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## Disease constraints for utilization of the African buffalo (*Syncerus caffer*) on game ranches in Zambia

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### Abstract

Eco-tourism depending on wildlife is becoming increasingly profitable and landowners are beginning to favor game farming and ecotourism. In these areas, large-scale translocation of wildlife involves a diversity of species and large populations. The African buffalo (*Syncerus caffer*) is one of the major tourist attractions in Zambia. It accounts for 8.7% and 12.4% of the total animal species hunted in the Game Management Areas and the total hunting revenue earned in Zambia, respectively. It is ecologically an important animal species essential for the purpose of habitat control and facilitating the provision of suitable grazing pastures. However, the rearing of the African buffalo on game ranches has been hampered by its carrier state of the Southern Africa Territory (SAT) serotypes of foot and mouth disease virus (FMD). The African buffalo is also known to be a carrier of *Theileria parva lawrencei*, the causative agent of corridor disease (CD) that continues to have devastating effects on the livestock industry in Zambia. In addition, the importation of buffaloes from countries with populations endemic to bovine tuberculosis is highly restricted. Veterinary regulations in Zambia, strongly advocate against the translocation of buffaloes from protected areas to private ranches for dis-

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ease control purposes thereby mounting a considerable constraint on the economic and ecological viability of the industry. It is hoped that this review will motivate the relevant government authorities in exploiting ways in which this animal species play a central role in eco-tourism.

Key Words : Buffalo, Disease Control, Game ranches, Socio-economic impact, Zambia

### Introduction

Game ranching has emerged as a strong economic and conservation industry being a shift from livestock production by most commercial farmers in Zambia, a landlocked country in Central Africa with an area of approximately 725,600km<sup>2</sup>. The country is administratively divided into nine provinces<sup>30)</sup>. Land use is divided into four general types as follows : i.) communal areas with small scale and peasant agriculture ; ii.) commercial farmland ; iii.) urban areas ; and iv.) wildlife and forest areas. Zambia has an estimated population of 10.3 million<sup>4)</sup> with 1,596,271 cattle<sup>12)</sup>.

Commercial game farming is considered to be the best environmentally sustainable and economically viable industry than cattle ranching because of its ability to integrate eco-tourism and wildlife utilization, thereby, having twin objectives of conserving the environment and improving the earnings from foreign exchange. Bojo<sup>3)</sup> demonstrated in a survey carried out in Zimbabwe that wildlife enterprises in the large-scale commercial ranch sector were often more financially profitable than cattle enterprises. Unlike livestock whose income is directly related to meat sales, the income from wildlife is derived from eco-tourism, trophy hunting, venison and the sale of live animals. Therefore, lower or more conservative stocking rates can be maintained with wildlife to the benefit of the environment thereby increasing the income per hectare un-

like the situation with livestock. Besides, game ranches are considered to be important *in-situ* conservancies particularly in securing threatened and endangered species and habitats. As observed by Siamudaala *et. al.*<sup>38)</sup>, game ranches also have the advantage of providing backup specimen for restocking protected areas especially in situations where endangered species risk extinction.

A checklist of wildlife species currently reared on game ranches has been provided by Siamudaala *et al.*<sup>38)</sup>. Although the African buffalo is on the checklist, only one game ranch, thus far, is keeping this animal species unlike the other wildlife species that are widely distributed on most game ranches. The exclusion of wildlife species such as the African buffalo from game ranches and other livestock grazing areas is highly advocated by veterinary authorities as a disease control measure. The translocation of the African buffalo from *ex-situ* to *in-situ* conservancies is prohibited because the buffalo is considered a reservoir of diseases of national economic importance that are transmissible to livestock. Therefore, the economic viability of the game industry in Zambia is constrained by the absence of the African buffalo on game ranches. This paper discusses the economic potential and ecological significance of the African buffalo on game ranches as well as the disease constraints that limit its utilization outside the protected areas.

