

# “Wilding the farm or farming the wild”?

## The evolution of scientific game ranching in South Africa from the 1960s to the present

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This article analyses in some detail the scientific developments relating to extensive game ranching for meat production in South Africa from the 1960s onwards. Initially it recalls how game was utilised in South Africa in the nineteenth century and then reflects on the rise of the modern livestock industry and its detrimental effect on the herds of game that survived in the region into the twentieth century. The roles of scientists from different regions – Britain, the United States and South Africa – are identified and their respective scientific contributions to the wildlife industry evaluated. The narrative is situated within the context of a rise in environmental consciousness in the mid-twentieth century and the recent challenges that have faced the formal agricultural and pastoral sector in South Africa.

**Key words:** game ranching, South Africa, wildlife conservation, game management.

### INTRODUCTION

Between 1959 and 1961 two Fulbright scholars from the United States worked on a remote Rhodesian cattle ranch with a mission to save “some part of the magnificent wild fauna of tropical Africa” (Dasmann, 1964: xi; Dasmann, 1959). Both men were new to research in tropical climates. Raymond Dasmann, who had been working on the “cool foggy redwood forests of California”, and Archie Mossman, “fresh from working on wildlife problems in Alaska”, had been invited by Reay Smithers, then Director of the Rhodesia National Museums, to investigate whether wildlife on land belonging to Ian and Alan Henderson, covering some 54 000 ha about 200 km southeast of Bulawayo in the Rhodesian lowveld, could co-exist with and be ranching in a manner similar to cattle (Dasmann, 1964: 48).

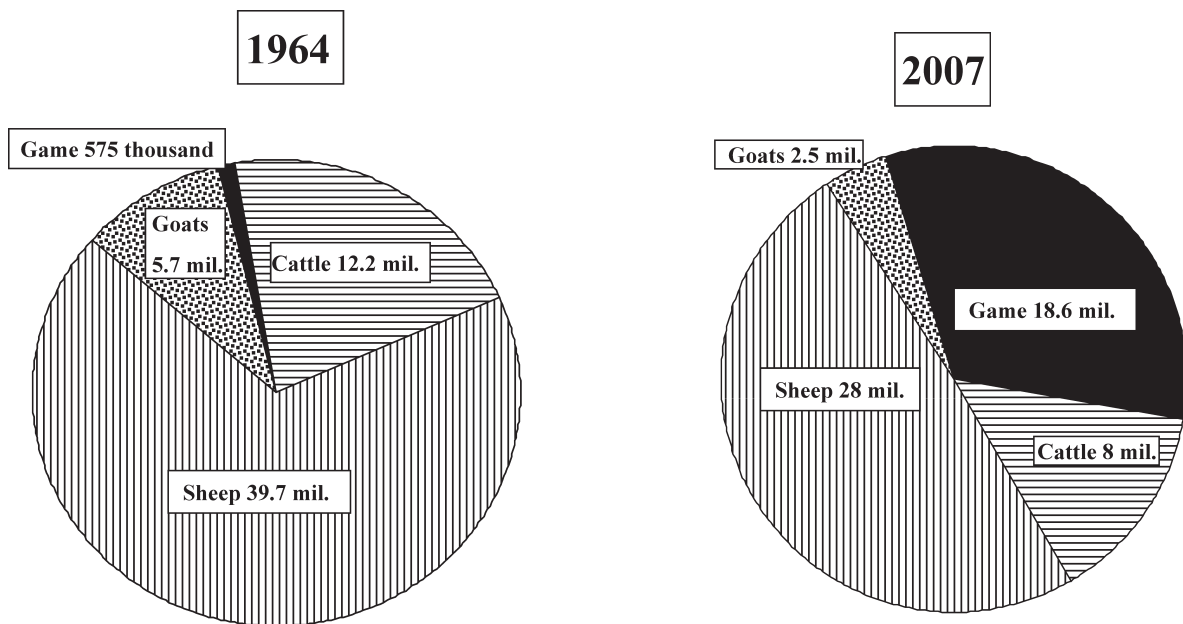
Until Dasmann arrived, with ideas that later attained “almost paradigmatic status” (Nell, 2003: 102), it was the accepted wisdom that wild animals and domestic livestock needed to be separated because they competed with each other for grazing and because transmittable wildlife diseases threatened the health of stock (Joubert, 1977: 183). It was thus assumed that in order for modern agriculture to prosper, the game of Africa should be exterminated to make way for cattle (*Bos taurus/indicus*), sheep (*Ovis aries*) and goats (*Capra hircus*), and throughout Africa in the first half of the twentieth century Agricultural and Game Departments had acted in accordance with this objective. In conducting their research into the breeding cycles and habitat use of wild animals on the Henderson’s property, Dasmann and Mossman instigated a scientific and cultural change that encouraged wildlife utilisation and which, some consider, will come to be regarded as “one of the great agricultural transformations in Africa’s recent history, comparable to the adoption of maize and cattle” (Nell, 2003:96; Jarrell, 2003: 324). Others have described it as “a conservation revolution since the 1960s in South Africa” (Bothma *et al.*, 2004: 840).

For what Dasmann (later chief ecologist of the International Union for the Conservation of Nature) and Mossman (whose interest in the subject had been sparked by Transvaal mammalogist Berndt Lundholm in 1952 (Bond 1977: 3)) postulated was that not only could wildlife survive on cattle ranches,

but that in itself, game ranching held enormous potential for augmenting Africa’s protein supply. What they had to say resonated with changing ideas around nature and environmental conservation, wildlife management and sustainable development as well as with transformations in agricultural politics and organisation in the late 1950s and 1960s. This was so particularly in South Africa, the region that is the principal subject of this article.

Although Dasmann’s and Mossman’s template has been modified by agricultural scientists and wildlife managers in subsequent decades, it is nevertheless important to note that in South Africa today larger numbers of wildlife occur than has been the case for very many decades. This is the situation not only in national parks and formal game reserves – as might be expected – but specifically on private property, where wildlife is harvested as a source of meat, hunted for trophies, traded in the market, and viewed by eco-tourists (Du Toit, 2007) (Figure 1). It has been suggested that there are some 1.7 million large mammals on 13.3% of the land formerly designated for agriculture (Van der Merwe *et al.*, 2004), and this should be compared with the 1966 estimate of about 340 000 animals (Du Toit, 2007: 17). The Amalgamated Banks of South Africa (ABSA) report (2003) states that there are about 5000 game ranches in South Africa and more than 4000 mixed game and livestock ranches, covering some 13% of the land area, in comparison with 5.8% for all officially declared conservation areas, of which the national parks comprise 2.8%. In addition to its economic importance, in terms of biodiversity conservation, it has been estimated that 80% of nature conservation in South Africa takes place on privately owned land (Van der Merwe *et al.*, 2004). Thus over 17 million ha are used for wildlife production, with a conversion rate of 2–2.5% annually from livestock to wildlife production (Republic of South Africa, 2005: 7).

Game ranching has spawned a new scientific discipline within animal husbandry, and many aspects of wildlife management now have a respected place in South African universities. In addition, attempts at commercial game ranching have contributed immeasurably to improvements in techniques of translocation, capture and immobilisation,



**Figure 1.** Change in numbers of domestic animals to game between 1964 and 2007 (Du Toit, 2007: 25–26).

developed a resilient market in the sale of live animals, provided a source of protein for local and export markets, and encouraged the growth of a new professional class of wildlife managers and consultants. Moreover, as the title of this paper suggests, it has blurred the distinction between “wild” and “tame” as well as between state (public) and private property, and brought about changes in land tenure and legislation.

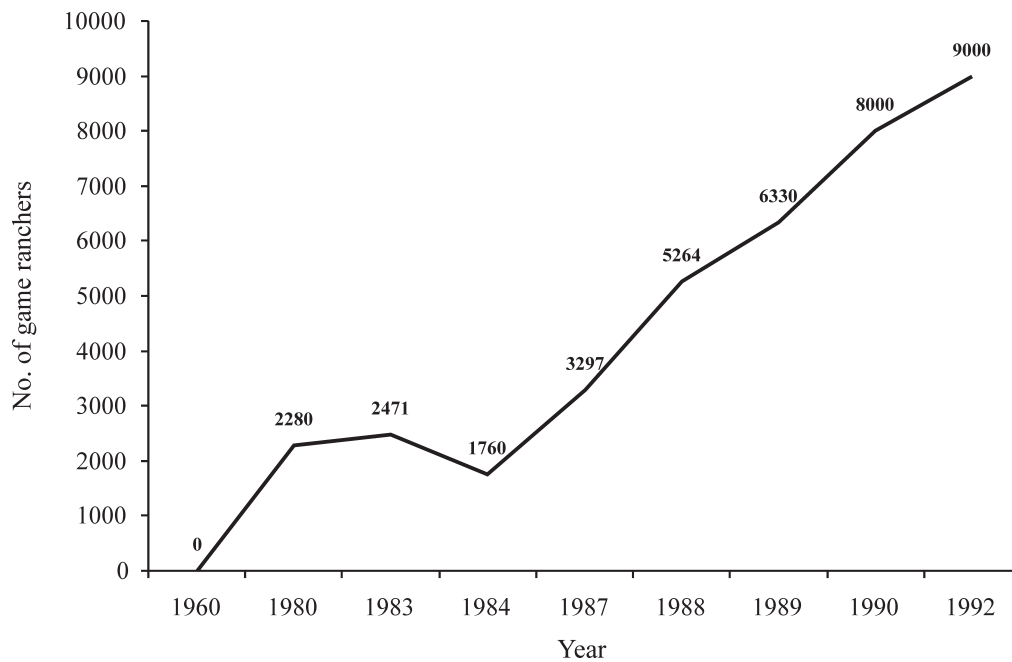
#### HISTORIOGRAPHY

This paper aims to contribute to the “animal turn” as well as to the history of science that have become the focus of much environmental history. Currently there is an emphasis on the perceived dichotomy between indigenous and exotic, that which “belongs” in the landscape and the (often disparaged) alien that has been introduced. In *Man and the Natural World* Keith Thomas observed that civilisation and settled society would be unknown without the domesticated animals that have become part of the social fabric with specific and often complex rituals of use and slaughter (Thomas, 1984: 25). As Harriet Ritvo argued, the most useful animals to humans are those that are “fully domesticated” (Ritvo, 1987: 17). The animal turn in the historiography has not only led to a growth of interest in domestic and indigenous animals, but also to exploring the development of ecology and various animal sciences (Anker, 2001; Brown & Gilfoyle, 2007; Carruthers, 2007a,b). This article extends the author’s research into the roots of wildlife management in the South African protected area estate by amplifying the analysis into commercial wildlife management on private property.

In what follows, for example, it is argued that during the 1960s in South Africa there was little to distinguish between wildlife management in a national park and on an extensive cattle ranch because both were managed, indeed manipulated, for productivity. On being shown the large abattoir in the Kruger National Park near (but not within sight of) the Skukuza tourist camp that processed, canned and dried thousands of culled elephants (*Loxodonta africana*), buffaloes (*Syncerus caffer*) and hippopotamus (*Hippopotamus amphibius*) carcasses, East African conservationist Richard Leakey exclaimed, “I watched for a while impressed by the size and scale of the operation, but appalled that this was what wildlife

‘management’ in the late twentieth century had come to”. As far as Leakey was concerned, nature and “wild” Africa had been dispossessed of its ideals and aesthetics, it had become a modern industrial farm based on an ideology of killing for sustainable utilisation and maximum production, and to him, this had always been a “wrongheaded argument ... if wildlife and wilderness were regarded solely as items that generate money, their days were surely numbered” (Leakey, 2001: 220–221).

If Leakey was disillusioned to find that commercial harvesting of wildlife in South Africa’s premier national park had lasted from the 1960s into the 1990s, others were delighted to be able to profit from a renewable resource, both within and outside of national parks and took the opposite view to that of Leakey: if wildlife did not generate money, if they could not pay their way, that was when their days were surely numbered. During the 1960s there were signs of a bifurcation in protectionist thinking, strict preservationists and those of the “use it or lose it” school. There were challenges to both paradigms and the renewable resource potential of wild animals was recognised by overcoming a number of challenges that are discussed below. Various factors contributed to the rise of modern game ranching in South Africa. One was the shared expertise between wildlife management in state-protected areas – especially in the wildlife-rich savanna regions of the then Transvaal – and on private farmland. Another was the eventual change in South Africa law that facilitated game ranching as an industry. In addition, questions around how best to deal with Africa’s growing population focused research efforts on increased levels of protein production, while conservation and sustainability became international imperatives. The political environment in South Africa has also played its part, with the virtual collapse of agriculture owing to closed international markets and an altered agricultural regime without state subsidies, control boards and other organs of state that protected South Africa’s white commercial farmers for so many decades. More recently, game ranching has been predicated on the need to reduce farm labour, the prevalence of farm murders and security issues generally as well as the threat of land restitution claims and expropriation. Nell has developed some of the other threads that allowed the spread of wildlife utilisation as an agricultural innovation, such as the informa-



**Figure 2.** Estimated number of game ranchers in South Africa, 1960–1992 (Nell, 2003: 201).

tion flow, core leadership, the relative advantages, compatibility with existing values and practices, and profitability (Nell, 2003). Since the 1960s, however, game ranching itself has altered over the decades and many of the early assumptions have been refined, even abandoned, with changing political, institutional and organisational structures, particularly the growth of tourism (Figure 2).

#### **SOUTH AFRICA: BACKGROUND AND DEFINITIONS**

South Africa's settler population, having been indigenised for more than 350 years, is not homogeneous and there has also not been the same strong British influence or tradition of "the hunt" or "game preservation" that is reflected elsewhere (MacKenzie, 1988, 1990; Carruthers, 1995a). The South African economy is not typical of the rest of Africa, because it has very strong commercial, mining, service, manufacturing and industrial sectors that make up 96.9% of GDP (Centre for Development and Enterprise, 2005; Van der Merwe & Saayman, 2003; ABSA, 2003). Urbanisation is currently expanding and agriculture is declining. In the period 1998 to 2002, tourism (principally eco-tourism) accounted for some 6% of GDP. The decline in agriculture is remarkable, from some 20% of GDP in the 1920s, it had shrunk to just 3.4% in 2004. Apart from the reasons mentioned above, a significant factor for this is that South Africa's agricultural subsidies are currently among the lowest internationally, at about 4% (compared with 22% in the United States, 45% in the European Union, 5% in Japan and 1% in New Zealand). Moreover, net earnings from agriculture continue to drop in South Africa, from R110 per hectare in 1990 to around R80 in 2000.

South Africa has an immensely rich ecology. It is the third most biodiverse nation in the world, containing at least ten biomes and an entire floral kingdom (World Conservation Monitoring Centre, 1992). But it is a small country (1219 912 km<sup>2</sup>) with limited environmental resources, and arable land has been calculated as only 13.7% of the landmass. Most importantly, the western half is extremely arid and consequently very difficult to farm profitably. The total value of output per hectare in sub-Saharan Africa is just US\$69.3 in comparison with a world average of US\$266 (Centre for Development and Enterprise, 2005; ABSA, 2003: 1). South Africa's

black rural poor rely on the communal lands to eke out a living from subsistence crops (mostly maize) and by keeping small herds of diverse domestic stock.

