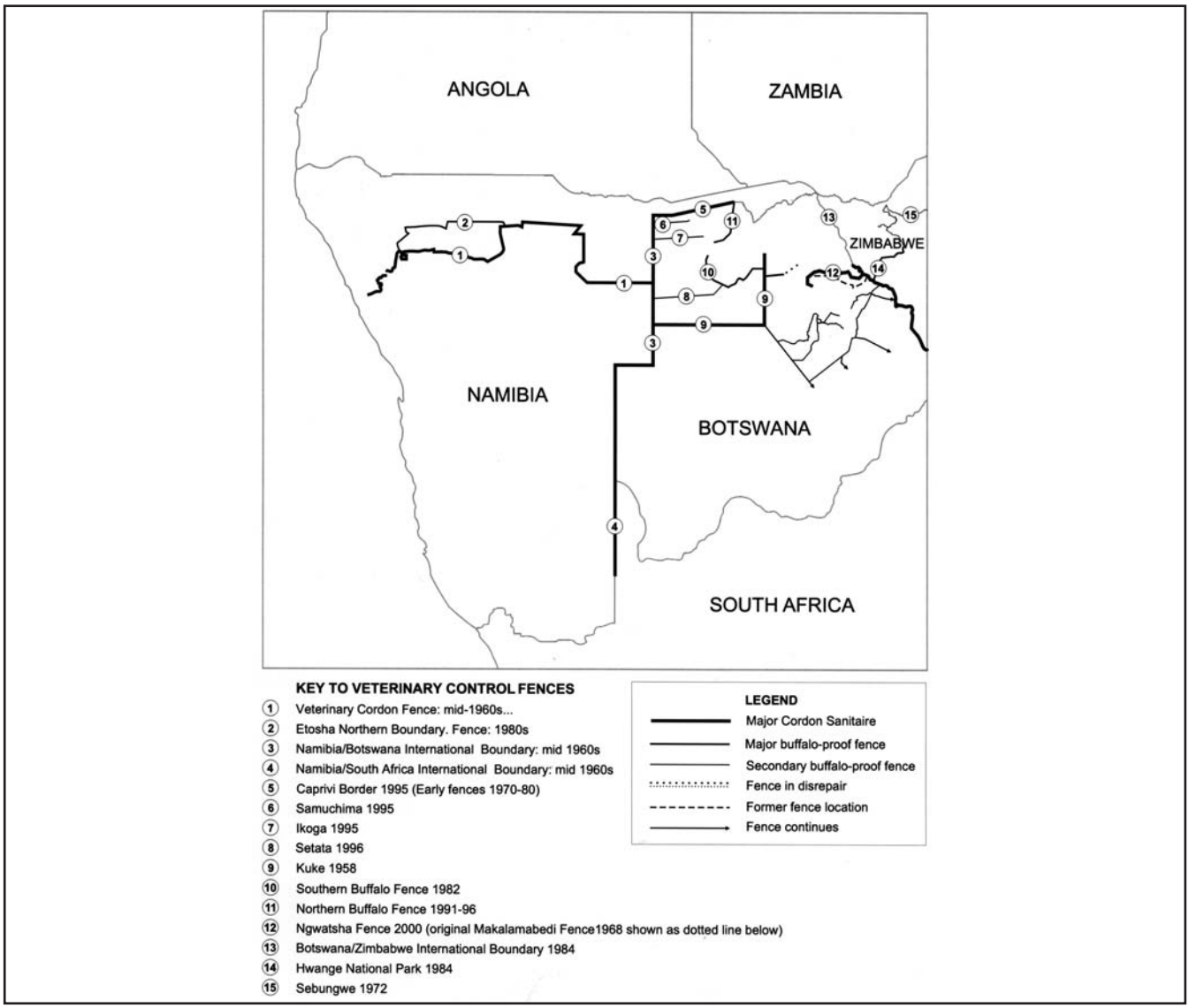
In northern Namibia, buffalo were eradicated from large areas as part of the veterinary campaign but, in any case, the construction of the fences alone would have been responsible for many deaths. Volker Grellmann (chair, Namibian Professional Hunters Association, personal communication) related the fate of some 200 buffalo in the Bushmanland area that were isolated from Botswana by the international boundary veterinary fence. Most of this group died of thirst and starvation and, by 1988, the only survivors were 18 of the original herd, which later formed the nucleus for the present foot and mouth disease-free herd in Tsumkwe. It is significant that, up until the time of their quarantine in 1996, buffalo in this herd had been in regular contact with cattle without transmitting the disease.