**Economic potential of the African Buffalo (*Syncerus caffer*)**

In Zambia, the African buffalo population in protected areas is estimated to be above 40,000 and is a major tourist attraction for eco-tourism, trophy hunting and venison production. Trophy hunting and eco-tourism on game ranches is constrained by the general lack of the most sought after and lucrative species such as the lion (*Loxodonta pardus*), leopard (*Loxodonta leo*), black rhino (*Dicornus bicornis*), African elephant (*Loxodonta africana*) and the African buffalo (*Syncerus caffer*). The lion and the leopard are not favoured on game ranches for biological reasons. Lions and leopards would seriously constrain population growth of the prey species. The rate of population decline of prey species

would be in proportion to the number of predators. This would consequently lower the revenue of entrepreneur. The black rhino and African elephant cannot be utilized on a consumptive basis as they are listed on appendix I of the convention on international trade on endangered species of wild fauna and flora (CITES). Hence the extinction of the black rhino (*Dicornus bicornis*) and the ban on trade in the African elephant (*Loxodonta africana*) have enhanced the economic value of the African buffalo as a trophy animal. This, therefore, leaves the African buffalo as the only available most sought after species being the only member of the large game for trophy hunting and venison that can be utilized on game ranches. The buffalo-hunting quotas in Game Management Areas and the resulting revenue are shown in Tables 1 and 2.

Table 1. Number of buffaloes hunted in game management areas in Zambia during 1996-2000

Year	Buffalo quota	Other animal species combined	Total quota	% Buffalo quota
1996	314	3,058	3,372	9.1
1997	299	3,534	3,833	7.8
1998	298	3,076	3,374	8.8
1999	270	3,144	3,414	7.9
2000	138	1,265	1,403	9.8
Total	1,319	11,019	12,338	10.7
Average	263	2,204	2,468	8.7

Note that figures for the national hunting were not available at the time of the analysis.

Table 2. Hunting Revenue (US \$) from safari hunting for the period 1996-2000

Year	Buffalo	Other animal species combined	Total	% buffalo revenue.
1996	125,250	953,205	1,078,455	11.6
1997	134,100	904,585	1,038,685	12.9
1998	135,500	968,100	1,103,600	12.3
1999	137,500	1,017,175	1,154,675	11.9
2000	143,000	919,675	1,062,675	13.5
Total	675,350	4,792,740	5,438,090	12.4
Average	135,070	958,548	1,087,618	12.4

The African buffalo has been reported to adapt easily in *ex-situ* conservancies. In the protected areas in Zambia buffaloes increase in number rapidly as long as the habitat conditions are favourable, thereby, becoming destructive to the environment if they become overpopulated in the area. This, therefore, implies that there will be need for culling, safari hunting or sale of live animals as the population increases in *ex-situ* conservancies. The population growth is expected to motivate private sector participation in the conservation of wildlife.

### **The ecological significance of the African buffalo (*Syncerus caffer*)**

The buffalo is ecologically important for the purpose of habitat control both for *in-situ* and *ex-situ* conservation. Considering that buffaloes are bulk grazers that are non-selective in their feeding habits and favor the utilization of tall coarse grasses, which are not palatable to other antelopes, they make the conditions suitable for selective feeders by exposing the shorter and more palatable grasses. The ability for buffaloes to feed on dry grass helps control the grass overgrowth such that in their absence or where they occur in smaller numbers habitat managers in Zambia, like in other tropical countries<sup>27)</sup>, tend to burn to reduce the long grass coverage for selective feeders.

Various tick species infest and complete their life cycles on buffaloes, which have proved to be resistant to most tick-borne diseases. The heavy loads of ticks carried by infested animals render the African buffalo to be a dependable source of ticks for ox-peckers that voraciously feed on them. The symbiotic relationship between ox-peckers and the African buffalo as well as other animal species act as a biological tick control method. Generally, it has been observed in the protected areas in

Zambia that there is an ecological balance between tick populations and ox-peckers facilitated by the presence of large animal species such as the African buffalo. In the absence of animal species that are susceptible to tick infestation, habitat managers on game ranches have often resorted to burning of the grass in order to reduce the tick burden or promote the use of cattle to be infested by ticks followed by de-ticking them with acaricides. The latter approach has led to the gradual extinction of the ox-peckers from cattle grazing areas especially in areas where farmers have resorted to extensive usage of acaricides as a control measure for CD. Current observations indicate that the ox-pecker is mostly found in protected areas in Zambia. A ban on the use of acaricides coupled with the introduction of the African buffalo together with other animal species susceptible to tick infestation on game ranches is expected to promote the resurgence of ox-peckers from extinction.

