

Review

## The Contribution of Wildlife to Sustainable Natural Resource Utilization in Namibia: A Review

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**Abstract:** Namibia is the driest country in sub-Saharan Africa, but well known for its richness in species and sustainable natural resource utilization. The Namibian farming sector consists mainly of extensive farming systems. Cattle production contributes 54% of the livestock sector's production output, followed by sheep and goats (25%), hides and skins (9%), and other forms of agricultural production (12%). Namibia's freehold farmers have obtained ownership rights over land and livestock since the early 1900s; commercial rights over wildlife and plants were given to freehold farmers in 1967 and to communal farmers in 1996. Natural resource-based production systems then overtook agricultural production systems and exceeded it by a factor of at least two. The shift from practicing conservation to sustainable utilization of natural resources contributed to the rapid growth of wildlife utilization. The wildlife industry in Namibia is currently the only animal production system that is expanding. There are in total at least two million head of different wildlife species. The broader impact of the utilization of wildlife on the economy is estimated to be around N\$ 1.3 billion. Tourism, live sales and trophy hunting, cannot sustain further growth. Wildlife farming could offer better opportunities for ensuring long-term sustainability. As the game meat trade in Namibia is not formalized, harvesting wildlife to satisfy the demand for game meat in export markets is still in its infancy.

Sustainable harvesting of wildlife for meat production, however, has the potential to increase earnings to the beneficiaries in the wildlife sector.

**Keywords:** Namibia; wildlife; sustainable natural-resource based production; biodiversity; farming; harvesting; game meat; economic benefits; sustainability; meat

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## 1. Introduction

Namibia is well known for its natural resource-based production systems and sustainable use of natural resources. People living in the remote areas of Namibia depend directly on biodiversity for their survival through farming, tourism, hunting, fishing, forestry, manufacturing, trade and education. Biodiversity includes all forms of life, from the smallest microbe, to the largest mammals, trees, and other living organisms. It continuously changes so as to ensure that ecosystems stay in harmony. Species diversity in Namibia is clearly observed along the latitudinal rainfall gradient from the south west to north east of the country [1].

Despite being the driest country in sub-Saharan Africa, the diversity of natural resources in Namibia has enabled many species to adapt to the harsh environment [2]. Namibia is one of the few countries with internationally recognized biodiversity clusters, which include areas that are extremely rich in species and endemism [1].

In Namibia, the preservation of biological diversity and its sustainable utilization are linked through the Namibian National Constitution Act no. 34 of 1998 Article 95 which requires the “*maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis*” [3]. Namibia’s National Biodiversity Program was established in September 1994 to support and stimulate national activities relating to natural resource conservation and sustainable use of biological resources [2]. As future developments are inevitable to ensure economic growth, the nature and quality of developments should take into account the value of biodiversity for the country and its inhabitants [1].

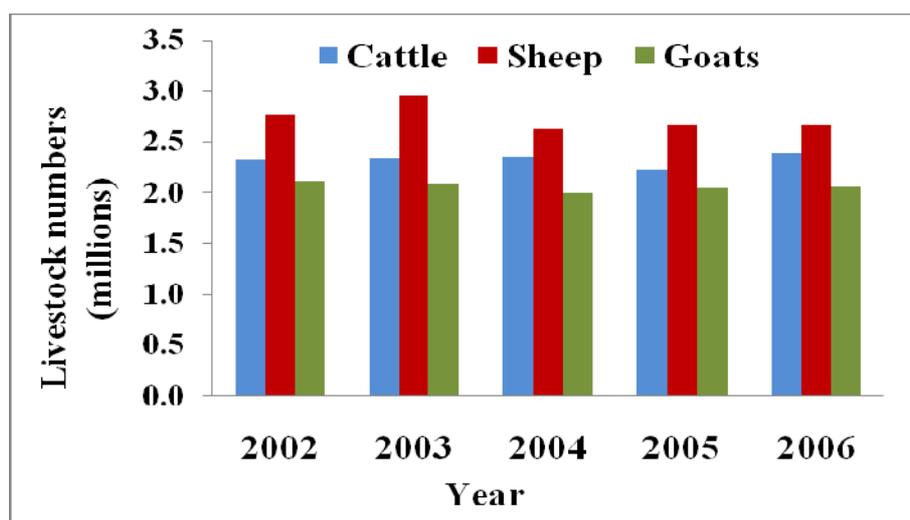
## 2. Livestock Production

The Namibian farming sector comprises mainly of extensive farming systems, with species such as cattle (*Bos taurus*), sheep (*Ovis aries*) and boer goats (*Capra hircus*) [4,5]. The indigenous sanga (*Bos taurus africanus*) evolved from different breeds and can be distinguished by region, as some are better adapted to water scarcity and extreme temperatures [1]. The sector is well developed and has grown in value since 1990 with an average annual nominal growth rate of 10%. On average, cattle production constitutes 54% of the livestock sector’s production output, followed by sheep and goats (25%), hides and skins (9%) and other forms of agricultural production (12%) [6]. The Namibian cattle herd is approximately 2.4 million cattle (Table 1) of which 1.5 million cattle are in communal areas and 0.85 million in commercial areas [7].

Namibia has a total of 2.7 million sheep (Figure 1) of which the Dorper sheep (*Ovis aries*) is the most prominent breed with a population of 1.7 million. Wool and pelts from Karakul (*Ovis aries aries*

*karakul*) sheep, dairy and pigs contributes only 4% to the output from agricultural production systems. The total number of goats in Namibia is approximately 2 million (Figure 1), 1.48 million in communal areas and 0.52 million in commercial areas. No formal slaughter market exists for goats, although it is a very popular meat source in rural areas. Most of the goats are sold live to South African agents in Kwazulu-Natal where a lucrative market exists during festive seasons [7].