The outbreak of contagious bovine pleuropneumonia in 1995 in the extreme northwestern corner of Botswana (Xaudum, Ngamiland) resulted in the eradication of 320,000 cattle and a proliferation of veterinary control fences over the next few years (Amanfu *et al.* 1998).

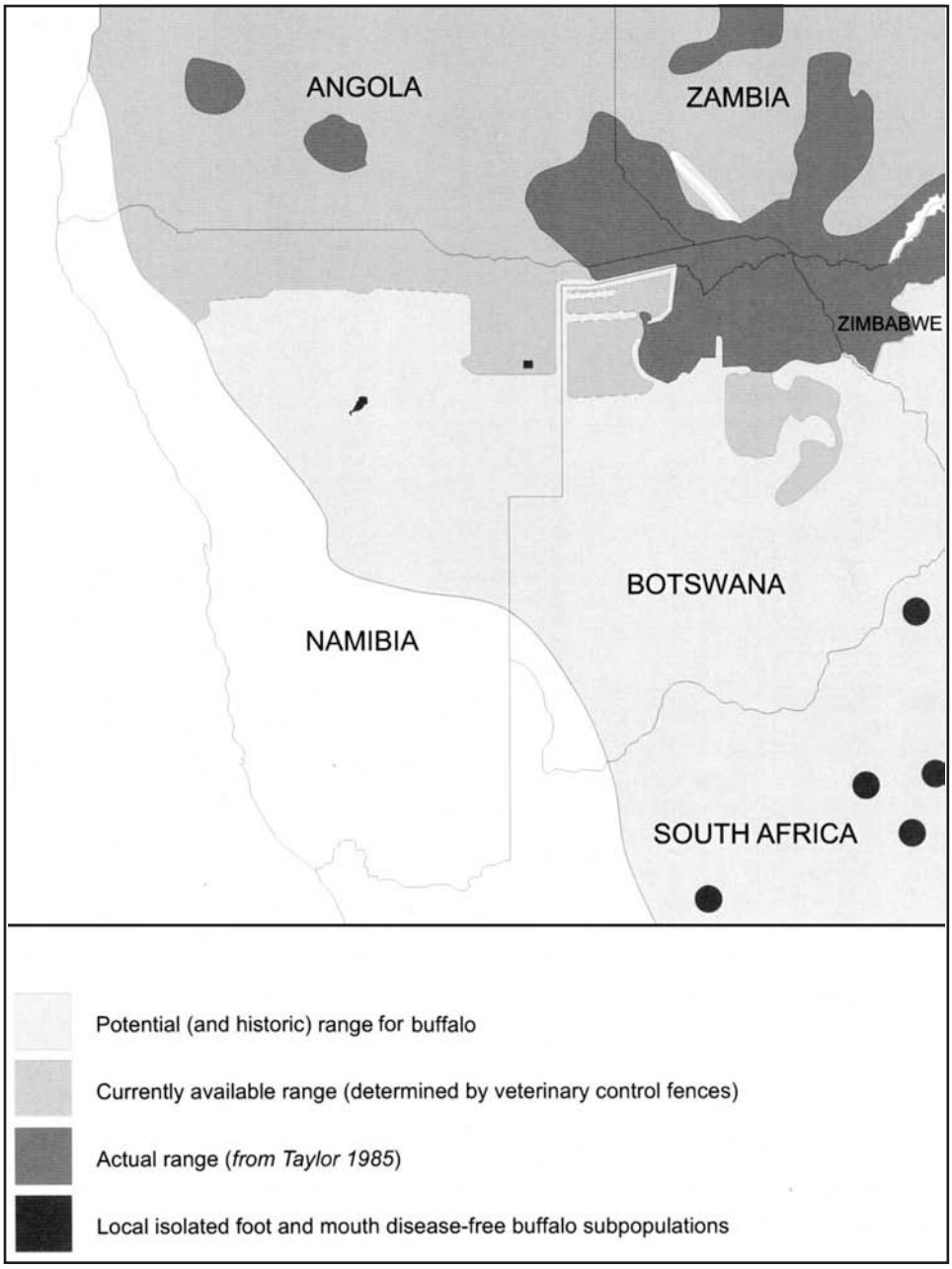
The reduced range now available to buffalo in the trans-boundary project area is shown on Map 11. Of particular significance is the convoluted shape of this range in northern Botswana. In theory, through a disjointed set of breaks in the Botswana veterinary fences, the present buffalo range could extend as far south as the Makgadikgadi Pans; in practice, the obstacles to buffalo movement seem to preclude this. In fact, the last surviving buffalo in the Makgadikgadi Pans area were translocated to the northern part of the buffalo range in 2000. These were potentially disease-free buffalo due to years of isolation (MD Kock, personal communication 29 Oct 2003).