### **Disease constraints**

The exclusion of the African buffalo from livestock grazing areas is highly advocated by veterinary authorities because it is regarded as a reservoir of diseases such as FMD<sup>6, 7, 31, 37)</sup>, CD<sup>8)</sup>, bovine tuberculosis<sup>14, 24, 42)</sup>, brucellosis<sup>16, 20, 25, 36)</sup> which have had a devastating effect on cattle farming in Zambia. Outlined below are some of the disease constraints prohibiting the translocation of buffaloes from protected areas to game ranches.

#### *a) Foot and Mouth disease*

FMD virus isolates obtained in Zambia in the 1940s were among the FMD viruses that were used for characterization leading to the discovery that Sub-Saharan Africa had unique serotypes namely, the SAT 1, 2 and 3 that were distinct from those isolated from other parts of the world (FMD virus types A,

Table 3 . FMD serotypes detected from wildlife between 1955 and 1999 in national parks in Zambia

Year	Animal Species	Location	Virus Isolation	Serology
1955	Lechwe ( <i>Kobus leche kafuensis</i> )	Lochnivar	—	—
1955	Buffalo ( <i>Syncerus caffer</i> )	Luangwa	—	—
1967	Buffalo ( <i>Syncerus caffer</i> )	Luangwa	—	SAT 1, 2, 3
1967	Elephant ( <i>Loxodonta Africana</i> )	Luangwa	—	—
1967	Hippo ( <i>Hippopotamus amphibius</i> )	Luangwa	—	—
1973	Buffalo ( <i>Syncerus caffer</i> )	Blue Lagoon	SAT 1	SAT 1
1976	Buffalo ( <i>Syncerus caffer</i> )	Blue Lagoon	SAT 1, 2, 3.	SAT 1, 2, 3
1976	Buffalo ( <i>Syncerus caffer</i> )	Lochnivar	SAT 1, 2, 3.	SAT 1, 2, 3
1993	Buffalo ( <i>Syncerus caffer</i> )	Kafue	SAT 1, 2, 3.	SAT 1, 2, 3
1996	Buffalo ( <i>Syncerus caffer</i> )	Kafue	SAT 1, 2, 3.	SAT 1, 2, 3
1996	Buffalo ( <i>Syncerus caffer</i> )	Lochinvar	SAT 1, 2, 3.	SAT 1, 2, 3
1999	Buffalo ( <i>Syncerus caffer</i> )	Kafue	—	SAT 1, 2, 3

O, C and Asia 1)<sup>46)</sup>. Scientific evidence has shown that the African buffalo is a carrier of the SAT serotypes of FMD virus persisting for up to five years or more in individual animals<sup>40,41)</sup> and is responsible for transmitting the disease to livestock<sup>10,11,19)</sup>. The virus localizes in the tonsil-pharyngeal area as well as the anterior oesophagus of carrier buffaloes<sup>37,39,40)</sup>. This has significant implications when considering the rearing of buffaloes on game ranches<sup>21)</sup>.

FMD surveys carried out in wildlife between 1955 and 1999 as shown in Table 3 clearly indicate that FMD viruses have only been found in buffalo populations and not in other wildlife species. It is interesting to note that FMD SAT 1 and 2 viruses have been isolated from outbreaks in livestock in areas close to the Kafue, Blue Lagoon and Lochnivar national parks while SAT 3 is confined to buffalo populations in these national parks without any extension or spillover to livestock. It is feared that once buffaloes are translocated to game ranches that are proximal to livestock farming areas, FMD viruses will be transmitted to domestic animals. Based on these fears, veterinary authorities in Zambia

demand that only “FMD-free buffaloes” should be translocated to game ranches.