This article deals with "game ranching" or "wildlife ranching" and these terms need to be explained. Ritvo (1997: 189) is correct to suggest that the word "game" indicates not only the species, but also who would pursue them. Eltringham (1984: 4–5) emphasised that "wildlife" and "game" are not scientific terms, but unreliable words, used differently in different conversations. Carruthers observed further that while the word "game" is sometimes reserved for animals that are hunted for amusement or sport in a "fair chase", and "wildlife" for all indigenous animals, a problem arises in the South African context because there is no such distinction in the Dutch or Afrikaans languages, where *wild* (pronounced "vilt") is used interchangeably for both "game" and other "wild" animals (Carruthers, 1995a: 5). The distinction between "game" and "wild" animals is not merely of semantic interest because, as will be explained below, there are significant legal connotations that pertain to the categorisation. Only certain animal species were (and are) accorded status on account of being either "game", "wild" or "vermin", or indeed, "domestic", and they may change categories such as ostriches (*Struthio camelus*) have done. In many parts of the world (including South Africa), certain animals have been classed as "vermin" and their eradication is encouraged, other species are stringently protected and yet others are legally harvested. In game ranching, however, the term "game" generally applies to the ungulates, itself a broad category of hoofed mammals.

Insofar as "wildlife management" is concerned, Aldo Leopold, the world's most renowned "game management" innovator, defined the discipline as that of keeping game at desirable levels, or "the art of making land produce sustained annual crops of wildlife" for recreational use (Leopold, 1986: 3–4). In this respect, Leopold believed that game should be "positively produced, rather than negatively protected", that it was a "crop which nature will grow" (Meine, 1988: 240). Pollock (1974: 122) has defined game ranching as the being the scientific management of certain species of wild animals in their natural habitat without an effort to domesticate them. Grossman *et al.* (1999: 261) identify it as the "commercially-orientated

stocking and use of game”, in which veld management differs from nature conservation because production-related considerations, rather than ecological or biodiversity concerns, are paramount. This is an important distinction.

South Africa’s wildlife management outside of national parks is commercially focused, and the game management industry now comprises a number of sub-sectors. “Intensive” game or wildlife “farming” refers to an agricultural system in which wild animal species are maintained in order to harvest by-products such as meat or skins in a domesticated or semi-domesticated manner by being enclosed in relatively small areas and provided with regular supplementary feeding and water. Leopold distinguished between “management” and “farming” (he did not use the word “ranching”) referring to “game farming” as an intensified form of game management that involved propagating wild species in confinement (Leopold, 1986: 4). He also used the word “artificial” to explain the “farming” aspect. Ostriches (imported into southern Africa from Ethiopia) and crocodiles (*Crocodylus niloticus*) are intensively farmed in this way – as is well known, ostriches for more than a century (Goldie, 1968; Nixon, 1999; Van Sittert, 2005), crocodiles more recently. Du Toit makes a clear distinction between “game farming”, being a small fenced area on which wild animals are intensively managed to produce and harvest marketable products and “game ranching”, being a large privately owned or communal area, either fenced or unfenced, that is extensively managed in order to utilise wildlife products through hunting, sales, tourism and other “indirect” use, generally of ungulate species (Du Toit, 2007: 5).

It appears that the word “ranch” was introduced into the South African vocabulary around the mid-twentieth century and it was adopted from the United States usage (*via* Spanish) that began a century earlier (1840) denoting a very large cattle breeding establishment. Similarly to the observation above that there is no distinction between “game” and “wildlife” in Afrikaans, just “wild”, so too there is not a different word in Afrikaans to indicate a difference between “farming” and “ranching”, both are *boerdery* [farming]. It may even be for this reason, namely to make a distinction which the Afrikaans wording lacks, that the adjectives “intensive” and “extensive” have come into use. One form of South African “wildlife ranching” involves trophy hunting and/or eco-tourism and this currently is the most popular and lucrative variety.

Based on scientific rather than more general sources, the subject of this paper is “extensive” game or wildlife “ranching”. This is arguably the most direct descendant of the Dasmann model, in which selected species of ungulates are maintained on large tracts of land in a semi-wild state that does not involve regular feeding and water provision (although these might be provided in drought years) at a level that can be harvested regularly for meat. In other words, meat production is the main goal, towards which objective appropriate environmental conditions are maximised, unlike the manipulation required for intensive game farming defined above. Much of the scientific research that has been conducted on wildlife management for extensive game ranching has related to selective breeding, maximum production, disease control and transporting or relocating disease susceptible or carrier species, possible domestication, promoting markets as well as hygienic conditions of killing and processing (Jansen, 1977; Grootenhuis, 2000).

Although it has been indicated that Dasmann and Mossman generated a new form of agriculture in South Africa, the importance of wildlife on private property under conditions that can almost be considered to be “ranching” has a longer history

which may explain why its modern research agenda was so attractive. This is briefly explored in the section below.

### WILDLIFE UTILISATION UNTIL 1910

While autochthonous Africans had hunted many species of wildlife for aeons, the advent of firearms combined with intensifying European settlement and a market economy led to increasing extraction that decimated the herds of South Africa. From the earliest days of the Dutch East India Company’s station at the Cape (1652), company employees, free burghers, trekboers and traders alike spread into the subcontinent seeking a lifestyle based on hunting and extensive pastoralism rather than on labour- and capital-intensive agriculture (Pollock & Agnew, 1983; Van der Merwe, 1945, 1995). But the era of greatest wildlife slaughter was from the mid-nineteenth century onwards, with a thrust of colonial expansion into the interior. One wave of hunters during the nineteenth century was that of people who called themselves “sportsmen”. Often recreational, the initial expeditions of visiting hunters such as William Cornwallis Harris, whose books were extremely popular (Harris, 1852), were followed by many Europeans who sought adventure and freedom in hunting the wildlife of South Africa. More significant, however, were the large Voortrekker parties who were potential settlers in the 1830s and 1840s seeking to establish independent polities in the interior free from British control. They cemented partnerships with African mercenary hunters who, at times, numbered in the hundreds. These *zwarteskutters* [black shots] were able to foray out in the summer months, well beyond the tsetse fly and malaria belts and on foot, unlike the whites. In 1855 it was estimated that 90 000 kg of ivory was exported from the Transvaal, together with vast quantities of hide and horn (Carruthers, 1995a: 21). Species, such as black wildebeest (*Connochaetes gnou*) which occurred in thousands, were slaughtered like the bison (*Bison bison*) of North America. In 1866, a single firm in the small town of Kroonstad exported some 157 000 black wildebeest and blesbok (*Damaliscus pygargus*) skins; by 1900 both species were almost extinct (Vrahimis, 2001). It would appear that the market was the main driver of game hunting, while recreational sport-hunting added substantially to the destruction.

Various sources testify to the diverse values that different communities placed on wildlife. Visiting British sportsmen, for instance, regarded their own sport hunting, profligate though it was, as “good”, market hunting as “evil” and they believed that only “backward” people – like Boers and black Africans – would kill animals for their skins. By contrast, Africans and Boers found it hard to comprehend that there were people who hunted only for amusement and discarded by-products that had monetary and sustenance value (Carruthers, 1995a: 40–41). By the end of the nineteenth century, when the heyday of hunting was over because the numbers of wild animals had dwindled so drastically, owing both to hunting and to the epizootic of rinderpest that swept through southern Africa in 1896, a landowning class of Boers had emerged in the Transvaal. They, like their often English-speaking counterparts in the Cape and Natal, came to value the game on their very large (and often numerous) farms for its aesthetic and recreational significance (Brown, 2002). As explained by Carruthers in respect of the Transvaal, a class distinction emerged between poor and landed whites that had an effect on attitudes towards game. Property owners took special steps to protect game on their farms and gained a reputation for a proprietary attitude, although – in terms of the law – it was *res nullius*, or an object that cannot be owned (Carruthers, 1995a: chapter 3).

However, wild animals can be “owned” if a landowner takes

control of them with the intention of becoming the owner (*res intra commercium*), in which case *res nullius* can change status to *res alicuius* (things which have owners) (Rabie, 1973, 1976; Fuggle & Rabie, 1983; Greyling, 1984; Glazewski, 2000; Higginbottom & King, 2006). Thus wild animals are not the property of the person on whose land they occur until they are killed and thereby possessed, an event that landowners went to considerable trouble to prevent. As a British magazine expressed it in 1881, "Another thing Boers think a great deal of is the preservation of game on their farms. They live upon buck, and consider them private property" (Anon., 1881: 759). As early as the 1860s farmers in what was then the South African Republic (Transvaal) advertised in the *Staatscourant* (Government Gazette) that their properties were out of bounds to trespassers, hunters and unauthorised cattle grazers. By 1881 more than 200 such notices had appeared and applied to more than 300 farms (Carruthers, 1995a: 33) and some owners even established specific *wild kampen* (camps for game) to protect "their" wildlife (Carruthers, 1995a: 77, 86). It appears that the situation in the Cape Colony was similar (Brown, 2002).

By the 1890s the gulf between landed and non-landed people is evident from debates in the *Volksraad* [Parliament] of the Transvaal Republic. Landowners resisted increasing preservationist laws when it came to hunting on their own properties, but advocated harsh penalties for Africans and "poor whites" who hunted on state land. The discourse in this period contains numerous comments about the fact that "only lazy and unproductive people" continued to hunt for a livelihood, and many people believed that while wildlife still survived outside of private property, poor people would not even try to find better employment, but would continue to subsist on game and selling biltong, hides and horn in order to generate an income no matter how meagre (Carruthers, 1995a: 49–50, 60, 86). By that time, earning an income in this way was simply not possible in much of the rest of South Africa as so little game survived on state land.

The campaign against market hunting intensified after the South African War of 1899–1902 when the Transvaal became a British colony. Particular invective was reserved for African "poachers", but debates in the Legislative Council around the prohibition of market hunting were also very emotional. By selling biltong poor whites, particularly in the Transvaal, could still make a living from hunting and the colonial government was intent on stopping the trade entirely, not merely controlling it. The demand for biltong was large, some 7000 kg being exported from a single railway station in the Waterberg in 1907 alone. One lone voice on the Legislative Council at the time argued that prohibiting the sustainable use of game was wasteful and that the principle of saving it merely for the "benefit of the leisured classes" needed to be questioned. Nicholson even went further, averring that "to say that this food product of the country [biltong] is to be wasted in such a fashion is, I think, bringing legislation to a ridiculous pass", but he was overruled by his colleagues and selling biltong was outlawed (Carruthers, 1995a: 111).

In 1910 when the four British colonies united as the Union of South Africa wildlife protection devolved to the provinces. By the end of the First World War the South African agricultural economy was modernising and the well organised Department of Agriculture began systematic research into both livestock and crops in order to produce more food.

#### GAME AND LIVESTOCK: 1920s AND 1930s

In the 1920s and 1930s there were two strongly opposing views on wildlife management in South Africa and there was

no bureaucratic mechanism through which they might be resolved. National parks and other forms of game reserves were managed without any scientific foundation by amateur "wardens" and "rangers" with military precision. From 1902 until 1946 Colonel James Stevenson-Hamilton was warden of the area that became the Kruger National Park in 1926. For about a decade after his appointment he adhered to the traditional sportsman's management objective of game husbandry by preventing public access, stopping poaching and exterminating predators. Over time, however, he came to alter his opinion in favour of a more holistic approach based on "leaving nature alone". In keeping the park as "natural" as possible, he advocated no management intervention at all, preferring to be custodian of a "faunal sanctuary" (Stevenson-Hamilton, 1947: 11; Carruthers, 2001). Other national parks were founded in the 1930s, three of them were very small, species-specific "game farms", namely Bontebok (1931), Addo Elephant (1931) and Mountain Zebra (1937) and even in these, scientific management was lacking. Moreover, the much larger Kalahari Gemsbok National Park (1931) which, as an extremely interesting arid region would have benefited from scientific study and management, was left in the control of a local untrained farmer. The only national park initiated in the 1930s for scientific reasons, although formally founded only in 1947 – the Dongola Wild Life Sanctuary – was abolished in 1949 with the coming to power of a new government under extreme pressure from local farmers to do so.

Stevenson-Hamilton's attitude was strongly influenced by what he had observed went by the name of "science" in terms of wildlife management. In the first half of the twentieth century, South Africa's veterinarians and agriculturalists in government service were the country's most powerful field scientists. Their political influence and high profile was due to their work in promoting and developing commercial livestock and crop-farming industries. Believing that wild animals spread diseases to domestic stock and that rather than establishing "worthless" game reserves and national parks, all land should be in some kind of "productive" use, the majority of men in the Division of Veterinary Services of the Department of Agriculture were vehemently opposed to any form of wildlife conservation (Carruthers, 1995b: 150–178). In terms of scientific study, national priority was given to domestic stock and the veterinary research institute at Onderstepoort (part of the Department of Agriculture) gained international renown (Bigalke & Verwoerd, 2008). It is possible that scientific research on African megafauna lagged behind in veterinary science because wild animals were extremely difficult to study in the wild (Haagner, 1916). At that time there were no techniques for capture, immobilisation, marking or translocation. Moreover, because game had so little monetary value (if any), there was no funding for research.

The Division of Veterinary Services demonstrated its power on two particular occasions in the 1920s. At that time, the Zululand game reserves were situated in an area of endemic *nagana* (trypanosomiasis) and veterinary scientists believed that wild animals harboured this disease and communicated it to domestic stock. The result was the wholesale slaughter of wild animals as a containment measure (Brown, 2005a,b; Brown & Gilfoyle, 2007: 2–16). In just two years (1929–1931), more than 35 000 animals were destroyed at a cost to the taxpayer of the then enormous sum of some £25 000. Dr Ernest Warren, Director of the Natal Museum, was concerned that the game of Natal would never recover from the onslaught – which P.R. Viljoen, Acting Director of the Division of Veterinary Services, described as "complete extermination" (Bigalke &

Skinner, 2002) – and that the then rare square-lipped rhinoceros (*Ceratotherium simum*) might well become extinct in the process. A second case of wildlife-agriculture conflict occurred in the Sundays River valley in the Eastern Cape which had become the last refuge for a herd of about 150 elephants. When a citrus irrigation scheme was started in the Addo area these elephants raided the trees and destroyed the water supplies. Again the government stepped in to protect commercial agriculture, employing a professional elephant hunter to exterminate the elephants. Despite protests, within a year all but 16 elephants were dead and, belatedly, a game reserve (later to be upgraded into a national park) was proclaimed to protect this small group of traumatised animals (Hoffman, 1993). In short, the conservation of indigenous megafauna and the prosperity of the South African agricultural industry were regarded as being inimical to one another. (This was not, of course, an attitude peculiar to South Africa. A farmer complaining about the restocking of the Flint Hills in Kansas with native animals is recorded to have said, “What the goddam hell are they doing putting antelope back in here for? Everything we worked a hundred years to get rid of, they’re bringing back!” (Least Heat-Moon, 1999: 243).)

Some farmers in South Africa thought otherwise and provided the property was large and the continued presence of antelope did not impact negatively on livestock and other farming operations, it was frequently allowed to remain. Throughout the 1920s and 1930s many property owners allowed game numbers on their farms to climb and it seems that farms with game on them fetched higher prices than farms without (Smith, 1937). In the grassveld savannas of the Orange Free State province, blesbok were the most common animal, some farmers actually reintroducing them in the 1930s, while others claimed to have protected them for decades (Von Richter *et al.*, n.d.; Von Richter, 1971; Vrahimis, 2001). In the more arid areas of the karoo and the districts around Colesberg and Graaff-Reinet where properties were extensive, the most abundant indigenous antelope to be found among the sheep was the springbok (*Antidorcas marsupialis*) (Beinart, 2003: 328). There was a small market for venison at the time: in 1933 home economist Miss E.M. Ferguson provided a number of venison recipes to readers as well as hints about hanging and trussing the different cuts of meat in an article in *Farming in South Africa*.