In Namibia, perhaps the most serious effect of veterinary fences is the effective separation of the western core wildlife areas on the Kavango River from the remainder of the Caprivi. The Caprivi Strip is a waterless tract of land, and the likelihood of any of these species traversing it is remote.

Map 10. Veterinary control fences affecting wildlife in the proposed "Four-Corners" Transfrontier Conservation Area



Map 11. Past, available and actual ranges for buffalo



Current status of populations

The most recent surveys of buffalo in the Caprivi indicate the presence of about 500 animals (Craig 1998, DSS 2002). This population is on the fringe of the larger Botswana population of about 100,000 animals (DWNP 2002); therefore, the size of the "permanently resident" population in the Caprivi is speculative. However, the Botswana distributional data does suggest that buffalo movement is restricted during the dry season, when the estimates for the Caprivi population were made.

The status of roan, sable, and tsessebe in the Caprivi is of concern; there appear to be fewer than 50 roan, about 200 sable, and less than 200 tsessebe surviving. In northern Botswana, the estimated numbers of roan, sable, and tsessebe are about 1,500, 3,000, and 10,000, respectively (ULG 1995). Although these numbers may appear high, the densities are low given the large range available (150,000km^2) and not dissimilar to those in the Caprivi. The tsessebe are concentrated in the Okavango Swamp and cannot be regarded as contiguous with the Namibian Caprivi population.

Cause and effect

The numbers of buffalo, roan, sable, and tsessebe in the Caprivi all seem to have declined sharply since 1995 when the animals were relatively abundant. The decline follows the most recent wave of construction of veterinary control fences. The question is "to what extent can the observed decline be attributed to the influence of veterinary control fences"?

Limiting factors

Rainfall

Rainfall is the ultimate factor limiting the distribution and abundance of all these species in southern African savannas. For buffalo, rainfall determines not only the final carrying capacity of the range but also the age of first conception and fecundity of females.

Using the data of Sinclair (1974b), Taylor (1985), and recent survey results from low-rainfall areas, Martin (2002a) showed that the ecological carrying capacity for buffalo is well described by the relationship in Fig. 1.

$$\text{Density} = 8.5 \times 10^{-10}(\text{Rainfall})^{3.3}$$

The Caprivi is the only part of Namibia that enjoys an annual rainfall above 500mm, and the area could be expected to carry buffalo at densities of 1–2/km^2, i.e., in an area of 20,000km^2, there should be at least 20,000 buffalo, taking into account present human settlement.

Dunham *et al*. (2004) showed that the population performance of tsessebe in Kruger National Park was strongly correlated with the long-term cumulative surpluses and deficits above and below the mean annual rainfall. Martin (2003a) observed that the effect appears to extend to roan in areas that are on the margin of acceptable rainfall (i.e., around 400mm) and may also affect sable. However, the effect seems to be less pronounced at higher rainfall such as that of the Caprivi. Based on successful populations of these species in other southern African savannas, densities of the order of 1–2/km^2 seem to be eminently feasible.

Other factors

A range of other potentially limiting factors was examined to assess the primary causes of the species' poor conservation status. In the eastern Caprivi, poor land-use planning is likely to be a major factor limiting the abundance of wild species. The ad hoc westward expansion of people and domestic livestock threatens the integrity of the range for all wild species. Wedges of human settlement are fragmenting the range and, in several places, continuity of species populations can be maintained only through spatial links with northern Botswana (Map 12).