**Figure 1.** Livestock numbers in Namibia (2002–2006) (data from [7]).



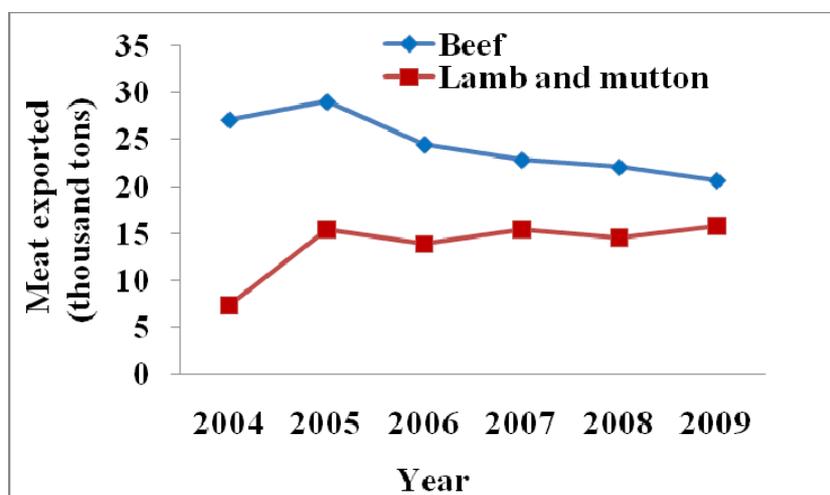
**Table 1.** Cattle numbers in Namibia (2002–2006) (data from [7]).

Cattle numbers	2002	2003	2004	2005	2006
Commercial	862,480	947,377	892,347	792,897	748,405
Communal south of the Veterinary Cordon Fence	336,231	343,045	278,845	363,576	350,027
Communal north of the Veterinary Cordon Fence	1,130,842	1,045,672	1,178,508	1,062,857	1,285,528
<b>Total cattle</b>	<b>2,329,553</b>	<b>2,336,094</b>	<b>2,349,700</b>	<b>2,219,330</b>	<b>2,383,960</b>

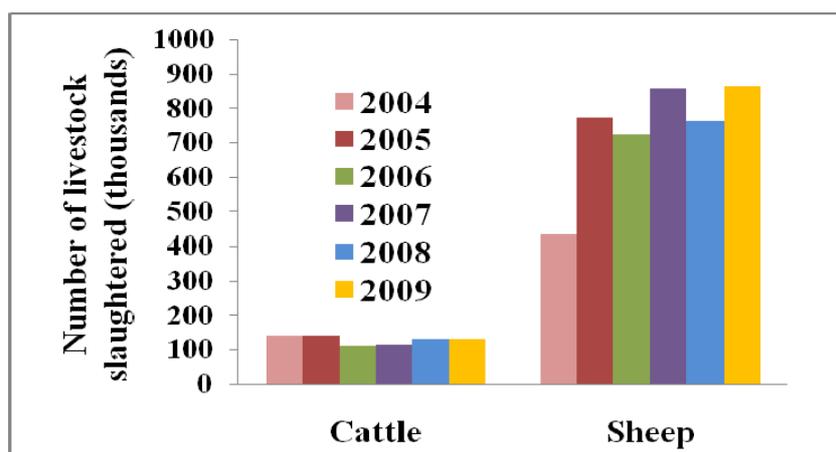
When both live cattle and meat exports are taken into account, figures from a five year average indicate that a total of approximately 72,000 tons of beef are produced in Namibia annually. The value of sales from the cattle sector increased from N\$ 733 million in 2004 to N\$ 1,277 million in 2009. Live cattle exports contributed 28,031 tons to exports in 2009, while beef cuts and processed beef products (Figure 2) contributed 20,655 tons [5]. The number of cattle slaughtered at export abattoirs during the previous six years is presented in Figure 3.

Deboned lamb cuts from Namibia have been successfully exported to overseas markets since 2001. However, the majority of lamb is exported as carcasses to the South African market. Total exports of lamb and mutton comprised 15,748 tons in 2009 (Figure 2). Local consumption of lamb and mutton was around 615 tons. The sheep sector earned a revenue of approximately N\$ 478 million in 2009, which is 28.4% of the total value of N\$ 1,682 million earned by the cattle and sheep sector in 2009 [5].

**Figure 2.** Beef, lamb and mutton exported to the European Union, South Africa and other countries (2004–2009) (data from [5]).



**Figure 3.** Cattle and sheep slaughtered at Namibian export abattoirs (2004–2009) (data from [5]).



### 3. Non-Agricultural Resource-Based Production

Natural resource-based production systems in Namibia has overtaken agricultural production systems and exceeds it by a factor of at least two [8]. In 2005, the total gross annual output of Namibian livestock, as well as crops from the commercial as well as communal sectors, amounted to approximately N\$ 1,878 million, whilst gross annual output of the non-agricultural natural resource-based sector in commercial areas (Table 2), such as tourism, trophy hunting, wildlife products and indigenous plant products (commercial sector) amounted to approximately N\$ 3,200 million.

In 2004 the total direct added value contribution of the wildlife use sector (wildlife viewing, trophy hunting, live game and meat sales) represented approximately 2.1% of the gross national product (GDP), compared with 4.6% for agriculture, 5% for fishing, 6.8% for mining and 3.4% for the tourism industry [9]. The broader impact of wildlife use on the economy is in fact greater than its direct contribution, when including the revenue earned from the game harvesting teams, game processing

facilities, trade at game meat outlets and added value to the transport sector. The total value is estimated to be around N\$ 1.3 billion when these indirect contributions are included using a multiplier effect of 1.86 [10].

**Table 2.** Natural resource-based production (N\$) in Namibian commercial areas (2005) (adapted from [8]).

Commodity	N\$ million
Trophy hunting	316
Live game sales	14.3
Wildlife viewing	2,700
Wood fuel	63
Charcoal	75–100
Plant products	21.6
Total	3,600

#### 4. Wildlife Utilization

The Namibian Government's Vision 2030 aims to ensure the conservation of natural resources and the sustainable utilization of the country's wildlife for economic benefits [11]. Approaches to wildlife conservation have changed considerably over recent years; where moving away from practicing conservation towards wise and sustainable use of natural resources has had a major impact [12]. Revenue obtained through natural resource-based production is, however, often taken for granted. Therefore the concept of sustainable harvesting is essential in order to provide for future generations [1].