In the 1920s and 1930s South Africa was part of a wide international network of scientists, most of whom were British and who worked on problems relevant to the African continent as a whole. In 1938 Lord Hailey’s monumental *African Survey* encapsulated many of the challenges of the time. In terms of game, white settlers, far more than black Africans, were castigated for destroying wild animals through extermination programmes to wipe out diseases that might affect livestock and also because hunting was such a popular recreational pastime. Importantly, Hailey highlighted game as a meat supply for the first time, referring to “the problem of ensuring the perpetuation of a reasonable quantity of wild animals, which will provide a meat supply essential to the well-being of the indigenous population, is one which in the past appears to have received insufficient attention” (Hailey, 1938: 887). Hailey’s opinion was echoed by E.B. Worthington, a renowned ecologist who, in his book *Science in Africa* (1938), also expressed concern that the diminution of game in Africa resulted from “anti-game campaigns”. He argued that agricultural scientists were on the wrong track in trying to improve African livestock breeds, rather than studying indigenous African mammals in terms of what protein they could provide on a sustainable basis for local people. Worthington also said that far too many agricultural research projects were crop-related, and he

considered Burt-Davy’s work on maize (Burt-Davy, 1914) to be wasted effort because so much of southern Africa was unsuitable for any form of cultivation. In Worthington’s opinion, more attention needed to be paid to the new science of animal ecology, and research funding found for the meat industry, indigenous cattle breeds and investigating the potential of mixed farming (Worthington, 1938).

### CHANGING IDEAS: THE 1950s

Although there might be an argument that the modern form of game ranching merely gave scientific, agricultural and official legitimacy to an older form of land use in which both domestic and wild animals shared very large farms, there is no doubt that the 1950s are important. It was then that there was a combination of scientific and attitudinal changes regarding wildlife management and also in regard to the “value” of wildlife generally. Provincial nature conservation in South Africa required regularisation and, as a result, in all four provinces a dedicated nature conservation department was established – although not all of an identical form (Hey, 1977). Although full-blown scientific interest in game ranching came with the 1960s, some hint of what was to come can be discerned shortly after the war in a 1945 report that emanated from a Game Commission of Enquiry in the Transvaal, established to set up the conservation department mentioned above. In the course of their work, the commissioners were apparently surprised by the “keen interest” landowners showed in game preservation. However, quite incorrectly – they were, after all, men of their time – the commissioners assumed that game would generally disappear from private property in the face of intensified agricultural development, leaving specimens of indigenous fauna alive only in protected areas. They concluded their report: “We cannot accept the point of view that game on privately owned land plays any part in the economic life of the country as a means of attracting tourists. We cannot visualise tourists visiting privately owned farms for the purpose of seeing game ... national parks fully cater for this” (Transvaal Province, 1945: 6–9).

Owing to meat rationing after the war the local consumption of game grew, but the market was very small and prices extremely low. In 1949 in Johannesburg, the largest outlet, the total value was £5019, Kimberley £406, Pretoria £355, Port Elizabeth £204 and Durban a mere £153. Cape Town did not rate a mention (Skead, 1950). The 1940s had been very dry years and by the 1950s, there were farmers in the arid and semi-arid areas of South Africa who had noticed that springbok had not been as badly affected by the dry years as had livestock and they began to harvest them (Beinart, 2003: 328; 386). In the northern parts of the country there were similar developments: “One or two species are ... kept in a semi-natural state on some farms in the Transvaal and produce a useful supply of venison for the market” (Worthington, 1958: 331–332).

While farmers might have been pleased by the increase in venison consumption, some conservationists decried the change in values around wild animals, resenting the rise of a utilitarian perspective. Cape naturalist C.J. Skead for example, wrote that it was a pity that “we have to think of our wild animals as objects of price quotations, but some of this meat must have come from farmers who have protected it” (Skead, 1948). But another saw the potential, and A.D. Thomas argued that conservation would succeed better if it were based on economic principles rather than only on values that were aesthetic and idealistic (Lundholm, 1952: 122).

Together with a growing economic value in the private sector and in the market, attitudes towards science and management

in the state protected areas, particularly in the Kruger National Park, played their parts in public acceptance that wildlife was not merely beautiful, but was also a valid object of scientific, even experimental, study. Attitudes changed at many different levels. With the retirement of Warden Stevenson-Hamilton in 1946 scientists instigated formal research in national parks and the various provincial nature conservation divisions did likewise in the game reserves they controlled. Not only was there scientific benefit in an active research agenda, but good management would ensure the stability of the profits to be derived from game viewing and the growing eco-tourist industry. Rudolph Bigalke, Director of the National Zoological Gardens, played a seminal role in demanding that the National Parks Board establish a research section and employ suitably qualified scientists in senior positions (Bigalke, 1950). Even in 1945 he was insisting that "game preservation is the task of the scientist, i.e., the work of the biologist" and that the absence of organised scientific knowledge was detrimental, leading to human-wildlife conflict and to animal diseases (Transvaal Province, 1945: 24).

While the role of local scientists like Bigalke is important, there is a strong argument that it was the influence of scientists from outside Africa that tipped the balance towards sustainable game ranching in South Africa. In his 1958 book entitled *Science in the Development of Africa* Worthington specifically pleaded for more scientific attention to be given to Africa's mammals. While he praised the research being done by biologist T.G. Nel (a protégé of Bigalke) in the Kruger National Park, he said that many more quantified studies were required on how wild and domestic species competed for grazing and on the prospects for domestication of appropriate game. Worthington pointed out that most people were aware that wild animals were immune to disease, capable of growth and multiplication on very poor land that was unprofitable for the cattle industry, and yet little was being done by way of scientific and organised experimentation in this regard (Worthington, 1958: 193, 200–213, 331–332). Frank Fraser Darling was another internationally renowned British scientist with similar ideas, and his work contained a warning about future shortages of protein for a growing world population, a shortfall that could be remedied through game ranching (Darling, 1960a,b; Skinner, 1970; Ovington, 1963; Apps *et al.* 1994). Mervyn Cowie, East African game warden, also wrote at the time, "When the Africans realise that some land is more valuable for producing wild animal products than for ranching useless scrub cattle or trying to grow very scanty crops, they will appreciate that our endowment of wild life is an asset of great value" (Cowie, 1961: 217).

Scientific research cannot take place in a vacuum and although Worthington was correct in his assessment that more studies were required, these needed an enabling political, economic and cultural environments, and these came about slowly. First, studies on game ranching required technical expertise and international support. A positive development occurred in 1953 when the International Union for the Protection of Nature (founded in 1948) held its Third International Conference at Bukavu in the Belgian Congo. The conference supported the transformation in conservation management from a "negative form of protection" to a discipline based on knowledge acquired through experimental zoology. It was appreciated that such studies would require "modern" ecological methods, "undertaken and developed by groups of specialists working with assurance of permanence and continuity" (IUCN, 1953: 534). South African delegates attended this conference and took heed of these ideas and a number of them were later to spearhead game research in

South Africa – W.K. Kettlitz and T.J. Steyn (Fauna and Flora Branch Transvaal Province) and Jack Vincent (Director of Wild Life Conservation, Natal) among them. As well as research expertise, technical innovation was required. In this regard, a breakthrough came with the aerial census, and with the early work of A. Harthoorn in Uganda and I. Hofmeyr and H. Ebedes in Namibia in developing tranquillising and immobilising drugs that would enable the translocation of wild, even dangerous, animals (Ebedes, 1992; Du Toit, 2007: 19–20), techniques that were soon applied in South Africa. Over the years further research was done that rendered obsolete the older methods such as using dogs to ambush and drive frightened animals into snares or pits with attendant casualties and deaths of animals (Kettlitz, 1962b, 1983a,b).

In the 1950s, before the Dasmann and Mossman era of extensive game studies, domestication and cross-breeding was the focus of research. This began in South Africa with eland (*Taurotragus oryx*). Because of their large size and cattle-like qualities eland had been identified as Africa's prime species for possible domestication from the late 1770s (Pollock, 1974: 119–121). Work on this species that had been conducted in the 1920s was revived and updated in the 1950s by the Natal Parks Board (Moe, 1953) while Posselt conducted a pilot project in Rhodesia (Roth, 1970; Pollock, 1974: 121). Bigalke and Neitz published on the subject in 1954, signaling an early warning that hybridising eland and buffalo in order to produce a new domesticated species simply did not work. They had also crossed two different kinds of eland, but experiments showed that the progeny were no more domesticable than the parents, and crossing African with domestic Asian buffalo (*Bubalus bubalus*) had simply ended in the deaths of the animals. An experimental station was established at Onderstepoort to cross African buffalo with cattle in an attempt to breed an animal that was immune to disease, but this too was a failure (Bigalke & Neitz, 1954; Van Zyl & Skead, 1964; Kettlitz, 1983a). In 1956, the Cape Department of Nature Conservation acquired a farm for breeding game and to investigate the "relationship between wildlife and farming practices" (Nell, 2003: 56). The era of intensifying wildlife management science had begun.

## A NEW INDUSTRY DEVELOPS: THE 1960s

### Dasmann and Mossman in Rhodesia

There was thus an enabling local and international scientific and cultural milieu when Dasmann and Mossman arrived in Southern Rhodesia in 1959 to begin work on the Henderson property "Doddieburn Ranch", with the objective of investigating whether there was scientific validity for ranching livestock and game together in Africa (Nell, 2003: 71). Dasmann, Mossman and Thane Riney, another Fulbright scholar who took part in the project, were all "from the Aldo Leopold school of thought" (Child, 1996: 356). Aldo Leopold's 1933 book, *Game Management*, was not widely acclaimed in South Africa when it was first published, although its ideas had enjoyed considerable success and publicity in the United States, even generating a new applied science (Dunlap, 1991: 76–77). With their Leopoldian background, the Americans came with the opinion that a distinctive form of "African" pastoralism was possible that meshed livestock with game "farming" (Dasmann, 1964: 22). They sought a new approach, one that bridged the divide between wild and tame, in which game was conceptualised in a similar way as cattle, sheep or goats. This would not only have the desired practical outcome of an increased supply of protein, but agricultural productivity would be achieved with consideration for the environmental sensitivity that was

developing worldwide in the early 1960s.

As a research post, Southern Rhodesia had advantages over South Africa at the time. First, unlike South Africa which was well on the path to becoming a republic outside the British fold, there was a benign political climate within the British Commonwealth and a cooperative engagement with the local agricultural authorities. Indeed, in 1958 the Southern Rhodesian government had created a national Department of Wild Life Conservation to research and control game outside national parks. Second, there was considerable public interest in wildlife, generated by "Operation Noah" that removed many thousands of wild animals from the site of the Kariba Dam that was then under construction (Child, 1996: 355–367).

The work of the British scientist Fraser Darling, as well as that of the Fulbright scholars, was timely in terms of the incipient new thinking around pastoral issues in Africa, including South Africa. These included an emphasis on a population in need of protein, which the Food and Agriculture Organisation estimated in 1966 was growing at a rate of 20 million a year. This population explosion was occurring at a time when agricultural production was falling by 5% on a per capita basis in the developing countries, causing malnutrition in as much as one-third of the world's population (Ovington, 1963; Crawford, 1968). The men in Rhodesia were also imbued with fresh environmental ideas that were given expression in the IUCN meeting in Warsaw in 1960 around the "Africa Special Project" that aimed to promote ecologically appropriate game cropping (Nell, 2003: 59, 146). Moreover, current scientific research was demonstrating that wild animals, ungulates in particular, increased quickly in number and that there was a market for them. The publications of Dasmann and Mossman, written for a popular as well as a scientific audience, informed a new generation of rural managers and farmers and generated a great deal of interest in the sustainable utilisation of African wildlife (Darling, 1960a,b; Dasmann & Mossman, 1960, 1961; Dasmann, 1962a,b; Dasmann, 1964; Talbot *et al.*, 1965; Mossman, 1975; Mossman & Mossman, 1976).

Fundamentally, the Rhodesian research – so influential on South African scientists – recognised that much of Africa was arid or semi-arid and that, because of a "preference for a tame meat and milk supply in place of a wild one", together with Africa's indigenous "cattle culture" as a marker of wealth and status, livestock had been encouraged to spread into unsuitable habitats which created overgrazing of the vegetation and led to substandard animals and breed deterioration (Dasmann, 1964: 21; Nell, 2003: 65). In these marginal areas, game was exterminated and livestock protected, necessitating expensive infrastructure to support cattle by way of fencing, water supply, additional feed and – very often – agricultural subsidies. Moreover, the spread of disease from game to cattle – which Dasmann thought had been "exaggerated" by vested interests – had led to the slaughter of many thousands of wild animals. Referring to wasting the "wild" meat only to support a "tame" supply as "government sponsored madness", Dasmann began from the premise that wild animals "produce" meat in the same way as livestock. He hypothesised that wild game would eventually be shown to be more efficient producers, because different species used the veld differently in their feeding habits (they found nourishment in distinct vegetation niches) and could survive the ingestion of many species of poisonous plants. They could also travel further distances than cattle without losing condition and they had a much reduced need for water. In theory, therefore, wild ungulates were the perfect "farm" animal. The research at Hendersons was complex, and involved population studies, game counts, harvest-

ing levels, feeding habits, birth rates, carcass weights, hunting techniques, comparative costs of cattle versus game and the possibilities of developing new domesticated species (Dasmann, 1964).

The prospects were promising, but there were legal obstacles that combined with real practical and scientific challenges around disease and marketing (Dasmann, 1964: 39, 48, 53–56, 60). Dasmann did not underestimate the problems confronting the new industry. One was the "unpleasant business" of market hunting, the emotionally "disturbing" nature of large-scale game slaughter done in a manner so as not to spoil the meat. Those involved apparently remained at their dreadful task only by reminding themselves that the alternative to finding a solution to the cattle–game dilemma was the extermination of game. There was a conservation imperative involved. In addition, there were problems with dressing the carcasses and storing them hygienically in a hot climate with makeshift facilities that could not be shared with cattle. The first efforts at commercial biltong-making were failures, and an initial marketing success was mitigated by the quick saturation of the venison demand among whites and the too-high cost of the product for blacks (Dasmann, 1964: 56; Westcott, 1984). Many of these conclusions and characteristics were later to apply to South Africa too.

In particular, however, Dasmann emphasised the "fundamentally conservative and tied to tradition" mentality of governments and their agencies, an issue that was to prove significant in South Africa in retarding the growth of game ranching (Dasmann, 1964: 71). But as Crawford expressed it, "with the human population increasing at the present logarithmic rate, the need to break away from tradition and explore new possibilities becomes a matter of real urgency" (Crawford, 1968). Despite the optimistic tone of his book, Dasmann ended with a caution that he could not "present a bright picture" because so much remained to be done to prove whether the initially promising studies would, in fact, lead to permanent success and to new agricultural and land use patterns (Dasmann, 1964: 70–73).

The project at Doddieburn Ranch showed that large properties could ranch game and cattle simultaneously but it had also stimulated ecological research and training, including studies around the domestication of eland and buffalo. Indeed, it had been responsible for the start of crocodile farming, the "intensive" arm of the industry. But above all, it had shown the importance of private landholders, such as the Hendersons, in taking the lead (Cumming & Bond, 1991: 3, 6), a trend that continues today (Du Toit, 2007). Rhodesia adopted the ideas and the research of these academics enthusiastically, and it did not take long for legislative and policy changes in that country to provide incentives and government support, including permits to harvest game and market the meat. In 1964, a number of game departments were amalgamated into a national body in which a wildlife research branch was established to service the emerging game ranching industry. What had taken place in Rhodesia inspired a number of professional scientists in South Africa and their efforts are analysed later.