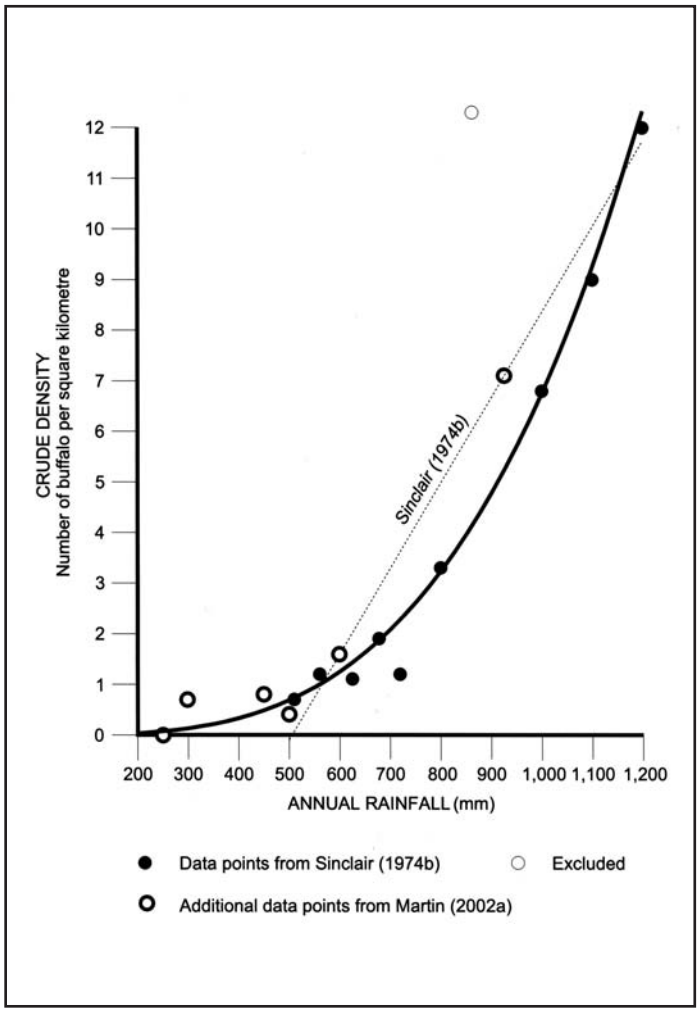
Any ill-considered placement of fences in this area would likely result in the total isolation of a number of small subpopulations and, ultimately, lead to their demise. In the western Caprivi (the Caprivi Strip), the present location of veterinary fences has caused the isolation of Mahango and Khaudum National Parks and has effectively broken all linkages not only between the east and west Caprivi but also between Botswana and Namibia.