Namibia has an abundance of wildlife. There are in total at least two million head of different wildlife species (Table 3), a figure roughly similar to the number of domesticated livestock [13]. Wildlife—defined here as all wild animals other than fish and forest dwelling invertebrates—as a resource, is complex, as it comprises all wild animal life, both vertebrates (mammals, birds, reptiles, amphibians) and invertebrates [10]. In the previous two centuries, wildlife numbers in southern Africa were reduced by outbreaks of diseases and over-exploitation by hunters [14]. Although Namibia's freehold farmers have obtained ownership rights over land and livestock since the early 1900s, commercial rights over wildlife were only given to freehold farmers in 1967 through the South West Africa Wildlife Ordinance [15]. The wildlife industry has been regulated by the Nature Conservation Ordinance No. 4 of 1975 as amended since 1975 [16]. However, minimal community based natural resource management (CBNRM) was put into practice until the implementation of the policies of the Nature Conservation Amendment Act of 1996, resulting in wildlife being utilized and valued by the private sector. This contributed to the rapid growth of wildlife numbers [17].

As depicted in Table 3, approximately 90% of the numbers of wildlife are located outside formally proclaimed conservation areas [18]. While more than 80% of the numbers of the larger wildlife species are found on privately owned farms which comprise about 44% of the total land area of the country [19,20]. This reflects the fact that property rights for use and management of wildlife were given to private landowners 43 years ago [10] and to communal areas 14 years ago [17].

**Table 3.** Wildlife numbers in Namibia in 2004 (adapted from [10]).

Species	Scientific name	Protected areas NVCF*	Protected areas SVCF*	Communal land NVCF*	Communal land SVCF*	Private land	Total
Springbok	<i>Antidorcas marsupialis</i>	33,811 <sup>#</sup>	1,771	37,150	37,270	621,561	731,563
Kudu	<i>Tragelaphus strepsiceros</i>	2,063 <sup>#</sup>	1,484	1,545	1,000	345,801	351,893
Gemsbok	<i>Oryx gazella</i>	11,450 <sup>#</sup>	3,115	18,670	5,084	350,092	388,411
Red hartebeest	<i>Alcelaphus buselaphus</i>	1,468 <sup>#</sup>	115	700	0	122,805	125,088
Eland	<i>Tragelaphus oryx</i>	1,704 <sup>#</sup>	524	245	0	34,743	37,216
Plains zebra	<i>Equus burchelli</i>	18,098 <sup>#</sup>	0	20	0	7,303	25,421
Mountain zebra	<i>Equus zebra hartmannae</i>	8,564 <sup>#</sup>	4,347	2,130	2,175	55,520	72,736
Ostrich	<i>Struthio camelus</i>	3,947 <sup>#</sup>	530	2,840	2,020	36,336	45,673
Blue Wildebeest	<i>Connochaetes taurinus</i>	4,975 <sup>#</sup>	224	470	0	16,623	22,292
Black faced impala	<i>Aepyceros melampus petersi</i>	1,500 <sup>#</sup>	0	0	0	1,870	3,370
Common impala	<i>Aepyceros melampus melampus</i>	77 <sup>#</sup>	0	385	0	14,980	15,442
Roan	<i>Hippotragus equinus</i>	440 <sup>#</sup>	120	95	0	435	1,090
Sable	<i>Hippotragus niger</i>	256 <sup>#</sup>	60	15	0	902	1,233
Lechwe	<i>Kobus leche</i>	0	0	250	0	284	534
Tsessebe	<i>Damaliscus lunatus</i>	0	15	0	0	162	177
Waterbuck	<i>Kobus ellipsiprymnus</i>	0	0	0	0	4,475	4,475
Buffalo	<i>Syncerus caffer</i>	1,025 <sup>#</sup>	250	90	0	0	1,365
Giraffe	<i>Giraffa camelopardalis</i>	3,683 <sup>#</sup>	229	666	68	5,769	10,415
Warthog	<i>Phacochoerus aethiopicus</i>	148 <sup>#</sup>	61	40	0	173,866	174,115
Cheetah	<i>Acinonyx jubatus</i>	706 <sup>#</sup>	149	405	270	2,970	4,500
Leopard	<i>Panthera pardus</i>	1,970 <sup>#</sup>	430	960	640	4,000	8,000
Lion	<i>Panthera leo</i>	574 <sup>#</sup>	23	109	22	0	728
Elephant	<i>Loxodonta africana</i>	9,043 <sup>#</sup>	24	735	155	0	9,957
Hippopotamus	<i>Hippopotamus amphibious</i>	1,262 <sup>#</sup>	0	300	0	0	1,562
Black rhino	<i>Diceros bicornis</i>	816 <sup>#</sup>	43	45	75	134	1,113
White rhino	<i>Ceratotherium simum</i>	54 <sup>#</sup>	62	0	0	75	191
<b>TOTAL</b>		<b>107,634</b>	<b>13,576</b>	<b>67,865</b>	<b>48,779</b>	<b>1,800,706</b>	<b>2,038,560</b>