### Sustainable wildlife utilisation in South Africa: The role of conservation authorities

#### The National Parks Board and the Kruger National Park

Once there had been scientific acceptance that killing wildlife commercially was ecologically acceptable (even desirable), the first place in which it was practiced as an industry in South Africa was not on private farmland, but in the Kruger National



Park by a growing staff of professional wildlife managers and ecologists. In the 1960s ecological studies there had, like the research at Doddieburn Ranch, indicated the “carrying capacity” of the landscape and how “acceptable” numbers could be determined and the “excess” cropped (Talbot, 1964; Liversidge & Van Eck, 1994). This manipulation of wildlife would come to be called “command-and-control” or “management by intervention” and it is distinct from the newer paradigm of “adaptive management” (Venter *et al.*, 2008; Du Toit *et al.*, 2003; Gunderson & Holling, 2002). In order that the number of animals remained in “equilibrium” with the food supply – a stocking density concept – scientific work in South Africa’s national parks was at that time conducted on population dynamics and herd structures. Vegetation was monitored from fixed point photographs to determine feeding habits and appropriate carrying capacity. Complex modelling determined optimum numbers of different species, and sophisticated aerial census methods, by fixed-wing aircraft and helicopter, were developed. Game capture, sedative darting and translocation created interesting scientific problems which were solved by biological study and by – more often – developing and refining equipment, technology and tactics (Visagie, 1968; Kooy, 2002; La Grange, 2006). This form of management also led to the most controversial of the interventionist regimes, the culling of “excess” animals, and the construction of the abattoir near Skukuza rest-camp in the Kruger National Park which had so horrified Leakey and from which, in the form of dried, fresh and canned meat or provided as staff rations and for workers at nearby mines, wildlife was turned into a saleable item at state expense (Brynard, 1967). Or, as one of the veterinarians in the Kruger Park responsible for the culling expressed it, “sold commercially to offset the considerable investment in equipment and manpower needed for control operations” (De Vos *et al.* 1981). Over a fifteen-year period (1968–1983) 9456 elephant, 25 857 buffalo and 828 hippopotamus were killed (De Vos *et al.*, 1983; Brynard, 1967; Pienaar, 1983). In many respects, the Kruger National Park was run on game ranching principles, but being a parastatal entity, it did not compete with the private sector or have to report to an unsympathetic and bureaucratic Department of Agriculture.

#### *Provincial nature conservation authorities*

At the time, animal husbandry in South Africa (particularly in the Transvaal) was well advanced and experts were well poised to take up and test Dasmann’s ideas and turn them into scientifically valid projects. But owing to rigid ideas about what constituted “agriculture”, this proved impossible to push forward. The formal agricultural sector lost its chance to promote and develop what was clearly to be an important growing trajectory in environmental management and land-use. It was left to the conservation authorities to take the lead, and the role of the Kruger National Park in wildlife ranching has already been mentioned. However, the provincial nature conservation authorities in South Africa, the agencies responsible for provincial game reserves and hunting legislation, also began to take an interest in the emerging science. The Transvaal nature conservation authorities took the lead in this regard and are thus employed as the example here. They began much needed baseline studies in their nature reserves such as Nylsvley, S.A. Lombard, Percy Fyfe and Loskop, often with the help of outside workers (Bigalke & Bateman, 1962; Vincent, 1962; Kettlitz, 1962b,c). As the report of the 1945 Transvaal game commission had indicated, there was a new generation of South Africans who cared for game and farmers who protected it, and in the fifteen years since the Transvaal Division of Nature

Conservation had been founded, it had educated the public about nature conservation and had also embarked on a number of research projects, a development that had not occurred in the rest of the country.

Some of these results were publicised in the Division’s informal journal *Fauna and Flora* and they provide evidence of the enthusiasm with which game ranching and game farming (the terms were used interchangeably at this time) were debated. Steyn’s 1961 article emphasised the fact that farmers often pursued inappropriate livestock practices and that stocking with game would be fitting in many marginal areas (Steyn, 1961). Van Zyl (a zoologist) dealt specifically with eland, but he, like others, appreciated that before eland could be considered either as a ranching animal or for possible domestication, more research and statistics were required (Van Zyl, 1962, 1968; Posselt, 1963; Roth, 1970; Skinner, 1971a; Lightfoot & Posselt, 1977). Buffalo was also a species earmarked for ranching, particularly because it responded well to artificial feeding, and from one to eight years of age increased in weight from 203 kg to 680 kg, producing meat that had no unpleasant odour and was very similar to beef (Van Zyl & Skead, 1964). As far as springbok were concerned, formal experiments conducted by the Transvaal Division of Nature Conservation on the S.A. Lombard Reserve had confirmed that they bred throughout the year and yielded a 60% edible carcass, not very different from buffalo and eland (Van Zyl, 1968).

Ungulates – blesbok, springbok and impala (*Aepyceros melampus*) – were already being “farmed” by some landowners, despite the extremely low prices live animals had fetched in 1961: springbok dead were fetching R4, and alive R12 per animal, impala dead R10, and live up to R40 (Kettlitz, 1962a,b; Riney & Kettlitz, 1964). These were not prices that would encourage commercial farmers. By 1966, at the height of the drought that characterised that decade, prices had not improved; in the Pretoria public market, duiker (*Sylvicapra grimmia*) went for R4–4.20, springbok, R6–10, blesbok R8–14, impala R7 R16, blue wildebeest (*Connochaetes taurinus*) R17–20 and kudu (*Tragelaphus strepsiceros*) R30–55 (Steyn, 1966).

Kettlitz also became involved and he too stressed the paucity of reliable knowledge around the broader subject of running game on farms: issues such as carrying capacity (the term “grazer unit” came into use because the carrying load is more complex to determine for game than it is for cattle or sheep because of the greater dietary variety and diverse eating habits), enclosure size, territorial behaviour and veld management were virtually virgin fields for research. Kettlitz, however, expressed concern that the enthusiasm for “wildlife” might result in exotic species being farmed, or even in using indigenous species in areas in which they had never naturally occurred (Kettlitz, 1962a,b; Riney & Kettlitz, 1964), matters which are still of relevance today.

#### *Commercial agriculture and science*

By the mid-1960s the aesthetic and emotional value of wildlife was well established, but given the sums of money mentioned above, the commercial prospects were still the subject of debate. The drought conditions of the 1960s had contributed to raising the profile of ranching with game but, as Steyn (1966) cautioned, many of the claims were exaggerated. In Uganda, for example, research by Petrides and Swank indicated that game was four times as productive as domestic stock, bred faster, suffered less from disease, needed less labour and range management and utilised the landscape more efficiently and thoroughly. However, there were some who thought that such results might not apply in South Africa, where the range

of animals that could be farmed on private property was limited. Moreover, game ranching was not only a scientific problem that required detailed and controlled experimentation and data, and many in the highly economically developed circumstances of South Africa appreciated would only be successful if there was adequate marketing and a strong profit motive. In this regard, Steyn (1966) considered that opening areas up for sport hunting might bring in more income to farmers than ranching for meat, a prediction which eventually proved to be correct – according to Du Toit (2007: 60) recreational hunting today is generating R3.1 billion in comparison with meat production of only R42 million.

Together with considering how best to manage game went new ideas and developments around transport and sale. South Africa is unusual in that it is one of few countries where indigenous wildlife can be traded. The Nature Conservation Division in the Transvaal found that blesbok, which were easy to maintain in fairly small enclosures, sold well, but there was a high attrition rate through the manhandling that took place with translocation. By 1968 various methods were being tried and they could be compared with each other, but the most reliable and safest had not yet been determined (Visagie, 1968). Work on this aspect of wildlife management was ongoing and exciting. After heavy losses at the start, Harthoorn, in collaboration with Ian Player of the Natal Parks Board and U. de V. Pienaar of the Kruger National Park, developed an efficient immobilising dart, boma (enclosure) design was modified (the “Oelofse boma” (Du Toit, 2007: 18; La Grange, 2006) and the stress levels of the animals minimised (Kettlitz, 1983). Today game auctions are a regular feature of the South African agricultural enterprise with both private sellers and sales from game reserves and national parks: this was a 1960s novelty that took off at once (Ebedes, 1994) and it has a monetary value currently of some R94 million p.a. (Du Toit 2007: 52, 60). Apparently, what was probably the first ever game auction took place in 1965 on Peter Knott’s farm “Werkplaas”, near Tshipise in what is now Limpopo Province, and it was followed by other private auctions before the nature conservation departments of the Transvaal and the Orange Free State and the Natal Parks Board entered the industry, often pleased just to give abundant game species away (Liversidge & Van Eck, 1994: 54; Nell, 2003: 99; Van der Merwe & Saayman, 2004) (Figure 4).

Interest in game ranching was aided by the fact that during the 1960s drought in South Africa beef prices were depressed. This made game ranching attractive to progressive farmers and some led the field by practical application without waiting for scientific validation. Because of the rangeland required for ungulates, it was the wealthier farmers with very large tracts of land that formed the “core leadership” of innovation. In Natal, this included Charles Tinley and Ian Scott-Barnes, while Andrew Conroy (of “Biesjesfontein” near Victoria West), Sidney Rubidge (of “Wellwood” near Graaff-Reinet) and P.H. Bunton were others (Nell, 2003: 97, 158; Marchant, 1985).

### SCIENTIFIC PARTNERSHIPS

The helpful intervention of the conservation agencies – the Transvaal in particular – has been outlined above, but more important in the South African context was the retarding role played by the Department of Agriculture, the organ of state tasked with protecting the country’s farming industry and which had, throughout what had passed of the twentieth century, been inimical to any interface between game and domestic stock. The Department had come into being with the Union of South Africa in 1910 and was by far the most powerful of the various branches dealing with veterinary matters. Issues

around disease were compelling, particularly because memory of the 1896 rinderpest that destroyed almost all cattle in southern Africa was so searing. The Department had no department or division that studied indigenous animals or plants for their own sakes, they were only objects of research in terms of their impact on modern agricultural practice – agribusiness – in the forms of vermin, pests or poisons. However, the Department’s research agenda did include the development of ecologically appropriate farm animals using “indigenous” cattle, and in this regard the research at Mara and Dohne Agricultural Research Stations in producing hardy productive varieties such as Bonsmara cattle as well as Dormer and Dorper sheep was prioritised, but not research into game. Essentially, the Department regarded its duty – and it was involved principally with white farmers, not blacks – as creating a neo-Europe, giving attention to export crops and agrarian research rather than promoting the use of indigenous fauna and flora.

In 1961 Transvaal Nature Conservation Division’s T.J. Steyn was correct to note that game ranching would never succeed unless there was cooperation and commitment from the Department of Agriculture and this was not forthcoming. Steyn appreciated the weak position of the various conservation administrations which had no say in the management or allocation of the country’s natural resources, nor were they in any position to offer inducements to farmers to use their land in novel or ecologically sustainable ways (Steyn, 1961). Still locked in the mindset of the 1920s, the Department of Agriculture was averse to game ranching, no doubt over real fears of disease and veld management, but also because it was determined to protect vested interests and traditional operations and research agendas that had been devised decades before. Moreover, the South African game meat market was principally driven by biltong rather than fresh, high-quality venison. The biltong market opened up in the 1960s as many of prohibitions on its sale were removed, and part of the Department’s reluctance to support the industry may well be related to the fact that effort invested in research into low quality meat was simply not rewarding, scientifically or economically (Nell, 2003: 109–110).

There were, however, a few scientists in the Department who, interested in what Dasmann and Mossman had done in Rhodesia, appreciated that animal husbandry had the potential to benefit commercial game ranching and thought that it was worth testing scientifically, even if the results would be slow. Working without the knowledge of his superior because he knew that he would not have approval, the young scientist J.D. Skinner was one of them, and he set out to apply “sound principles of animal production” to the problem (Skinner, 1975a,b; Skinner, n.d.). Skinner took the view that there were two specific regions in which antelope might prosper more than livestock. First, where poisonous plants such as *Dichapetalum cymosum* were abundant, and second, where there was a shortage of drinking water. The connection between grazers and browsers required closer investigation. Browsers, such as kudus (*Tragelaphus strepsiceros*), do not compete directly with sheep and other grazers so they assist in veld management and under extensive range conditions they can “produce more efficiently, grow as fast, dress out at a higher percentage carcass, and yield a much higher percentage of red meat” (Skinner, 1985).

There were other aspects of the research agenda that concerned scientists such as Skinner who had been appointed to the new Research Institute for Animal and Dairy Science, Division of Animal Physiology, at Irene, near Pretoria in 1971. This turned out to be a disappointing stint, without specific

leadership or projects and he therefore decided to pursue his interest in game ranching. Using connections he had forged a few years earlier, he began research at the S.A. Lombard Nature Reserve with the collaboration of M. von la Chevallierie, a meat scientist at Potchefstroom Agricultural College (Skinner, pers comm.). Nell mentions other tentative joint initiatives that commenced at this time, including those between the Kruger National Park and the Department of Agricultural Technical Services on wildlife grazing habits that began in 1962, between Van Zyl, of the Transvaal Division of Nature Conservation at the S.A. Lombard Reserve and the Department of Agriculture, as well as liaison between the Department of Agriculture and the Natal Parks Board on eland research (Nell, 2003: 61–63).

There was much to be done in terms of research to confirm or even elucidate and replicate the initial conclusions of Dasmann and Mossman. In the first instance, it was not proven that wild animals do not compete with each other for grazing although this was often stated as a fact. Second, interest began because poor people in Africa required additional sources of protein. Game ranchers, however, obtained far more income from supplying meat to high quality outlets or to Europe and receiving foreign currency in exchange and it appeared that there was cultural resistance from black Africans to purchasing game meat (Kyle, n.d.). Then, some species were disappointing, despite a high level of research, of which eland, eventually, was one. Even the expectation that farm management responsibilities would lessen, needed testing (Van Zyl & Skead, 1964; Van Zyl, 1962, 1968; Skinner 1971a,b; 1975). The euphoria of the early 1960s that the advantages of game ranching in terms of disease resistance, a broader spectrum of primary production, highly fecund species, high dressing out percentage, lower fat levels and overall, less demanding husbandry, soon dissipated in face of more detailed studies (Grossman *et al.*, 1999: 262–263).

The scientific challenges in which the Transvaal took the lead were principally around energy use and the need for careful experimental research that was directly related to agricultural productivity. For example, it may be possible to make biltong out of large, mature animals shot for trophies, but if tender meat is required, then young animals needed to be studied in terms of nutrition and resilience to environmental and other conditions. It was slowly emerging that game species do, in fact, compete with one another for food, there is little substantial long-term evidence that they out-produce domestic stock, and it is generally difficult to compare wild animals with domestic ones because the latter have been selected for fecundity and productivity, while wildlife has been selected for other attributes, principally survival (Grossman *et al.*, 1999: 263).