#### b) Theileriosis

In Zambia 5 theileria species have been reported<sup>23,26,28)</sup> and are outlined in Table 4 together with the vector ticks responsible for their transmission. *Theileria parva parva* is the cause of East Coast fever (ECF), which has been confined to the Northern and Eastern Provinces<sup>2,32,33)</sup> while *Theileria parva lawrencei*, the cause of CD is more widely distributed than the former infecting cattle in the Southern, Central, Copperbelt and parts of the North-western Provinces<sup>26,32,33)</sup>. *Theileria mutans*, *T. verifera* and *T. taurotragi* have been reported only from a few selected areas.

Although *Theileria parva lawrencei*, *T. taurotragi*, *T. velifera* and *T. mutans* have been isolated from buffaloes and are transmissible to cattle, *T. parva lawrencei* is the only species that is highly pathogenic to cattle. Studies carried out elsewhere have shown that the African buffalo has been found to be a long-term carrier of CD<sup>17)</sup>. Young *et al.*<sup>44)</sup> observed that almost every buffalo sampled during the surveys carried out in Kenya, Uganda

Table 4 . Theileria diseases, parasites and the transmitting vector identified in Zambia

Disease	Parasite	Vector
Corridor disease.	<i>Theileria parva lawrencei</i>	<i>Rhipicephalus appendiculatus</i> <i>Rhipicephalus zambeziensis</i>
East Coast fever	<i>Theileria parva parva</i>	<i>Rhipicephalus appendiculatus</i> <i>Rhipicephalus zambeziensis</i>
Benign theileriosis	<i>Theileria mutans</i>	<i>Rhipicephalus species</i> <i>Amblyoma species</i>
Benign theileriosis	<i>Theileria velifera</i>	<i>Rhipicephalus species</i> <i>Amblyoma species</i>
Benign theileriosis	<i>Theileria taurotragi</i>	<i>Rhipicephalus species</i> <i>Amblyoma species</i>

and Tanzania was a carrier of *T. parva lawrencei*. Therefore, the buffalo plays a significant role in the epidemiology of CD by living in harmony with *T. parva lawrencei* parasites and the vectors *Rhipicephalus appendiculatus* and *R. zambeziensis* that are also responsible for transmitting the disease to cattle. Apart from being a carrier, the African buffalo plays an important role in the evolution of *T. parva lawrencei* parasites, thereby, leading to antigenic diversity that has been associated with lack of cross protection between heterologous isolates being experienced during immunization programs<sup>9, 44, 45</sup>. Considering that vector ticks are more widely distributed than the theileria parasites in Zambia<sup>29</sup>, translocating the African buffalo from protected areas such as national parks and game management areas to game ranches poses a serious threat to the livestock industry by bringing the wildlife carriers in close proximity to the susceptible domestic animals. Therefore, it is vital that all buffaloes that have to be translocated to non-corridor disease affected areas are shown to be free of the disease.

### c) Bovine tuberculosis

There is a growing awareness, worldwide,

of the importance of bovine tuberculosis in wildlife, not only as a potential reservoir of infection for domestic animals, but also as a threat to valuable wildlife species<sup>13</sup>. As observed by other researchers, *Mycobacteria bovis* has emerged as an important disease of free-living wildlife in recent years<sup>1, 13, 14, 24, 42</sup>. Observations reported from the Kruger<sup>14, 24</sup> and Ruwenzori<sup>42</sup> national parks indicate that buffaloes are feared to be maintenance hosts of bovine tuberculosis, once the disease is established within infected populations and could serve as a source of transmission to other animal hosts. In Zambia, bovine tuberculosis has only been diagnosed from the Kafue lechwe (*Kobus leche kafuensis*) in Lochinvar and Blue Lagoon national parks<sup>15</sup>. Although these national parks are natural habitats for several other wildlife species, there has been no record of the disease being diagnosed in other animal species apart from the lechwe. However, the absence of the disease in wildlife species other than the lechwe can be attributed to the absence of active and passive surveillance programs in the protected areas. It is imperative that disease surveillance be strengthened in order to provide comprehensive epidemiological data on the disease status of each wildlife species existing

in Zambia.