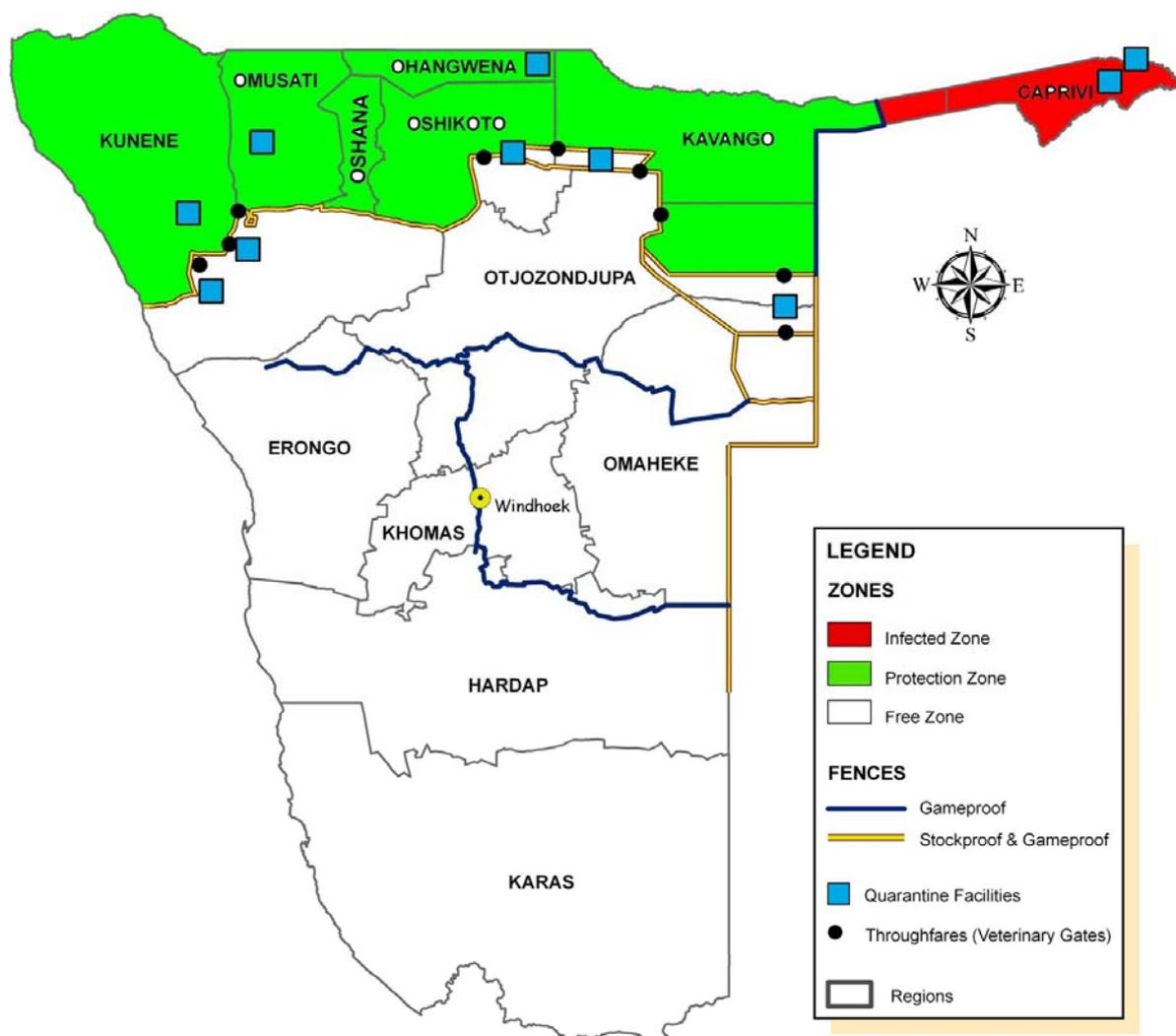
\* NVCF North of the Veterinary Cordon Fence; \* SVCF South of the Veterinary Cordon Fence;

# Game counts are not representative of the current numbers of wildlife in protected areas.

The black rhino (*Diceros bicornis*) is a species that is regarded by the IUCN (International Union for Conservation of Nature) as being critically endangered, not only in Namibia, but also in South Africa, Botswana, and Zimbabwe. The mountain zebra (*Equus zebra*) is also an endangered species in Angola, Namibia and South Africa [21]. It is worth noting the numbers of these endangered species under private land ownership (Table 3). It is a clear indication of the value placed by landowners on these species for consumptive and non-consumptive use.

A veterinary cordon fence (VCF) in northern Namibia (Figure 4) separates areas free of foot and mouth disease from areas where outbreaks of this illness may occur from time to time. No hunting of game for commercial use is allowed in the areas north of the veterinary cordon fence [22].

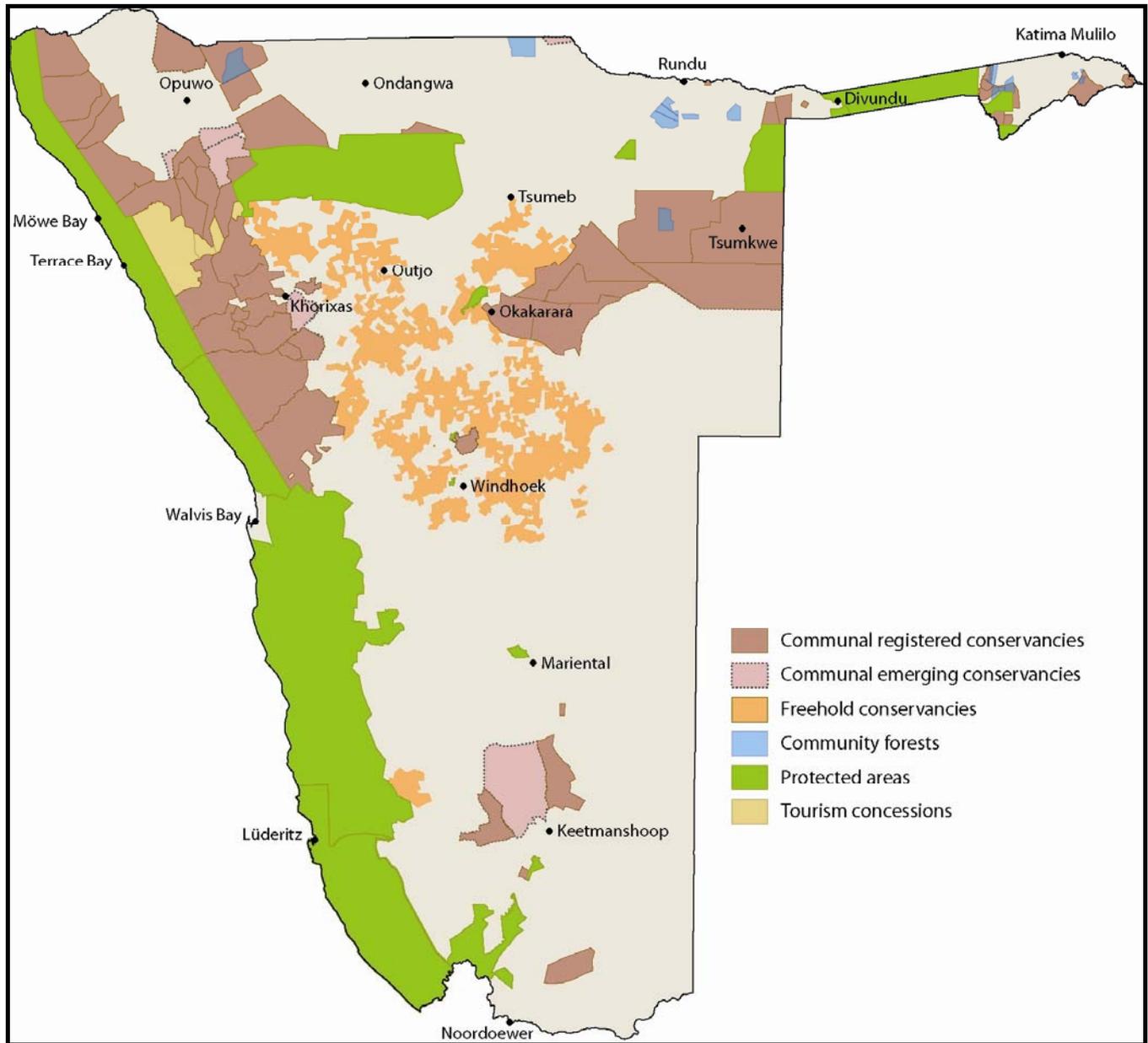
**Figure 4.** Foot and mouth disease free zones in Namibia (with new protection zone marked in green) (adapted from [23]).