### Specific species research

Early research concentrated on those species that had earlier been identified as possible subjects for domestication. The eland was the most obvious because it was so similar to cattle, with high quality meat and a docile nature. In the late nineteenth century a herd of eland was taken to Askania Nova in the southern Ukraine where there had been considerable success and thus profitable comparisons and deductions could be made with local South Africa herds (Skinner, 1966; Lightfoot & Posselt, 1977). However, despite initial promise, even by 1971 it had been concluded that the prospects of eland ranching had been over-estimated because it was so difficult to exploit the advantages, namely a higher reproductive rate than *Bos indicus*, physiological and behavioural adaptation to hot, semi-arid environments and a diet that might include plants that are poisonous to stock. Certainly, eland might thrive where the climate was harsh and the parasite load heavy but, in

such remote parts of the country, marketing was an almost insurmountable obstacle, given the large size of the animal and the distance from the sophisticated abattoirs that would be required. In addition, eland were timid creatures (although dangerous when cornered) and agile jumpers, almost impossible to constrain by fencing, they required a great deal of space and were extremely susceptible to ticks. They were also extremely expensive animals to buy. Intensive ranching with eland was simply not an economic option (Skinner, 1971a). Proving how economically viable extensive game ranching really would be, was yielding rather disappointing results.

Another species on which research was done was the mountain reedbuck (*Redunca fulvorufula*). Using a herd at Loskop Dam Nature Reserve in the early 1970s as research subjects, I.R. Irby was initially optimistic because the venison is highly palatable, the species grazes in rough terrain, it has a high reproductive rate and its social structure and territorial behaviour spreads the population over the available habitat, thereby reducing the possibility of over-grazing. But these same advantages were, in fact, disadvantages from a husbandry point of view, because the widely spread population and limited habitat of stony ground that mountain reedbuck preferred made it extremely difficult to hunt. In addition, population levels were very low (Irby, 1975). Easier to work on were blesbok because they adapted to grazing in paddocks and respected conventional fencing. By the early 1970s considerable research had been done on this tractable species (Skinner, n.d.). Scientists also worked hard on springbok in the late 1960s and early 1970s. The accepted opinion was that the dressing percentage was higher for game animals than for domestic stock, and Van Zyl, Von la Chevallierie and Skinner did controlled experimental comparisons between impala, springbok and Dohne Merino sheep. Springbok came out with a higher dressing rate than sheep, but only about the same proportion as cattle, which were, of course, far easier to farm (Van Zyl *et al.*, 1969; Skinner *et al.*, 1971; Von la Chevallierie & Van Zyl, 1971; Skinner, 1972b; Liversidge & Gubb, 1995). Impala are not sympatric with springbok and it was assumed that, although they switch from grass when it lignifies, they might be farmed in those northern areas where springbok cannot occur. Once again, the subject proved to be full of assumptions, theory and short-term studies that were not necessarily scientifically valid (Talbot *et al.*, 1962; Talbot *et al.*, 1965). In more careful research, it was found that impala in numbers degraded the veld, required considerable skills which most farmers and their labourers did not have, and that they were only profitable if the overhead expenses were carried by beef farming (for which government subsidies were available) (Collinson, 1979; Carles *et al.*, 1981; Kreuter & Workman, 1994).

### NEW ORGANISATIONAL STRUCTURES AND THE ROLE OF THE DEPARTMENT OF AGRICULTURE

Scientific results cannot be implemented if there is no organisational structure through which to disseminate and support them. If the 1960s and 1970s were decades of initial and follow-up basic scientific research, the 1980s ushered in a period of broader economic and statistical research as well as changes in organisational arrangements in game ranching, including, in 1988, the first International Wildlife Ranching Symposium held in Las Cruces, New Mexico. Despite the lack of engagement from the Department of Agriculture, the number of specialist academic studies on game ranching increased. These led to the founding of a number of organisations to promote the subject and the training of researchers, some of which overlapped with the ecological research that

had been done and the need for wildlife management principles to be taken forward in the public as well as in the private sector.

Formal support in the educational sector for wildlife management was initiated during discussions at the University of Pretoria in 1962 and a one-year postgraduate BSc Honours course in Wildlife Management came on-stream at that University in 1965, led for a six-month period by George Petrides of Michigan State University who had worked extensively in East Africa (Eloff, 1971a). The purpose of the Centre for Wildlife Management was designed to assist those “actively engaged in nature conservation in national parks and provincial, municipal and private nature reserves and even on the large number of farms where herds of wild animals are being farmed” (UP Archives file C-3- n.d.). In the year that this course began, the same university (also with the support of the Transvaal Division of Nature Conservation’s T.J. Steyn as well as the Smithsonian Institution in Washington D.C.) established the Mammal Research Institute with taxonomist Jurgens (Waldo) Meester as its first Director (Bennett, 2008). While the Centre for Wildlife Management concentrated on the practical and applied aspects of wildlife management, the Mammal Research Institute was specifically tasked with the science. As Eloff expressed it in 1971, “soon after the commencement of the wildlife course a serious shortcoming in our curriculum became obvious – nature conservation and wildlife management must be based on a scientific knowledge ... we simply do not have these facts at our disposal ... fauna research, especially on the mammals of South Africa, must be initiated [sic] immediately” (Eloff, 1971b). Subsequently, a similar programme began at the University of Stellenbosch in 1972 (Hey, 1977: 156). Almost two decades later, in 1988, the first veterinarians could be trained specifically on wildlife diseases at Onderstepoort (Du Toit, 2007: 24). Thus an educational infrastructure – which remains divided between the pure science and the applied technicalities – was set up to service the new industry. Moreover, private wildlife consultancies began in the mid-1960s, and in 1970 the South African Wildlife Management Association was founded (Nell, 2003: 68–73).

Despite the fact that game ranching was envisaged as a solution to a number of challenges facing livestock farmers at this time, government support was not forthcoming (Skinner, 1984b). The costs were high. Restraining animals which could jump over high fences demanded an enormous investment in high quality fencing. Methods of slaughter were more expensive than merely transporting docile live animals to accredited hygienic abattoirs as could be done with cattle. The use of costly helicopters was proving to be the most effective means of mustering game and, at times, shooting from the air was the most efficient manner in which to kill large numbers. Alternatively, game could be driven into bomas but skills were involved in doing this, and these were not generally available. The actual shooting was also problematic, because in the act of killing, bullets that entered or damaged the gut of the animal spoil the carcass. The costs of dressing the carcass and cold storage and transport were also impossible for a farmer to carry without government financial assistance. In South Africa at that time, there was tax relief, easy Land Bank credit facilities and government support for white farmers who wanted to fence for livestock, there were subsidies for marketing, transportation and infrastructural development. In addition, export drives were government-led and there was a reputable extension and research service that provided advice and information. None of this support was available for game ranching – as has been explained, wildlife was not even the property of the

landowner – and the Department of Agriculture was very reluctant to tamper with the *status quo*. To be fair, it is also possible that the Department appreciated that “wonderful illustrated lectures in East Africa” given by non-African zoologists overstated the case for game ranching. The necessary research had never actually been done, indeed when it eventually was, many of the initial hypotheses were found to be flawed (Skinner, 1989).

The Department of Agriculture and Fisheries could not, however, ignore the developing game ranching industry indefinitely, particularly as the country’s game reserves and national parks were producing wildlife at an increasing rate and either culling it or selling it to get rid of the “excess” that accrued when managed within a paradigm of stability and equilibrium. It was also clear that many scientists and technicians were intensely interested in the opportunities that were opening up to them through developments in provincial nature reserves and on private farms. Important research topics of considerable national and international importance were being developed. Moreover, by the 1970s wildlife tourism was a growing economic sector in South Africa and, despite the opinion of the 1945 Transvaal Game Preservation Commission that wildlife on private property would never become important from a tourist point of view (mentioned previously), this was, in fact, beginning to occur. Something had to be done to satisfy the growing demands of the private sector for organisational support and financial security in husbanding wild ungulates, both for tourism and for farming.

There is no doubt that pressure was brought to bear by farmers who wanted tax concessions if they fenced their properties, because only by “enclosing” wildlife could any kind of control be exercised over it, as ownership was not legally possible. The Department was reluctant to make a move, appreciating that when it did so, the state would be obliged to find large sums of money. As many have observed, government bureaucracy is notoriously slow to accept transformation, being hidebound by long-established practices, particularly if a cost to the fiscus is involved. Moreover sustainable management ideas were new, as was the notion – after centuries of destructive activity – that wildlife had a growing economic value similar to that it had enjoyed almost a century before (Child, 1971: 75–77).

Others appreciated better than the Department of Agriculture and Fisheries that changes in the agricultural paradigm would be environmentally and economically beneficial to South Africa. Debates began in public fora. From the scientific community came Skinner who, in 1971, contributed a significant article to the *Farmer’s Weekly*, a magazine widely subscribed to in South African farming circles (Skinner, 1971b). Further evidence of growing public interest in the subject was provided by James Clarke, a popular and influential newspaper journalist who specialised in environmental topics. In 1974 he published *Our Fragile Land: South Africa’s Environmental Crisis* in which he lamented that the momentum begun by Dasmann and Mossman had been lost. Most of the problems, Clarke argued, were bureaucratic. An extension service was lacking, financial assistance was not forthcoming, penalties for infringing agriculture or nature conservation provisions were not uniform, indeed the law was either confusing or there was no appropriate law at all. The country’s most marginal lands were being compromised by the introduction of cattle at government expense. While praising the work of the Transvaal Division of Nature Conservation and some of the scientists who worked in collaboration with it, the results so far had been rather puny. As others had done, the journalist pleaded for

some kind of centralised wildlife administration and rationalised research and farm management to take the emerging industry forward (Clarke, 1974: 108). Numerous articles in similar vein appeared in the popular journal *African Wild Life* published by the Wild Life Society of South Africa (Skead, 1950; Lundholm, 1952; Moe, 1953).

Eventually bowing to pressure from the public and from landowners, on 22 February 1974, the Department established a Directorate Committee for Game Farming tasked with formulating official policy. The Committee, which consisted of seven people, included two whose opposition to game ranching was well known, so the prospect did not look rosy. The chairman was A.J. Pienaar, whose field of expertise was pasture management, and who was wedded to the idea of rotational grazing systems which, of course, had no place in game ranching. Another antagonist was P. Mansveldt, the former state veterinarian at Louis Trichardt and later Chief Director of Veterinary Field Services, who was adamant in his belief that wildlife would infect the country's livestock herds with disease (Skinner, 1984b). Most receptive to new ideas were D.M. Joubert, then Assistant Director in the Department of Agriculture and Fisheries for the Transvaal Region, and W.K. Kettlitz, of the Transvaal Division of Nature Conservation. Although it must be appreciated that the task of this committee involved many interviews and site visits, the fact that its report (which was confidential) took six years to complete would suggest that it did not regard its undertaking as a matter of particular urgency. During the time that the Committee did its work, game ranching was described as "a story of fear, secrecy, prejudice and plain muddle" (Bond, 1977), and many hoped that the Committee would come up with a workable policy to assist this growing sector.

In the light of the powerful animal rights movement of the early twenty-first century and the international anti-hunting lobby, it is interesting to observe the absence of debate in South Africa around ethical issues in these earlier decades.

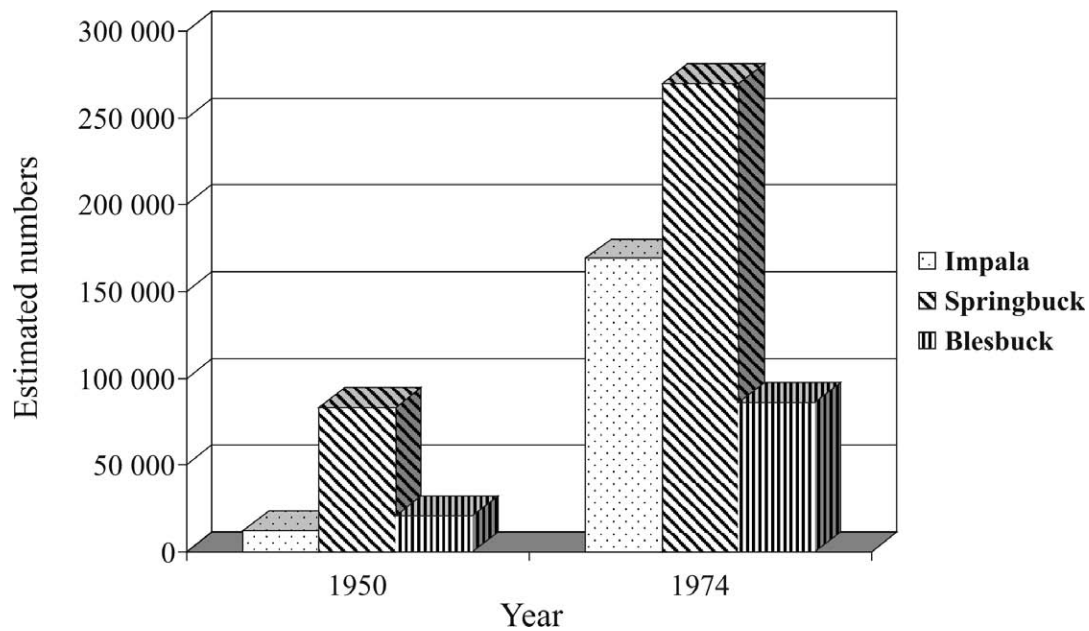
Certainly there were controversial aspects to killing game for the market, but those who were involved tried to develop techniques to lessen animal suffering, for example, by using immobilising darts, humane transportation and the harvesting procedures discussed previously (Halse, 1994; Cooper, 1995). In 1984 Keith Eltringham, at that time a lecturer in applied zoology at the University of Cambridge and formerly chief research officer in the Uganda National Parks, raised the subject internationally, pointing out the danger of conflating economic and ecological management imperatives. He explained that the valid economic motive for exploiting game, as a natural resource, for food should not be masked by false arguments over ecology and a conservation imperative for the "need to reduce stocks for their own good" (Eltringham, 1984: xi). Extensive game ranching was proving to be an interesting mix of practical farming, sophisticated science, emotional and ecological nature conservation philosophy and economics, not all of which research or expertise pointed in the same directions at the same time.

While the committee was slowly collecting its data, the industry prospered under the leadership of game ranchers themselves (Baard, 1984) (Figure 3). Andrew Conroy (Conroy, 2002) was one, and in 1976 he addressed the Symposium of the Game Owners Association on "Venison production and marketing". Concentrating on springbok venison, he voiced his opinion that it was "one of the most under-rated assets possessed by us ... the more I have eaten of it, the higher my regard for it". The demand for venison grew in the 1970s and suppliers were able to meet it. In 1972 the first venison was exported from South

Africa (Conroy, n.d.; Conroy, 1976) and, after the global slump of 1973 which adversely affected wool and livestock prices, many farmers converted to extensive game ranching despite the lack of government support. Together with local consumption, exports increased, particularly to Germany, which was the largest importer of game meat worldwide. During 1973 and 1974 cold-rooms were built in high production areas around South Africa, to which farmers could bring their freshly killed animals. South African venison producers had to work hard to expand their exports because transport costs were high, veterinary regulations unrealistically stringent (in comparison with Europe or New Zealand) and there was no government assistance (Westcott, 1984). The growth of venison exports was greatly helped by the fact that more efficient field harvesting techniques were being employed (Bigalke, 2000). Increasingly, helicopters were effectively used and most killing was done at night using spotlights, which had been shown to stress the victims less and thus did not detrimentally affect the quality of the meat. Apparently as many as eight springbok could be killed every hour by a single person from a vehicle at night using a spotlight and a high-powered rifle (Conroy, n.d.). In addition, not only was it catalysed by a growing tourist industry, game ranching was also given an impetus by political circumstances in South Africa because at that time the African "homelands" and "Bantustans" were being consolidated with significant boundary changes, there was general rural insecurity, higher labour costs and a rise in stock theft. Particular areas proved favourable for game ranching, Prieska in the northern Cape, the northwestern Transvaal around Ellisras, Zululand and the Vryheid-Dundee region of Natal. Despite the inconclusive nature of the science and the lack of state support, the industry began to flourish (Nell, 2003: 100–102).