The expansion of the game ranching industry in the sub-region has led to an increase on the trade of live animals. Considering that some countries in the sub-region have recorded cases of bovine tuberculosis in buffaloes in their protected areas, it is imperative that all animals to be imported should be tested for the disease. Only buffaloes from herds certified free of bovine tuberculosis should be translocated to game ranches. This requirement is being advocated by veterinary authorities and game ranchers in Zambia as a way of preventing transmission of the disease to the valuable wildlife species already existing on the game ranches. Furthermore, this requirement is being extended to buffaloes from all protected areas within Zambia considering that the disease status of most of the animals in the national parks and game management areas is unknown.

#### d) *Brucellosis*

Brucellosis has emerged as a potential threat to the wildlife industry with the African buffalo being amongst the carrier wildlife species, thereby, serving as a possible source of transmission to other game animals and livestock. In Southern Africa, the disease has been reported in buffalo populations in South Africa<sup>16,20)</sup>, Zimbabwe<sup>25)</sup> and Zambia<sup>36)</sup>, leading to stringent veterinary regulations regarding translocation and importation of infected animals. This has led to the Zambian veterinary authorities demanding that all buffaloes intended for translocation from protected areas to game farms and other *in-situ* conservation areas be free of the disease.

### **Discussion**

There is a growing body of evidence that the African buffalo has a lot of potential eco-

nomic benefits that would strengthen the expansion of commercial game farming in Zambia. Considering that most game ranches are operating without any member of the large game, which are the most sought after and lucrative species, the introduction of the African buffalo on game ranches can significantly improve the earnings from eco-tourism and trophy hunting. Thus far, commercial game farms do not attract an equal proportion of tourists as the state protected areas such as national parks and game management areas because they do not have the large animals. Trophy hunting which is the most lucrative of all forms of wildlife utilization, is not developed on the game ranches as on the government wildlife estates because of the general lack of the most sort-after species. Therefore, the absence of the African buffalo on private owned wildlife estates is a serious constraint to the development of commercial game farming in Zambia. Tourism revenue can be predicted to offset most of the costs of conserving large game animals on game ranches. There should be deliberate conservation efforts to facilitate the derivation of eco-tourism-related benefits from the large game animals on game ranches to create incentives for their conservation. The economic impact of wildlife has a strong influence upon people's attitudes towards conservation<sup>22)</sup>. Eco-tourism needs to be part of a multi-faceted approach to large game animal conservation that also includes education and awareness campaigns and efforts to encourage game ranch owners to include large game animals on the ranches.

The carrier status of the African buffalo for zoonoses and diseases of national economic importance entails that only buffaloes free of FMD, CD, bovine tuberculosis and brucellosis should be translocated to game ranches. In addition, the diseased buffalo is considered a constraint in accessing interna-

tionally lucrative markets based in the developed countries. Most of the developed countries are free of FMD and CD, which they have eradicated from their territories. As a result, these countries impose strict veterinary sanitary measures on wildlife-based products from FMD potential territories to protect against re-importation of the diseases. Although bovine tuberculosis has not been reported from buffalo populations in Zambia, importation of buffaloes from other countries with populations endemic to this disease is feared to be a source of transmission to the valuable wildlife species already existing on the game farms. Therefore, 'non-disease free buffaloes' are not only a constraint to the export of wildlife, but a limiting factor to importation of game animals from bovine tuberculosis endemic areas, thereby, becoming a wildlife trade barrier. Work is underway to determine the current prevalence of other infectious diseases in the African buffalo in Zambia.

Policies that include ensuring that only buffaloes free of FMD, CD, bovine tuberculosis and brucellosis be translocated to game ranches should be implemented. There should be a parallel aggressive disease control program for the livestock on these farms as well. This would ensure that once on game ranches diseases are not introduced in these populations from livestock. It is hoped, therefore, that the Zambia Wildlife Authority and the Department of Veterinary and Livestock Development working with the School of Veterinary Medicine at the University of Zambia will be motivated to formulate disease control policies to ensure African buffaloes play a major role in support of eco-tourism based on wildlife.

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