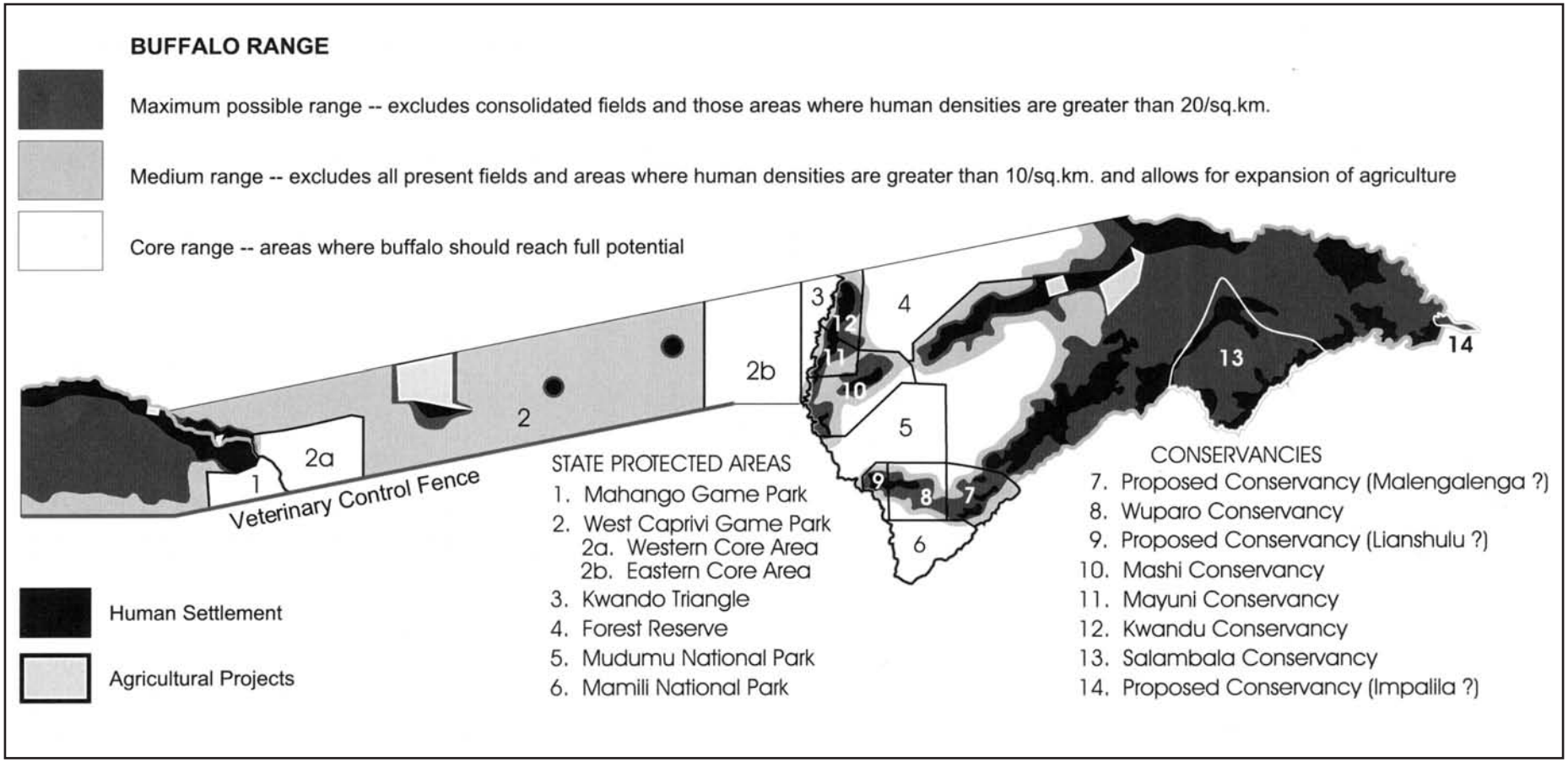
Unplanned settlement and veterinary control fences are not independent issues. Too often, the construction of a veterinary control fence is a reaction to ad hoc settlement and tends to ratify and entrench it. By so doing, options for land-use planning at a large scale are eliminated, and the likelihood of establishing successful TFCAs dims.

The burgeoning elephant population in northern Botswana and the Caprivi (currently estimated in excess of 100,000 animals) may be exerting a negative influence on all four species. Sinclair (1974b) notes that a population of any species is effectively competing with another species if it eats any of the food required by the first species. A large population of one species can have a marked impact on a smaller population of another species. In the Serengeti, large numbers of wildebeest depleted the resources of buffalo. It may well be that the very large elephant population is competing with buffalo, because both are wet-season grazers.

Roan, sable, and tsessebe are specialist feeders with habitat requirements that, despite much research, may not yet be fully understood. In those parts of southern Africa where elephant populations have increased unchecked, the major structural changes in habitats, effects of trampling, and competition for water have not been favourable for roan, sable, and tsessebe. In the Sebungwe region in Zimbabwe, all three species have been in decline for a number of years (roan and tsessebe are almost extinct), coinciding with a period during which the elephant population has continued to increase. If sable and roan prefer parkland savannas with dappled sunlight shining

Fig. 1. Carrying capacities for buffalo based on rainfall





Map 12. Caprivi – land use planning, veterinary fences and potential buffalo range

through tree canopies (thus favouring specific grass communities), then those conditions have disappeared.

Illegal hunting in the Caprivi may be responsible for reduced numbers of these species. Unfortunately, there are little data available other than verbal reports to evaluate this influence. Illegal hunting is carried out by residents of the Caprivi and by people from neighbouring countries. The arguments against this being a primary limiting factor are that there is no evidence of a sudden escalation in hunting after 1995, which would be required to explain the corresponding steep decline of the species in question; there is a reasonable level of law enforcement effort from the state wildlife agency, especially in the protected areas (Map 12); and the recent establishment of a significant number of local community conservancies (Map 12) should enhance wildlife populations.