Currently at least 41% of the land is under wildlife management as depicted in Figure 5. Approximately 60 communal conservancies were registered by 2010, representing 15.3% of the area

under wildlife management; 16.5% is managed by the government as game parks and state protected areas, 6.1% comprise freehold conservancies, 2.1% private protected land and 1.3% community forests and concessions [19].

**Figure 5.** Areas in Namibia under wildlife management in 2009 (adapted from [19]).



Wildlife in Namibia is traditionally marketed by means of non-consumptive tourism, trophy hunting, sale of live game and sale of game meat [24]. The Namibian tourism industry is the strongest driving force behind the growth of the wildlife industry. Tourists to the country increased almost fivefold between 1990 and 2005 [17] and this sector is envisaged to grow by 6.9% per annum between 2008 and 2017 [25]. The country's Tourism Satellite Accounts indicated that in 2006 tourism established directly, as well as indirectly, through support industries to the tourism sector, approximately 75,000 jobs (18.7% of employment) and N\$ 6.6 billion to the GDP [26].

Until recently, live sales were a feasible option for managing wildlife populations, however auction prices reached a peak and are approximately half that obtained for commercial meat sales [8]. The marketing channels for selling live game are: direct sales from wildlife dealers to game ranchers (30% of all animals sold); sales at wildlife auctions (16% of all animals sold); live exports, mainly to South Africa (46% of all sales); and farmer to farmer sales within the country (8% of all animals sold) [17]. A total number of 6,271 and 5,778 game animals were sold live (Table 4) during 2008 and 2009, respectively [27].

**Table 4.** Wildlife numbers exported live to neighboring countries in 2008 and 2009 (data from [27]).

Species	2008 Quantity	Country	2009 Quantity	Country
Black wildebeest	15	Angola	25	Angola
Blesbok	10	Angola, South Africa	48	Angola, South Africa
Blue wildebeest	70	South Africa	188	Angola, South Africa
Burchell's zebra	37	Angola, Botswana, South Africa	36	Angola, South Africa
Common impala	0		60	Angola
Eland	340	Angola, Botswana, South Africa	340	Angola, Botswana, South Africa
Giraffe	99	Angola, Botswana, Congo, South Africa	87	Botswana, Congo, South Africa
Red hartebeest	900	Angola, Botswana, South Africa	728	Angola, Botswana, South Africa
Kudu	118	Botswana, South Africa	242	Angola, South Africa
Lechwe			8	Angola
Oryx	3,540	Angola, Botswana, Congo, South Africa	2,603	Angola, Botswana, Congo, South Africa
Nyala	0		8	Angola
Ostrich	60	Angola, Congo	20	South Africa
Roan	6	South Africa	0	
Sable	2	South Africa	6	South Africa
Springbok	1,074	Angola, Botswana, South Africa	1,352	Angola, Botswana, South Africa
Waterbuck	0		27	Angola, South Africa
<b>TOTAL</b>	<b>6,271</b>		<b>5,778</b>	

Trophy hunting is an element of the Namibian tourism industry, contributing approximately 14% to the total tourism industry with revenue of at least N\$ 134 million per annum [28]. It offers recreational hunts on private land to upper-income hunters from abroad through hunting packages comprising mainly of plains wildlife species. Trophy hunting, however, gives the lowest return per unit area when considering the low percentage of trophy animals on a game ranch [29]. Namibian landowners with sufficient fenced-in wildlife stocks can register with the Government as hunting farms and offer hunting operations in accordance with the Nature Conservation Ordinance no. 4 of 1975 as amended [30]. On public land, Government and community conservancies can offer hunts. Trophy hunting is only

allowed if accompanied by a registered hunting guide [28]. The majority of species hunted by trophy hunters during 2008 and 2009 is depicted in Table 5.