Meanwhile, in comparison with the slow-moving situation in South Africa, Rhodesia was forging ahead with extensive ranching, accelerated by the *Parks and Wildlife Act* (Act No. 14 of 1975) which formalised categories of wildlife and categories of land, as well as giving landowners a high level of control and use rights of wildlife on their land (Wolmer, 2005). "Ownership", for that is what it was in practice, gave great incentives to ranchers to care for and maintain "their" wildlife herds and this led to improved infrastructure around capture, killing and processing (Bell, 1987: 75, 91). On the other hand, as Nell (2003) reminds us, in 1977 all hunting was banned in Kenya in an effort to halt the extermination of the country's wild animals, and South Africa benefited thereby, as well as from the perception that trophy and recreational hunting was safer in South Africa (Kettlitz, 1983; Kock, 1995). Before long, hunting rather than controlled husbandry was the most popular form of game ranching in the subcontinent. In 1980 some 6 421 00 African mammal trophies (about 88 different species) were imported into the United States, of which 60% were from South Africa (Nell, 2003: 115).

Despite the lack of support from the Department of Agriculture and Fisheries, the 1970s were extremely productive years for research on game husbandry. Many of the studies were conducted on provincial nature reserves and a partnership between scientists in different government agencies was a beneficial result (Skinner, 1984b). Throughout this decade a number of South African animal scientists were putting statistics to the overstated benefits of game ranching as expressed by Dasmann and Mossman and by East African workers (Huntley, 1971; Asibey, 1974; Eloff *et al.* 1973; Skinner, 1973, 1975; Berry, 1975; Collinson, 1979). For example, although eland were theoretically better husbandry subjects than cattle or sheep, it was being established that no game was as efficient as domestic



**Figure 3.** Estimated impala, springbok and blesbok populations in South Africa in 1950 and 1974 (Nell, 2003: 159).

livestock at utilising energy or converting feed into liveweight (Skinner, 1971a, 1972a). Seasonal breeding was also a deterrent to efficient game ranching methods, despite game's higher reproductive rate and some successful experiments at manipulation. There was also the issue of a legally determined hunting "season" (only in winter) that applied to game ranching, which, together with the absence of administrative and technical support, hampered both research and practical efforts to determine the scientific merit and profitable future of the enterprise.

Indeed, the difficulties under which the work was done were immense, but the one that perhaps affected scientists most directly was the absence of applying agricultural production principles to the matter. It was all very well for farmers to shoot a few springbok or impala on their farms, descendants of animals that may have been there for decades, and turn them into biltong or rather tough cuts of meat – or even, in some cases, more tender ones – but this was not the manner in which to promote a sustainable effort at efficient commercial husbandry. Prices for wild animals were increasing, and it was becoming important to distinguish between those that were suitable to augment the farming sector and those that might be more profitably used in the tourism and trophy hunting industry. In addition, absence of research support had meant that there were many species whose suitability for ranching needed to be determined (warthog (*Phacochoerus aethiopicus*), for example), and this needed to be accomplished by animal scientists, not by zoologists or wildlife managers, and particularly not by expatriates working outside of South Africa in places where circumstances were quite different (Rogerson, 1968). In terms of social science research the cultural attachment of Africans to livestock still needed to be investigated and teased out so that more sustainable pastoral practices might be developed. As Marchant said of Natal in 1985, there was no basic ecological grounding, no clear objectives, and no appropriate management studies. Farms were being acquired for tax relief, stocked with too many species and were then badly run by unqualified managers (Marchant, 1985; Boonzaier & Collinson, 1985).

In 1980 the report of the 1974 Directorate Committee for Game Farming finally appeared. The group had consulted widely with other national and provincial departments and

established that many farms were devoted solely to wildlife (399 properties, 610 757 ha in extent) but very many more contained mixed livestock and game. The report identified numerous problems – overgrazing, selective feeding, seasonal production (which meant an erratic supply to the market as well as an irregular demand for hunters and facilities), disease and carrying capacity – and, perhaps predictably, far fewer advantages (poisonous plant and a wider spectrum of food source). It recommended that much more research be done on the subject – suggesting that the Mammal Research Institute at the University of Pretoria and various museums become involved – and outlined many of the areas which such research should cover. Much of the report was taken up with the question of which organs of state were statutorily responsible for the diverse aspects of game ranching, for example, issues of public health around abattoirs (which game farmers did not want to be as stringent as those that applied to beef) (Nell, 2003: 202), difficulties in defining game products legally as "agricultural" for purposes of subsidy and marketing, issues around "ownership" and whether wildlife should be classed as "animals", as well as nature conservation, disease control and overall sustainable development (Republic of South Africa, 1980).

The committee concluded its report with a number of recommendations that at last benefited game ranching. The most important was the recognition that "intensive wildlife ranching" be acknowledged as an official branch of "farming". The committee took into account that farmers had already made considerable capital investments in the industry, that it was an optimal use of natural resources, that it held promise for reversing bush encroachment and that, without adequate control, it might well damage livestock farming. For these reasons, intensive game farming was to be placed on the same footing as other branches of agriculture, and as befitted an industry in its infancy that needed to grow, it would receive research funding and the necessary information and financial assistance (by way of tax relief, subsidies etc.) from the Department of Agriculture. Additional staff would be taken on to oversee this newly accepted pastoral practice.

However, very disappointingly to some landowners, the committee expressly denied extensive game ranching, arguably the sector that might contribute most to sustainable develop-

ment and appropriate land use, the same status or the same privileges. Many of the obstacles in the way of carrying out the recommendations of the committee were not within its purview to resolve, but it suggested that these, for example, the matter of defining an "animal" in terms of agricultural, health, marketing and other legislation, be finalised as soon as possible (Republic of South Africa, 1980).

The committee's report was met with considerable pleasure in many quarters, for at least it seemed as though some of the research over two decades and private investments had paid off. Moreover, perhaps with some of the infighting and institutional politics in the Department laid to rest and new ideas accepted at last, the research agenda could accelerate (Skinner, 1984). At the meeting of the 1984 congress, Andrew Conroy, then chairman of the South African Agricultural Union's National Game Committee, was pleased to confirm that a number of issues had finally been clarified. First, the Department of Health was working on how best to handle venison in terms of slaughter and hygiene regulations. Second, a chair of Game Disease Science had been established at Onderstepoort, and an "Officer for Game Farming", D. Grossman, had been appointed (Conroy, 1984). Shortly afterwards, the South African Agricultural Union established a National Game Committee of South Africa with Conroy as first chair (Kok, 1984).

In addition, although actual "ownership" of wildlife had not been conferred on landowners, the matter was now unambiguous – if farmers could prove to the authorities that they had fenced in their wildlife satisfactorily, they were eligible for a "Certificate of Adequate Enclosure" from each of the provinces, a move that entitled them to subsidies as well as to other benefits. By the end of August 1982, some 1148 certificates had been issued in the Cape Province, relating to some 45 125 sq km, and representing 10% of landowners and some 26% of all private land in the province. In 1983, "game farm" status was accorded to some 528 properties in the Transvaal, while in Natal and the Orange Free State farmers were not encouraged to construct game fences, but rather to manage utilisation on mixed farms of a large area (Conroy, 1984). The Transvaal numbers soon rose to 711 in 1985 and to 1763 in 1993, fully 11.5% of this province (Nell, 2003:192). Overall there were apparently 1760 game farms in South Africa in 1987, covering some 6.2 million ha (Republic of South Africa, 1990).

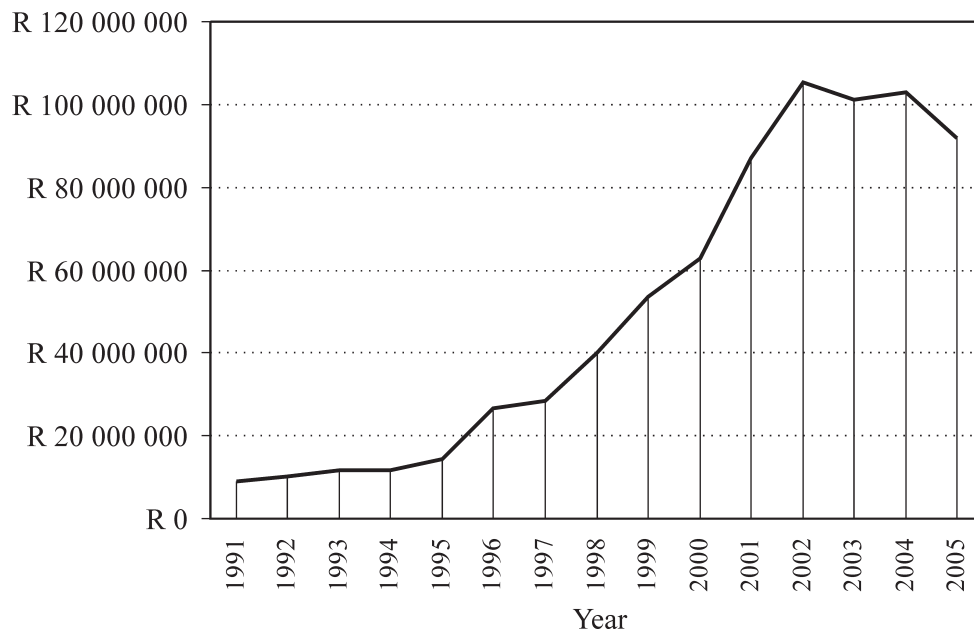
Around this period, more synthetic publications about game ranching began to appear (Conroy & Gaigher, 1982; Colvin, 1983; Bigalke, 1984; Coetzee, 1986; Stroleny-Ford, 1990; Small, 1992). Particular note in this regard should be taken of J. Du P. Bothma's edited tome entitled *Game Ranch Management: A Practical Guide on all aspects of Purchasing, Planning, Development, Management and Utilisation of a Modern Game Ranch in Southern Africa*, first published in 1986 (in Afrikaans) and currently in its 4th edition. At the time, Bothma held the Eugene Marais Professorship of the Centre for Wildlife Management at the University of Pretoria and his book is, as the English title indicates, a practical guide to game ranching in South Africa, aimed at the farmer and technician rather than the scientist. Since it first appeared, it has sold over 30 000 copies (Du Toit, 2007: 24).

In addition to an organisational structure and increased publicity, the effect of the committee's report was to give assistance to venison farmers. The 1980s were "the most punishing period this century" according to Conroy, then chair of the South African Agricultural Union's National Game Committee. With black African resistance inside the country growing in intensity and violence, the imposition of a new Constitution (1983), South Africa's military engagements in southern Africa

against those who assisted African National Congress exiles, and economic sanctions imposed by many countries, Conroy said that the fact that farmers were even planning for the future "said a lot" about their commitment to the land. Farmers needed to be "smart", to see what tourism might hold for them and also to consider diversification as an option (Conroy, 1984). It is somewhat ironic that these sentiments were expressed at a time when the venison industry was in peril. In 1982 South Africa was extremely high on the list of countries supplying venison to Germany, the biggest importer and the largest producer of game meat, consuming 40–50 000 tonnes annually and producing some 20 000 tonnes (Hartge, 1982). Through its feral and farmed red deer, New Zealand supplied some of the shortfall and was the favoured importer whose meat had an "unsurpassed reputation", South Africa a good deal of the rest (Hartge, 1982), and South African farmers came to rely on this lucrative outlet for their venison (Conroy, 1984).

In 1977 the venison trade was worth R4 million, by 1980, R9.7 million, but it then collapsed to only R8.3 million in 1981 and was down to a mere R5.5 million in 1982 (Baard, 1984). Although a number of sources mention this collapse (Luxmoore, 1985), only two provide an explanation. Apparently South African venison was sold as "red deer" or "roe deer meat" (which springbok and blesbok and impala lambs could pass for) and the market was built up on this subterfuge (Conroy, 1981). Australian kangaroo meat was also sold under the same name, "red deer". When this became known, there was an outcry and a backlash in Germany against all imported venison products and thereafter all game meat products had to be accurately described. Not surprisingly, springbok prices, that had been about R1.30 per kg in 1978 and had risen to R2.30 by 1982, plummeted to R0.80 at this time – and springbok accounted for 80% of the total South African export (Wildlife Trade Monitoring Unit, n.d.). No substantial domestic market had been encouraged, and there was accordingly a great local oversupply that seemed to herald very poor economic prospects (Bigalke, 1984). Exports recovered slightly in the later 1980s, only to be hard hit again after the reunification of Germany in 1989 when venison from the Eastern Bloc became available to Europe. At the time, the domestic market in South Africa simply could not absorb 60 000 to 70 000 springbok carcasses that had previously gone to Germany (Nell, 2003: 110–111). In the mid-1980s very few South African farmers depended on game ranching for their income. A survey in 1983 found that of 363 game rancher respondents, only four derived more than 50% of their farm income from game, 9% less than 10% and 239 referred to this as a "minimal" financial contribution (Wildlife Trade Monitoring Unit, n.d.).

Because of the economic significance of game ranching in all its various manifestations, some parts of South Africa have been studied in some detail. What emerges is an industry that is far from homogeneous, whether in terms of science or management. There is no single optimum "model", but a variety of game ranching templates that are dependent on the specific location, climate, vegetation and land use history. None of them, however, are in areas that were previously designated as "homelands". The work of Smith & Wilson (2002) demonstrates that in the thicket biome of the Eastern Cape province (south and central districts) the size of individual game ranches is relatively small and that conservancies, or joint management structures that frequently include the provincial conservation authorities, are important in contributing to the overall success of game ranching. Constraints include the extremely high cost of establishing a game ranch in that area and this has the consequence that the agricultural norm is a mix of livestock and



**Figure 4.** Total turnover of game auctions in South Africa, 1991–2005 (Du Toit 2007: 52).

game. The seasonality of game ranching also contributes to the dominance of mixed farming. Following the research of Grossman (1991) the authors of this report consider whether the factors are “push” or “pull”, i.e. is the growth of game ranching due to a belief in the inherent superiority of this as a form of land use, or is disenchantment with livestock farming (for reasons outlined in this article) the main driver (Smith & Wilson, 2002: 10–11). A similar study for Gauteng, which is a small and heavily industrialised province, indicated that privately owned ranches constituted 67.6% of the total 115 913 ha devoted to game ranching. Ecotourism, rather than hunting, is the primary revenue earner in this province, which is an interesting statistic given that of the 89 properties that were surveyed, 71% were smaller than 1000 ha (median size 654 ha). There was little mixed farming in Gauteng, only 19% of game ranches had cattle on their properties in addition to wildlife. Conservancies were found to be uncommon in the province, and this was different in the Eastern Cape (Reilly *et al.*, 2003). Cloete *et al.* (2007) conducted a case study in switching from cattle to game ranching in the Northern Cape Province near Kimberley and concluded that it is not always profitable to make the change, it takes very many years in order to break even, and it always involves both enormous upfront expense and many unforeseen difficulties. Spenceley’s study deals with wildlife tourism more broadly, an industry that – far more than game ranching *per se* – can provide benefits for local communities who may be beneficiaries and shareholders in commercial wildlife tourist operations. Of the Southern African Development Community (SADC) countries, South Africa has the largest share of nature tourism arrivals (some 4.6 million, including domestic and international), as well as income, more than US\$2 billion (Spenceley, 2007: 4). Extremely useful current statistics – as well as an outline of the problems that still bedevil game ranching – are contained in the report by Du Toit (2007). In this document, the value of meat production is given as a mere 1% (R42 million) of the total monetary value of game ranching, compared with 66% (R3.1 billion) for what is defined as “recreational hunting”; 1% (R510 million) “trophy hunting”; 16% (R750 million) “translocation and capture”; 4% (R200 million) “taxidermy”, and 2% (R94 million) “live animal sales” (Cloete *et al.*, 2007; Du Toit 2007: 60).