Mendelsohn and Roberts (1997) present a compelling picture of the gravity of the fire situation in Caprivi. Burns begin as early as April each year and continue until December, when over 60% of the vegetation has been burnt and the total count of individual fires may have exceeded 3,000. Whilst a limited fire regime might have beneficial effects in preventing bush encroachment on grazing habitat, it seems more likely that burn-off of a high percentage of dry-season grazing will have a negative influence. However, the present fire regime in the Caprivi has probably persisted to a similar extent for more than half a century and is unlikely to account for a sudden decline in all four species.

More habitat in the Caprivi and Bushmanland could be made available to buffalo, roan, sable, and tsessebe by the artificial supply of water. All of these species are water dependent and seldom move further than a few kilometres from surface water (Martin 2003a). In the Caprivi, this means they must remain near the large rivers for much of the year. This limits the ability of populations in the eastern and western ends of the Caprivi Strip (the Caprivi Game Reserve) to maintain contact and, in conjunction with the veterinary control fences along the Botswana border and a hostile environment in Angola, could result in the total isolation of various subpopulations. However, the major declines in the populations of all four species have occurred in areas where surface water is adequate.

Disease has to be considered amongst the potentially limiting factors for these species. Morkel (1988) gives an excellent catalogue of the diseases affecting both cattle and buffalo, and it is clear that there are a number of strong arguments for keeping buffalo separated from cattle – as much for their own protection as for the possible threat to cattle. Except for rinderpest, the effects of various diseases to which buffalo are susceptible are relatively minor. Together, predation and disease tend to be secondary factors acting on undernourished animals (Pienaar 1969). Disease may differentially affect juveniles, but the resultant mortality is likely to cause population fluctuations rather than substantive long-term alterations to population growth rates (Sinclair 1974a). Rinderpest is an exception – the whole population is affected.

Roan, sable, and tsessebe are susceptible to various diseases of which anthrax is likely the most serious (Pienaar 1961). However, as is the case with buffalo, predation and disease acting together tend to be secondary factors acting on undernourished animals.

Discussion and conclusions

The case is by no means proved that veterinary control fences are wholly responsible for the decline in buffalo, roan, sable, and tsessebe in the Caprivi. A number of other potentially limiting factors may act in concert to reduce their numbers, although deductive reasoning suggests that none of these factors considered in isolation could be the sole cause of the decline. However, the sudden decrease in numbers of all four species immediately after the construction of double electrified fences along the western and northern sides of the international border between Botswana and Namibia is the strongest evidence that these veterinary control fences are largely responsible for the population declines.

Scott Wilson Resource Consultants (2000) state that the impact of these fences on wildlife mobility has critical long-term implications for these species' survival. They have proposed various measures to the Botswana government to mitigate the effects of the fences, including the realignment or removal of certain fences. As yet, none of the options has been implemented. At a time when expectations for TFCAs are high, this is a retrogressive situation.

Conservation issues may be secondary to the long-term development potential based on wildlife management as the primary form of land use for the Caprivi and northern Botswana. Martin (2002a) estimates that if buffalo densities could be increased to about 1/km^2 in the unsettled areas of the Caprivi (about 17,000km^2), the net annual income from safari hunting would rise to about US $12 million annually. If roan, sable, and tsessebe populations could increase to the same density over half of the available area, an additional US $5 million could be added to the sport-hunting income.

The financial and economic values offered by wildlife far exceed those possible from domestic livestock. Barnes *et al*. (2001) state that in the medium to long term, the comparative advantages of land use based on domestic livestock can be expected to decline as international subsidies are phased out. They also point out that the comparative advantages of wildlife land uses can be expected to increase over time, due to continuing rapid expansion in international tourist markets, increasing scarcity of wildlife elsewhere, and the development of markets to capture international wildlife nonuse values as income. It would be a great pity if, through myopia in land-use planning and consequent option foreclosure caused by veterinary control fences, governments and local communities were denied the development potential and long-term sustainable livelihoods that successful wildlife management could provide.

Acknowledgements

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