**Table 5.** Major wildlife species trophy hunted in Namibia (2008 & 2009) (data from [27]).

Species	Quantity 2008	Quantity 2009
Oryx	5,845	3,417
Kudu	3,193	1,835
Warthog	4,230	2,517
Springbok	3,704	2,043
Red hartebeest	2,679	1,586
Steenbok	1,229	702
Blesbok	1,204	744
Hartmann's zebra	1,820	1,064
Blue wildebeest	1,532	895
Eland	1,002	580
Common impala	1,127	670
Black wildebeest	1,163	705
Burchell's zebra	732	387

Although hunting tourism has long been an important part of Namibian tourism and wildlife policy, this sector remains poorly explored in economic terms [31]. Namibia is one of the most preferred hunting destinations in Africa and trophy hunting earns more foreign currency for Namibia than it does for South Africa. Humavindu and Barnes [28] suggested that trophy hunting is five times more important as a contributor to the national economy in Namibia than to South Africa. Moreover, only Tanzania earns more foreign currency from trophy hunting than Namibia [32]. The number of trophy hunters increased from 181 in 1994 to 775 in 2009 (77%), while the number of common species trophy hunted per year, increased from 4,828 to 18,709 (74%) over the same period [27].

The community-based natural resource management (CBNRM) programs in Namibia are based on the understanding that if resources have sufficient value to local inhabitants, who have exclusive rights of use, benefit and management, then this will create incentives for sustainable utilization [17,33]. This enabled communities in communal areas to establish and register communal conservancies, thereby managing wildlife within these areas, both for wildlife viewing and for hunting tourism [10]. Communities increased their income from all community-based natural resource programs from zero in 1994 to more than N\$ 41 million in 2008 [33].

Conservancies obtain benefits from various sources such as tourism, trophy hunting, craft sales, small enterprises and wildlife sales [17]. Lodges and camps earned N\$ 16.95 million (52%) of all conservancy income in 2008. The income from direct wildlife utilization was N\$ 12.2 million (38%) comprising trophy hunting, safari hunting, own-use hunting and hunting for the local market with harvest and sale permits [32]. Trophy hunting generated an income of N\$ 9.9 million of which 83% was from concession fees and 17% from meat distribution. A total of 25 concessions extending over 29 conservancies were allocated to professional hunters by the end of 2008. Of the total income from the CBNRM programs approximately N\$ 3.0 million was in the form of game meat distributed to

the members of the conservancies which was an important benefit to local households. Additional economic benefits are the value of local management institutions and capacity building which includes the training of those associated with the conservancies [33]. Estimations revealed that for every N\$ 1.00 contributed directly to the GDP through wildlife use, an additional N\$ 0.86 is contributed indirectly [10].

## 5. Wildlife Farming

The wildlife industry in Namibia has shown tremendous growth over the past decades and it is currently the only extensive animal production system that is expanding [13,34]. A recent survey concluded that this phenomenon can be attributed to increased rainfall, good farming practices, sustainable harvesting and the creation of additional water sources [35]. Barnes and Jones [34] indicated that, as a result of sustainable wildlife utilization and good wildlife practices, the number of the main wildlife species doubled while livestock numbers decreased by 45% primarily due to severe bush encroachment [36], during the period 1970 to 2000.

Tourism, live sales and trophy hunting alone cannot sustain further growth. Trophy hunting only removes approximately 1% of the national wildlife herd [13]. Predator populations that remove the excess of animals are continuously suppressed, mainly because of livestock farming [24]. Game ranchers also import exotic wildlife species at a high cost, such as blesbok, black wildebeest *etc.*, for tourist viewing. They often refer to the need to control the number of large carnivores by killing them off, or else run the risk of having expensive imported game species preyed upon. This behavior of game ranchers is not likely to change as long as wildlife viewing and wildlife utilization have commercial value [37]. Perceived losses of livestock also influence the removal of these predators [38,39], although game ranchers have more problems with predators than livestock farmers [40]. Possible explanations for this phenomenon could be that game farmers have improved accounting for their wild animals, more so than many livestock farmers, and most predators prefer to prey on wild game species than on domestic livestock species.

The Namibian freehold farmers are reluctant to venture into solely wildlife land uses. These fears are probably based on the belief that a dual system comprising livestock and wildlife farming is more profitable and less risky [35]. The relatively high investment costs for wildlife stocking and enclosure [41], as well as the variability of rainfall, are limiting factors [42]. Rain usually falls during summer (October–April) and ranges from 10 mm/year in desert areas in the west, to 600 mm/year in the subtropical savannah areas in the north [1]. The dry climate in Namibia results in little of the land being converted to arable agriculture and natural vegetation is rather used for extensive grazing by livestock and wildlife [10]. Mixed farming with wildlife could offer better options for long-term farming systems [42]. Namibia's pastures experience severe bush encroachment and it is estimated that Namibian livestock farmers lose approximately N\$ 700 million in meat production annually due to this problem [36]. The present cattle numbers in commercial farming areas represents only 36% of the figures for 1959 [4]. Fortunately, domestic livestock and most wildlife species do not compete for the same fodder [42,43]. Hopcraft [44] found that the productivity from wildlife within their ecosystem equaled or exceeded that of cattle farming in terms of meat production. Wildlife shows extreme physiological adaptation to the environment [45], maintains high standing crop and carrying capacities

and has better resistance to poisonous plants [46] and diseases than livestock [46,47]. These animals also roam large areas without losing weight and have less need for water than cattle [46]. The costs of raising wildlife were found to be lower than costs encountered with livestock farming as some management expenses associated with domestic animals such as dipping, inoculation and herding, are not required for wildlife [48]. This phenomenon was also observed in a study undertaken by the World Bank, which indicated that wildlife utilization can offer better returns than commercial or communal livestock farming [20].

Wildlife populations naturally increase in numbers, typically at a rate of 15–35% per year [13]. Some authors suggest that the abundance of wildlife on freehold land is higher for species such as gemsbok, kudu, hartebeest, impala and eland [10,24,35]. If uncontrolled, particularly on fenced land, wildlife numbers can rapidly exceed the carrying capacity of the land and result in rangeland degradation [49]. Several factors, such as declining income from livestock production, limited farming subsidies and an increase in hunting and ecotourism resulted in some Namibian farmers practicing or considering game ranching as an alternative or additional farming system to cattle ranching [42]. The shift from traditional livestock farming to more natural resource-based wildlife farming is likely to increase with climate change, as well as with the political uncertainty concerning land ownership resulting from new land reform policies promulgated after Namibia's independence in 1990 [50].