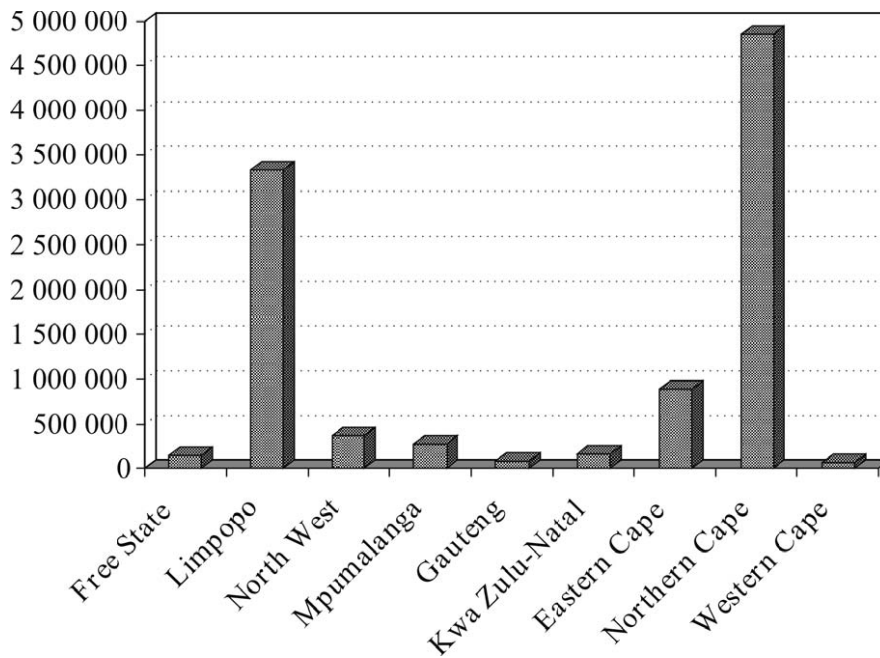
## CONCLUSION

In the event, while ostrich meat – from intensive farming operations – has become common on the supermarket shelves in South Africa, and while venison is increasingly to be found on restaurant menus, it is the biltong industry, rather than fresh venison or any replacement for meat produced by domestic stock, that drives game ranching (Van Rensburg, 1994; Hoffman *et al.*, 2004). Given the figures for this product from the late nineteenth century, one might argue that the wheel has come around full circle and the trajectory from utilitarian appreciation for wildlife to the aesthetic and ideological has reverted back to the utilitarian with biltong the major marker. It might well be argued that, despite some of the promising scientific research programmes that were instituted, venison was never able to fulfil its promise to replace beef, mutton and pork in the popular diet.

However, in comparison with the extermination programmes instituted by the Department of Agriculture in the first decades of the twentieth century both in South Africa and elsewhere on the continent, a complete revolution has come about in the economic value of wild animals. Prices of wildlife have continued to rise since the 1980s, auction sales from 1991 showing a turnover of R8 999 871 had increased to some R102 420 445 by 2003, an average increase of 9%. In 1992 there were nine game auctions, in 2003 there were 59. The increase in prices of individual species over the past decade show a combination of rarity and game ranching suitability in terms of percentage increase (Van der Merwe *et al.*, 2004; Du Toit, 2007) (Figure 4). A recent issue of *Wild en Jag/Game and Hunt* gives a list of the average prices for wild animals over the three years 2005 to 2007, almost all of which show a marked increase. Record prices over the period include a roan antelope (*Hippotragus equinus*) for R205 000, disease-free buffalo R285 000, eland R27 000, blesbok R3100, springbok R2400, impala R3550 (Du Toit, 2007: 52–53; Cloete & Taljaard, 2008). A further benefit has been in terms of ecosystem conservation, more than 80% of nature conservation occurs on privately owned land, some of it for tourism, but increasingly also for the breeding of rare and endangered species for sale (Du Toit, 2007).

Hunting too, is a lucrative industry for a landowner, and the popular magazine *Wild en Jag/Game and Hunt* (February 2008: 46–47) advertises prices of animals available for hunting as,





**Figure 5.** Area of exempted game farms in South African provinces in 2000 (Van der Merwe & Saayman, 2004: 104).

for example, blesbok R1500, zebra R5000, kudu R2300, blue wildebeest R2400. While international visitors comprise a large number of hunters in South Africa (7000), a recent survey in *Farmer's Weekly* emphasises why local white South Africans – among them some 200 000 biltong hunters – engage in the sport. The survey showed that international hunters were after trophies, locals after meat, particularly for biltong, but that this was often a pretext for a sense of belonging, of a return to the romance of the “old days”, of excitement and of relationship-building and identity (especially among males). Some of the motives were summarised by respondents. One reported: “I think that it makes a difference that I can provide my own meat ... that I can say I made my own biltong. It makes you proud.” Another referred to the joy experienced “To be out in the open, nothing to distract you...”; a third “It is just nice to be in the veld – even if I walk for two days without pulling the trigger”. And finally, “I don’t think women like to see dead animals lying there. That is why our groups mainly consist of men” and the freedom: “We can be as loud as we want to, we can talk as we like and about what we like. I don’t have a problem with women [joining us], but then they have to be like us” (Bezuidenhout, 2007). Du Toit expresses it differently, but alludes to the same phenomenon, “the culture of the Boer is to hunt ... hunting can never be classed as a sport because the killing of animals for food is part of a cultural action and not a sport ... South Africa has about 200 000 cultural hunters” (Du Toit, 2007: 56–57).

The statistics are worth recording. Some 99% of biltong hunters (springbok is the preferred quarry, although kudu generates the most income) are well educated males (89% of them married), 79% are Afrikaans-speaking and by far the majority is in the age group 40–64. Most of them (35%) live in Gauteng, compared with 4% in Limpopo and just 2% in the Northern Cape, but the preferred biltong hunting destinations are 37% for Limpopo Province, 15% for the Northern Cape and the least preferred is the Western Cape, a mere 3% (Van der Merwe & Saayman, 2008). The economic impact of this class of hunting on the rural economy is thus considerable.

In addition to providing this “cultural” outlet, game ranching employs some 63 000 people (Van der Merwe *et al.*, 2004), and a very large area is set aside for this purpose. In 2000 it was estimated that there were 7000 game farms in South Africa, 5061

of which were exempted (i.e. fenced in accordance with national and provincial specifications for subsidy purposes). The largest areas being used for game ranching were in Limpopo (3.3 million ha) and the Northern Cape (4.8 million ha) provinces (Van der Merwe & Saayman, 2004; Du Toit, 2007: 6–7) (Figure 5). Aiding the game rancher today are a large number of textbooks and support for the industry is also provided by consultancies, organisations and accredited university degrees and diplomas. In other words, game ranching has changed the face of the South African agricultural landscape. From being objects of extermination, wild ungulates are husbanded for a variety of purposes.

This has, however, not happened entirely in accordance with the Dasmann and Mossman template. It is difficult to say whether the live meat market in South Africa would have been greater than it is and game ranching attained the potential expected of it by the Food and Agriculture Organization (FAO) in the 1960s had the scientific underpinnings and marketing been encouraged rather than hindered by government agencies in South Africa. There have also been specific and fundamental structural drivers of game ranching in South Africa that could not have been foreseen in those early decades, specifically the loss of subsidy to commercial farming and the deregulation of the agricultural sector, the loss of political power of white farmers, the increase of livestock theft and the rising costs of labour, the cost impact of animal disease control, as well as HIV/AIDS and the re-emergence of malaria, land restitution claims and climate change (ABSA, 2003: 1–2; Van der Merwe *et al.*, 2004). Import duties on meat have disappeared and South African farmers are not protected against cheaper imports (ABSA, 2003: 3). About 450 tons of game meat are exported annually (mainly to Europe), the value of which is about R15 million, three times as much (1350 tons) as is consumed locally (Du Toit, 2007: 58).

While the transfer of land from traditional agriculture and domestic stock to more nature-based wildlife pursuits is likely to accelerate with climate change and political uncertainty around land issues (Van der Merwe *et al.*, 2004), some experts warn that game ranching for eco-tourism and live sales might be reaching saturation point, and – ironically in view of the

history outlined above – they advocate devoting more attention to expanding the market for venison and biltong, as well as to encouraging trophy hunting (Hoffman, 2000; Van der Merwe *et al.*, 2004; Hoffman, Kritzinger & Ferreira, 2005; Higginbottom & King, 2006: 12; Du Toit 2007).

The game ranching revolution has changed the face of the South African landscape with the scientific research conducted by animal scientists, zoologists and ecologists who acted collaboratively rather than competitively in the 1960s, 1970s and 1980s. In this regard, the role of individual scientists and ranchers in confronting and resisting bureaucracy was crucial. The partnerships that were forged between nature conservation agencies and individual scientists generated important savanna studies that have been of great benefit to the country's sustainability and environmental health (Féron, 1995; FAO, 1997, 2007). With new subjects, new sciences and technologies – such as capture and immobilisation – evolved in accordance with market forces (Norton-Griffiths, 2007). The fact that those scientists were engaged with the private sector and disseminated their findings widely added to the body of knowledge and created new organisational structures. Novel ideas around ecology and wild ungulate management filtered down to the public, producing debate as well as information. The distinction between the management practices on private farms and state land was eroded. Moreover, the legal relationship between wildlife, private property and humans altered with the need, and indeed the desire, to utilise wild animals productively.

In South Africa today there is more game than there was forty years ago, and perhaps even as much as there was when early traders, trekboers, explorers and travellers ventured into the interior in the early nineteenth century. The major difference, however, is that the game is not free for the taking, nor does it occur on public or communal land. While the ungulates themselves have not generally been tamed or domesticated, the distinction between wild and tame has, for the many reasons explained in this paper, become less clear-cut. By conceptualising game as a commodity, by giving it an economic value both within the formal protected estate and on private land, the number of wild animals has increased and the threat of extinction except in national parks, so realistic until the 1960s, no longer exists in South Africa.

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#### REFERENCES

- ABSA. 2003. *Game Ranch Profitability in Southern Africa*. Rivonia, The SA Financial Sector Forum. 73 pp.
- ANKER, P. 2001. *Imperial Ecology: Environmental Order in the British Empire, 1895–1945*. Cambridge MA, Cambridge University Press. 342 pp.
- ANON. 1881. The Boers at home: jottings from the Transvaal. *Blackwoods (Edinburgh) Magazine* 130(794): 753–770.
- ANON. 1952. Hunting and marketing of wild game in the Transvaal. *African Wildlife* 6(1): 19–20.
- APPS, P., VAN JAARSVELD, A., RICHARDSON, P., KNIGHT, M., KERLEY, G. & MCKENZIE, A. 1994. From ranching to farming: moving the goalposts to fill Africa's protein gap. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds) *Wildlife Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 241–244.
- ASIBEY, E.O.A. 1974. Wildlife as a source of protein in Africa south of the Sahara. *Biological Conservation* 6(1): 32–39.
- BAARD, C.R. 1984. The game commodity and the Department of Agriculture. In South African Agricultural Union, National Game Committee, *Report of the 2nd National Game Congress, Pretoria 13–15 September 1984*. pp. 10–17.
- BEINART, W. 2003. *The Rise of Conservation in South Africa: Settlers, Livestock, and the Environment, 1770–1950*. Oxford, Oxford University Press. 425 pp.
- BELL, R.H.V. 1987. Conservation with a human face: conflict and reconciliation in African land use planning. In Anderson, D. & Grove, R. (Eds) *Conservation in Africa: People, Policies and Practice*. Cambridge, Cambridge University Press. pp. 79–101.
- BENNETT, N.C. 2008. The Mammal Research Institute, 1966–2006. *Transactions of the Royal Society of South Africa* 63: 53–60.
- BENSON, D.E. 1991. Values and management of wildlife and recreation on private land in South Africa. *Wildlife Society Bulletin* 19(4): 497–510.
- BERRY, M.P.S. 1975. Game ranching in Natal. *Journal of the Southern Africa Wildlife Management Association* 5(1): 33–37.
- BEZUIDENHOUT R. 2007. Reluctant killers: what hunters are really after. *Farmer's Weekly* 22 June: 56–57.
- BIGALKER. 1950. Science and the conservation of wild life in South Africa. *Journal of the South African Veterinary Medical Association* 21: 166–172.
- BIGALKE, R. & NEITZ, W.O. 1954. Indigenous ungulates as a possible source of new domesticated animals. *Journal of the South African Veterinary Medical Association* 25(4): 45–54.
- BIGALKE, R.C. & BATEMAN, J.A. 1962. On the status and distribution of ungulate mammals in the Cape Province, South Africa. *Annals of the Cape Provincial Museums* 2: 85–109.
- BIGALKE, R.C. 1984. Utilisation of game. In Richardson, P.R.K. & Berry, M.P.S. (Eds) *Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land*. Pretoria, Southern African Wildlife Management Association. pp. 32–47.
- BIGALKE, R.C. 2000. Functional relationships between protected and agricultural areas in South Africa and Namibia. In Prins, H.T., Grootenhuys, J.G. & Dolan, T.T. (Eds) *Wildlife Conservation by Sustainable Use*. Boston, Kluwer. pp. 169–201.
- BIGALKE, R.D. & SKINNER, J. 2002. The Zoological Survey: an historical perspective. *Transactions of the Royal Society of South Africa* 57: 35–41.
- BIGALKE, R.D. & VERWOERD, D.W. 2008. A century of research achievements by the Onderstepoort Veterinary Institute. *Transactions of the Royal Society of South Africa* 63: 31–52.
- BOND, C. 1977. A very strange commodity. *African Wildlife* 31(4): 6–8.
- BOONZAAIER, W.V. & COLLINSON, R.F.H. 1985. Economic aspects of game ranching. In Coastal Subregion, Department of Agriculture (Ed.), *Proceedings Hlabisa Beef and Game Symposium*. pp. 87–98.
- BOTHMA, J. DU P. (Ed.) 1990. *Game Ranch Management*. 2nd edn. Pretoria, Van Schaik. 670 pp.
- BOTHMA, J. DU P. (Ed.) 2006. *Wildplaasbestuur*. 4th edn. Pretoria, Van Schaik. 765 pp.
- BOTHMA, J. DU P., VAN ROOYEN, N. & VAN ROOYEN, M.W. 2004. Using diet and plant resources to set wildlife stocking densities in African savannas. *Wildlife Society Bulletin* 32(3): 840–851.