Some experts believe that game ranching for eco-tourism and live sales might reach saturation point, thereby forcing a change in the focus to growing markets for game meat and meat products [51-54]. A study carried out by Berry [47] concluded that when different forms of wildlife utilization, namely trophy hunting, non-trophy recreational hunting, live animal sales and game meat production were evaluated, trophy hunting gave the highest net return, followed by live game sales. However, when an index based on harvesting percentages was developed, the net values of the weighted calculations showed that game meat production was the most profitable, followed by live game sales, non-trophy recreational hunting and trophy hunting. The harvesting percentages used were derived from actual harvesting figures and field operations and considered to be the exploitable surplus. The index value calculated from the harvesting percentages was then multiplied by the net value resulting in the weighted value. Although these findings cannot be generalized, it was observed that a broader based wildlife utilization strategy offered a better return.

## 6. Meat Production from Wildlife

Game harvesting operations with the purpose of satisfying local and export demand for game meat is still in its infancy in Namibia [13], as the formal game meat trade in Namibia is underdeveloped. This sector has however, significant potential for growth. Game harvesting also has a positive impact on the environment, since it provides a tool to landowners and custodians of land to manage wildlife numbers for ecological carrying capacity, thereby preventing environmental damage [55] in an often rapidly changing climatic area. Meat production potential from various wildlife species has long been recognized [56,57]. The major wildlife species in Namibia under consideration for commercial game meat export are springbok (*Antidorcas marsupialis*—Zimmerman, 1780), gemsbok (*Oryx gazella*—Linnaeus, 1785), kudu (*Tragelaphus strepsiceros*—Pallas, 1766), mountain zebra (*Equus zebra hartmannae*—Linnaeus, 1758) and red hartebeest (*Alcelaphus buselaphus caama*—Pallas,

1766). The suitability of these species for commercial meat production is not only based on their population numbers (Table 6), but also on other factors such as their reproductive performance, the fact that they occur in large herds in easily accessible regions, their suitability for commercial harvesting and proximity to de-skinning, de-boning and processing facilities.

**Table 6.** Population numbers of commercially harvestable wildlife species in the different districts in Namibia (2007) (adapted from [58]).

District SVCF*	Red hartebeest	Hartmann's zebra	Kudu	Gemsbok	Springbok
Bethanie	*	1,715	5,420	4,064	10,295
Karasburg	767	1,281	3,435	5,344	34,180
Communal conservancies	0	0	*	*	*
Keetmanshoop	1,761	0	4,685	21,225	93,785
Communal conservancies	0	0	*	*	7,000
Luderitz	0	1,030	2,580	8,086	13,129
Maltahohe	2,176	5,510	7,812	17,929	52,798
Mariental	2,359	347	18,593	37,230	254,050
Communal conservancies	0	0	0	*	*
Rehoboth	0	0	0	0	7,512
Gobabis	34,173	593	48,989	42,462	82,659
Grootfontein	4,601	421	55,959	16,312	1,224
Karibib	1,207	10,378	15,870	19,983	12,927
Communal conservancies	*	*	*	*	3,450
Okahandja	14,047	3,694	34,424	35,842	8,803
Okakarara	0	0	0	0	0
Communal conservancies	*	0	*	*	*
Omaruru	3,543	4,404	25,514	27,444	10,447
Communal conservancies					
Otjiwarongo	17,338	2,166	48,215	42,314	9,592
Outjo	5,982	9,606	43,388	33,431	21,986
Khorixas communal conservancies	*	2,500	2,600	5,000	27,000
Tsumeb	1,904	775	13,345	3,319	4,651
Otjinene communal conservancies	*	*	*	*	*
Windhoek	47,240	25,388	50,343	68,868	65,703
<b>TOTAL #SVCF</b>	<b>137,098</b>	<b>70,107</b>	<b>381,171</b>	<b>389,264</b>	<b>726,090</b>

\* No reliable data available; # SVCF South of the Veterinary Cordon Fence.

In Namibia, officials from the Ministry of Environment and Tourism determine the number of wildlife animals that may be hunted on private ranches on the basis of a single visit, where the size of the range, the vegetation type and density, as well as an estimate of wildlife numbers, are considered [42]. These numbers are then used to determine an off-take quota for live game sales, personal use or commercial harvesting. Long term studies of wildlife population dynamics and aerial

surveys will produce more reliable results, but these approaches are both expensive and time consuming [59].

Wildlife may not be harvested from areas subject to official prohibition of harvesting. The reasons for prohibition may be related to conservation, animal health and to animal or plant chemical control [60]. Game meat for export may only be harvested in the OIE (World Organization for Animal Health) recognized foot and mouth disease free zone without vaccination (Figure 4). The Nature Conservation Ordinance No. 4 of 1975 [30] and its associated regulations, regulate the registration of hunting farms, the harvesting of game animals, and the registration of game harvesting teams [61]. The meat from game harvested outside the foot and mouth disease free zone (Figure 4) may not be transported into the disease free area [13]. The primary responsibility for food safety rests with the food business operator as stated in the European Union Regulation (EC) No. 852 Chapter I Article I paragraph 1. According to these regulations it is necessary to ensure food safety throughout the food chain, starting with primary production. Food business operators must therefore, establish, implement and maintain hygiene control procedures based on HACCP (Hazard Analytical Critical Control Points) principles as described in the European Union Regulation (EC) No. 852 Article 5 paragraph 1 [62]. This is applicable to the harvesting of wildlife for meat exports to the European Union and other countries such as South Africa [63].

Only 3% of the commercially harvestable species exist north of the veterinary cordon fence, as these species tend to roam in arid to semi-arid areas. South of the veterinary cordon fence springbok make up the largest part of the wildlife population available for commercial harvesting, although the larger antelope exceed springbok in biomass by a factor of about 4.5. When the off-take rates of predators, trophy hunting and personal use are taken into account, a conservative off-take rate varying from 7% for Hartmann's zebra and gemsbok, 8% for kudu and red hartebeest and 14% for springbok (Table 7) is derived. In terms of income to land owners and conservancies (Table 8), the game meat market has the current potential of generating revenue in excess of N\$ 300 million annually [58]. The additional income to harvesting teams, abattoirs, exporters and outlets, could make the game meat industry worth in excess of N\$ 500 million per year [13].

**Table 7.** Off-take parameters for commercially harvestable wildlife species in Namibia (adapted from [58]).

Off take parameters	Red hartebeest	Hartmann's zebra	Kudu	Gemsbok	Springbok
Approximate population growth rate (%)					
No predators	20	15	25	20	30
Predators	15	12	15	15	25
Approximate trophy off-take rate (%)	2	2	2	3	3
Approximate own use off-take rate (%)	5	3	5	5	8
Estimated meat harvesting rate (%)					
No predators	13	10	18	12	19
Predators	8	7	8	7	14

Long-term sustainable harvesting should always be a pre-condition when wildlife populations are harvested for meat production. The ideal harvesting system should allow for the management of a population structure without disrupting population growth [64]. If the system is correctly designed and

managed, it can result in an increased population growth. The applied harvesting methodology should adhere to all ethical requirements to ensure that harvesting is not negatively perceived within the consumer market. Game harvesting should be planned and implemented so as to ensure the optimization of the total wildlife production system [13].

**Table 8.** Potential value (N\$) of sustainable game meat harvesting to land owners and conservancies in Namibia (2008) (adapted from [8]).

Wildlife type	Commercial farms	*SVCF Communal Conservancies	*NVCF Communal Conservancies
Springbok	44,429,457	2,027,718	1,101,240
Larger game	168,893,039	1,291,425	1,551,083

\*SVCF South of the Veterinary Cordon Fence; \*NVCF North of the Veterinary Cordon Fence.

## 7. Game Meat as an Alternative Meat Source

There is a clearly defined demand for meat from species such as springbok, gemsbok and kudu in some countries of the European Union [65]. It is also anticipated that the demand for game meat will increase [66] both locally and internationally [67]. Namibian game meat has to compete with other red meats such as beef and lamb [5], as products from different species are sold in the same markets [68]. Research has shown that consumers are poorly educated regarding the nutritional benefits and cooking methods of game meat [69]. Therefore, the marketing of game meat on a larger and more organized scale could be beneficial and increase profits to both game ranchers and game meat processors [70]. The correct marketing strategy and the availability of game products requiring less cooking time are imperative for the sustainability of game meat in consumer markets [71]. Respondents from a survey conducted at restaurants in South Africa reported that the majority of their respondents (86%) indicated that they would eat game meat [72]. Seventy-six percent of the respondents indicated that they would eat game meat because they like the taste, while reasons for not eating game meat include being afraid that wildlife will become extinct (3%). Two percent of the respondents considered game meat as typical of Africa.

Environmental concerns resulted in consumers showing more interest in free-range and organic products [69]. Game meat can easily be marketed as an organic product as game ranching conforms to the requirements for organic production [73]. These requirements include minimal damage to the environment, prohibition of agro-chemical pesticides and the careful attention to the impact of farming on the environment and the conservation of wildlife [74,75]. In recent years, consumers have an increased awareness of the health status of food they consume [76] and therefore question the origin of food products [77].

Game meat can offer a healthy alternative to consumers. The fat content of game meat is less than 3% and significantly lower than that of livestock [78]. Research on muscle tissue from wild animals has indicated that the percentage of polyunsaturated fatty acids in game meat is substantially higher than in meat from domesticated animals [29,79,80]. Various authors also concluded that the ratio of polyunsaturated fatty acids to saturated fatty acids is more important than the total fat content [81] from a health point of view. Furthermore, Aidoo and Haworth [82] noted the energy value of game

meat as less than 500 kJ per 100 g and, viewed with the high protein content of game meat [83], can be regarded as a nutrient-dense food ideal for the discerning consumer. It is however essential that consumers are educated on the health advantages of game meat compared to other red meats [84].

Namibia has a history of small scale attempts to commercially export game meat to the international markets. During the early 1990s Windhoek Wild (Pty) Ltd. exported kudu, gemsbok and springbok meat to Switzerland. This export plant was however closed soon after the Chernobyl accident in Europe which resulted in all game meat sold in European markets being perceived as contaminated with radio-active substances. Exports of game meat recommenced in 2003 when Farmers Meat Market Mariental Abattoir (Pty) Ltd. was approved by the European Union to export springbok meat to the European Union and Norway. This facility exports approximately 70 tons of de-boned springbok meat to the European markets annually. Another facility in the south of Namibia, Brukarros Meat Processors (Pty) Ltd., received approval for the export of de-boned springbok meat to the European Union in 2008 and exported almost 17 tons to various overseas markets during 2009 [5]. Whereas springbok meat is already quite well known in international markets, meat of the larger game species is still unknown in overseas markets [85]. To date, no facility exists to export meat or processed meat products from large game species to overseas markets. In Namibia, game meat is often utilized to produce biltong. This is a traditional form of dried meat consumed in Southern Africa. South Africa is the largest producer and consumer of biltong made from beef or game. The name originates from the Dutch word “bil” meaning buttock and “tong” meaning strip [86]. Other processed products manufactured from Namibian game are salami and smoked game meat; products with a high potential market value in overseas niche markets.

## 8. Conclusions

The Biodiversity Treaty, of which Namibia is a signatory, which was signed in Brazil in 1992, focuses on promoting the sustainable use of natural resources and the assurance of equitable distribution of the revenue derived from natural resource-based production systems to the beneficiaries. Promoting the direct use of wildlife in Namibia would create economic incentives for investing into wildlife resources on private, communal and state land. Sufficient numbers of commercially harvestable game seem to exist which could render the sustainable harvesting and processing of game meat complimentary to, or as a feasible alternative to, safari hunting and eco-tourism. Sustainable utilization of wildlife for meat production, destined for local distribution and exports, could assist the management of wildlife as a natural resource and economically viable production system. This has the potential to increase earnings to the beneficiaries in the wildlife sector.

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