- BROWN, K. & GILFOYLE, D. 2007. Introduction: livestock diseases and veterinary science in southern Africa. *South African Historical Journal* 58: 2–16.
- BROWN, K. 2002. Cultural constructions of the wild: the rhetoric and practice of wildlife conservation in the Cape Colony at the turn of the twentieth century. *South African Historical Journal* 47: 75–95.
- BROWN, K. 2005a. From Ubombo to Mkhuzi: disease, ecology and the control of bovine trypanosomosis (nagana) in Kwa-Zulu Natal. Unpublished paper presented at Livestock and Disease Conference, Oxford, June 2005.
- BROWN, K. 2005b. Tropical medicine and animal diseases: Onderstepoort and the development of veterinary science in South Africa 1908–1950. *Journal of Southern African Studies* 31(3): 513–529.
- BRYNARD, A.M. 1967. Game control in national parks. *African Wildlife* 21(2): 93–99.
- BURTT-DAVY, J. 1914. *Maize: Its History, Cultivation, Handling and Uses*. London, Longmans, Green. 831 pp.
- CARLES, A.B., KING, J.M. & HEATH, B.R. 1981. Game domestication for animal production in Kenya: an analysis of growth in oryx, eland and zebu cattle. *Journal of Agricultural Science, Cambridge* 97: 453–463.
- CARRUTHERS, J. 1995a. *Game Protection in the Transvaal 1846 to 1926*. Pretoria, Archives Yearbook for South African History. 224 pp.
- CARRUTHERS, J. 1995b. *The Kruger National Park: A Social and Political History*. Pietermaritzburg, University of Natal Press. 170 pp.
- CARRUTHERS, J. 2001. *Wildlife and Warfare: The Life of James Stevenson-Hamilton*. Pietermaritzburg, University of Natal Press. 244 pp.
- CARRUTHERS, J. 2007a. Influences on wildlife management and conservation biology in South Africa c.1900–c.1940. *South African Historical Journal* 58: 65–90.
- CARRUTHERS, J., 2007b. Conservation and wildlife management in South African national parks 1930s–1960s. *Journal of the History of Biology* 41: 203–236.
- CENTRE FOR DEVELOPMENT AND ENTERPRISE. 2005. *Land Reform in South Africa: A 21st century perspective*. CDE Research Policy in the Making No. 14. Johannesburg, CDE. 35 pp.
- CHILD, G. 1996. The role of community-based wild resource management in Zimbabwe. *Biodiversity and Conservation* 5: 355–367.
- CLARKE, J. 1974. *Our Fragile Land: South Africa's Environmental Crisis*. Johannesburg, Macmillan. 134 pp.
- CLOETE, P. & TALJAARD, P. 2008. Tendense van lewendige wildverkope op wildveilingen. *Wild en Jag/Game and Hunt* 14(2): 21–25.
- CLOETE, P.C., TALJAARD, P.R. & GROVÉ, B. 2007. A comparative economic case study of switching from cattle farming to game ranching in the Northern Cape Province. *South African Journal of Wildlife Research* 37: 71–78.
- COETZEE, P. 1986. Die kwaliteit van wildsvleis en wildskarkasse in Suid-Afrika. Unpublished BSc (Agric.) Project Report, University of Pretoria.
- COLLINSON, R.F.H. 1979. Production economics of impala. In Abbott, M.A. (Ed.) *Proceedings of the Symposium on Beef and Game Management*. Pietermaritzburg, Cedara Press. pp. 90–103.
- COLVIN, I.S. 1983. An enquiry into game farming in the Cape Province. Unpublished MSc (Environmental Studies) thesis, University of Cape Town, Cape Town.
- CONROY, A. 1976. Venison production and marketing. Unpublished paper presented at the Game Owners Association Symposium 23 March 1976.
- CONROY, A. 1981. Letter to the Secretary, S.A.V.D., 3 March 1981. Unpublished.
- CONROY, A. 1984. Chairman's report. In South African Agricultural Union, National Game Committee, *Report of the Second National Game Congress, CSIR Conference Centre, Pretoria, 13–15 September 1984*. Pretoria, South African Agricultural Union, 1984. pp. 2–4.
- CONROY, A. 2002. The philosophy of game ranching in South Africa. In Ebedes, H., Reilly, B., Van Hoven, W. & Penzorn, B. (Eds) *Sustainable Utilisation Conservation in Practice*. Proceedings of the 5th International Wildlife Ranching Symposium 2001. Pretoria. pp. 20–22.
- CONROY, A. n.d. A personal view of the requirements and management techniques for the ranching of springbok (*Antidorcas marsupialis marsupialis*) for the production of venison on Karroo rangeland. Unpublished manuscript.
- CONROY, A.M. & GAIGHER, I.G. 1982. Venison, aquaculture and ostrich meat production: Action 2003. *South African Journal of Animal Science* 12: 219–233.
- COOPER, M.E. 1995. Legal and ethical aspects of new wildlife food sources. *Biodiversity and Conservation* 4: 322–335.
- COWIE, M. 1961. *Fly, Vulture*. London, Harrap. 221 pp.
- CRAWFORD, M.A. 1968. Possible use of wild animals as future sources of food in Africa. *The Veterinary Record* 16 March 1968, pp.305–314.
- DARLING, F. FRASER 1960a. Wildlife husbandry in Africa. *Scientific American* 203(5): 123–124.
- DARLING, F. FRASER 1960b. *Wildlife in an African Territory: A Study made for the Game and Tsetse Control Department of Northern Rhodesia*. Oxford, Oxford University Press. 168 pp.
- DASMANN, R. 1959. *Environmental Conservation*. New York, Wiley. 307 pp.
- DASMANN, R.F. 1962a. Conservation by slaughter. *Pacific Discovery* 15(2): 3–9.
- DASMANN, R.F. 1962b. Game ranching in African land-use planning. *Bulletin of Epizootic Diseases of Africa* 10: 13–17.
- DASMANN, R.F. 1964. *African Game Ranching*. Oxford, Pergamon and Macmillan. 75 pp.
- DASMANN, R.F. & MOSSMAN, A.S. 1960. The economic value of Rhodesian game. *Rhodesian Farmer* 30(51): 17–20.
- DASMANN, R.F. & MOSSMAN, A.S. 1961. Commercial use of game animals on a Rhodesian ranch. *Wild Life* 3(3): 7–14.
- DE VOS V., BENGIS R.C. & COETZEE H.J. 1983. Population control of large mammals in the Kruger National Park. In Owen-Smith, R.N. (Ed.) *Management of Large Mammals in African Conservation Areas. Proceedings of a Symposium held in Pretoria, South Africa, 29–30 April 1982*. Pretoria, HAUM. pp. 213–231.
- DU TOIT, J.G. 2007. *Report: Role of the Private Sector in the Wildlife Industry*. Tshwane, Wildlife Ranching SA/Du Toit Wilddienste. 87 pp.
- DU TOIT, J.T., ROGERS, K.H. & BIGGS, H.C. (Eds). 2003. *The Kruger Experience: Ecology and Management of Savanna Heterogeneity*. Washington, Island Press. 519 pp.
- DUNLAP, T.R. 1991. *Saving America's Wildlife: Ecology and the American Mind, 1850–1990*. Princeton, Princeton University Press. 350 pp.
- EBEDES, H. 1994. Going, going, gone: an appraisal of game auctions. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds). *Wildlife Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 74–80.
- EBEDES, H. (Ed.) 1992. *The Use of Tranquillizers in Wildlife*. Pretoria, Department of Agricultural Development. 69 pp.
- ELOFF, F.C. 1971a. Correspondence Eloff to De Waal, 18 June 1971. University of Pretoria Archives, File C-3- Stigting van Leerstoel. Unpublished.
- ELOFF, F.C. 1971b. Correspondence Eloff to Treadwell, National Secretary Wild Life Protection and Conservation Society of South Africa, 3 March 1971. University of Pretoria Archives, File C-3- Stigting van Leerstoel. Unpublished.
- ELOFF, H.P., DAFEL, G.J., LÜDEMANN, C.J.F. & LADEMANN, E.E. 1973. A comparison between the growth of the impala (*Aepyceros melampus melampus*) and that of Dorper sheep in arid, sweet bushveld. *Symposium on Wildlife Conservation Utilisation in Africa Preliminary Publication No 25*. pp. 1–5.
- ELOFF, T. 2002. The economic realities of the game industry in South Africa. In Ebedes, H., Reilly, B., Van Hoven, W. & Penzorn, B. (Eds) *Sustainable Utilisation Conservation in Practice*. Proceedings of the 5th International Wildlife Ranching Symposium 2001. Pretoria. pp. 78–86.
- ELTRINGHAM, S.K. 1984. *Wildlife Resources and Economic Development*. Chichester, John Wiley. 337 pp.
- FERGUSON, E. M. 1933. The preparation and cooking of game. *Farming in South Africa* 8: 361–362.
- FÉRON, E.M. 1995. New food sources, conservation of biodiversity and sustainable development: can unconventional animal species contribute to feeding the world? *Biodiversity and Conservation* 4: 233–240.

- FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS 2007. *The State of Food and Agriculture 2007: Paying Farmers for Environmental Services*. Rome, FAO, 2007. Online: <http://www.fao.org/docrep/010/a1200e/a1200e00htm> (accessed 2 December 2007).
- FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS 1997. *Wildlife and Food Security in Africa*. (By Yaa Ntiamao-Baidu.) Rome, FAO. Online: <http://www.fao.org/docrep/w7540e/w7540e00.htm> (accessed 23 November 2007).
- FUGGLE, R.F. & RABIE, M.A. 1983. *Environmental Concerns in South Africa: Technical and Legal Perspectives*. Cape Town, Juta. 587 pp.
- GLAZEWSKI, J. 2000. *Environmental Law in South Africa*. Durban, Butterworths. 903 pp.
- GOLDIE, F. 1968. *Ostrich Country*. Cape Town, Books of Africa. 80 pp.
- GREYLING, I.F. 1984. Legal aspects of the ownership of game. In Richardson, P.R.K. & Berry, M.P.S. (Eds) *Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land*. Pretoria, Southern African Wildlife Management Association, 1984. pp. 3–6.
- GROOTENHUIS, J.G. 2000. Wildlife, livestock and animal disease reservoirs. In Prins, H.T., Grootenhuys, J.G. & Dolan, T.T. (Eds) *Wildlife Conservation by Sustainable Use*. Boston, Kluwer. pp. 81–113.
- GROSSMAN, D., HOLDEN, P.L. & COLLINSON, R.F.H. 1999. Veld management of the game ranch. In Tainton, N. (Ed.) *Veld Management in South Africa*. Pietermaritzburg, University of Natal Press, 1999. pp. 261–279.
- GUNDERSON, L.H. & HOLLING, C.S. (Eds.) 2002. *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington, Island Press. 507 pp.
- HAAGNER, A. 1916. On the variability in the nature or temperament of wild animals in captivity, with special reference to South African species. *South African Journal of Science* 12: 612–8.
- HAILLEY, LORD 1938. *An African Survey: A Study of the Problems Arising in Africa South of the Sahara*. London, Oxford University Press. 1837 pp.
- HALSE, A.R.D. 1994. Ethics and the game rancher. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds) *Wildlife Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 305–307.
- HARRIS, W.C. 1987. *Wild Sports of Southern Africa*. Fasc. of 1852 Edition. Cape Town, Struik. 359 pp.
- HARTGE, C. 1982. Game markets in Europe. *The Deer Farmer Winter*: 9–11.
- HEY, D. 1977. The history and status of nature conservation in South Africa. In Brown, A.C. (Ed.) *A History of Scientific Endeavour in South Africa*. Cape Town, Royal Society of South Africa. pp. 132–163.
- HIGGINBOTTOM, K & KING, N. 2006. *The Live Trade in Free-Ranging Wildlife within South Africa, and Implications for Australia*. RIRDC Publication No. 06/046. Barton ACT, Australian Government, Rural Industries Research and Development Corporation. 45 pp.
- HOFFMAN, L.C. 2000. The yield and carcass chemical composition of impala (*Aeyceros melampus*), a southern African antelope species. *Journal of the Science of Food and Agriculture* 80: 752–756.
- HOFFMAN, L.C., KRITZINGER, B. & FERREIRA, A.V. 2005. The effects of region and gender on the fatty acid, amino acid, mineral, myoglobin and collagen contents of impala (*Aeyceros melampus*) meat. *Meat Science* 69: 551–558.
- HOFFMAN, L.C., MULLER, M., SCHUTTE, DE W. & CRAFFORD, K. 2004. The retail of South African game meat: Current trade and marketing trends. *South African Journal of Wildlife Research* 34:123–134.
- HOFFMAN, M.T. 1993. Major P.J. Pretorius and the decimation of the Addo elephant herd in 1919–1920: important reassessments. *Koedoe* 36: 23–44.
- HUNTLEY, B.J. 1971. Carcass composition of mature male blesbok and kudu. *South African Journal of Animal Science* 1: 125–128.
- I.U.C.N. 1953. *Proceedings of the Third International Conference: Protection of the Fauna and Flora of Africa*. IUCN, Bukavu.
- IRBY, L.R. 1975. Meat production potential of mountain reedbeek. *South African Journal of Animal Science* 5: 67–76.
- JANSEN, B.C. 1977. The growth of veterinary research in South Africa. In Brown, A.C. (Ed.) *A History of Scientific Endeavour in South Africa*. Cape Town, Royal Society of South Africa. pp. 164–189.
- JARRELL, R. 2003. A giant among ecologists: Raymond F. Dasmann, 1919–2002. *Wildlife Society Bulletin* 31(1): 324.
- JOUBERT, D.M. 1977. Agricultural research in South Africa: an historical overview. In Brown, A.C. (Ed.) *A History of Scientific Endeavour in South Africa*. Cape Town, Royal Society of South Africa. pp. 265–282.
- KETTLITZ, W.K. 1962a. Game on farms. *Fauna and Flora* 13: 19–24.
- KETTLITZ, W.K. 1962b. The capture of giraffes without immobilisation. *Fauna and Flora* 13: 25–27.
- KETTLITZ, W.K. 1962c. The distribution of some of the larger game mammals in the Transvaal (excluding the Kruger National Park). *Annals of the Cape Provincial Museums* 2: 118–137.
- KETTLITZ, W.K. 1983a. And it is supposed to be easy to capture a buffalo.... *Fauna and Flora* 40: 8–12.
- KETTLITZ, W.K. 1983b. Trophy hunting in the Transvaal. *Fauna and Flora* 40: 26–29.
- KOK, L.G. 1984. The place of the game industry in the structure of government. In South African Agricultural Union, National Game Committee, *Report of the 2nd National Game Congress, Pretoria 13–15 September 1984*. pp. 29–30.
- KOOY, J.J. 2002. Game capture on a game ranch. In Penzhorn, B.L. (Ed.), *Proceedings of a Symposium on Game Ranch Planning and Management, Onderstepoort, 1 and 2 November 2002*. Onderstepoort, Wildlife Group of the South African Veterinary Association, 2002, pp. 65–67.
- KREUTER, U. & WORKMAN, J.P. 1994. The comparative economics of cattle and wildlife production in the Zimbabwe midlands. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds) *Wildlife Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 220–228.
- KYLE, R. n.d. Meat production in Africa: The case for new domestic species. Unpublished mimeograph.
- LA GRANGE, M. 2006. *The Capture, Care and Management of Wildlife*. Pretoria, Van Schaik. 314 pp.
- LEAKEY, R. 2001. *Wildlife Wars; My Fight to Save Africa's Natural Treasures*. New York, St Martin's Press. 319 pp.
- LEAST HEAT-MOON, W. 1999. *Prairie Earth*. New York, Mariner Books. 624 pp.
- LEOPOLD, A. 1986. *Game Management*. Madison, University of Wisconsin Press. (First published 1933.) 481 pp.
- LIGHTFOOT, C.J. & POSSELT, J. 1977. Eland (*Taurotragus oryx*) as a ranching animal complementary to cattle in Rhodesia. *Rhodesia Agricultural Journal* 74(5): 47–120.
- LIVERSIDGE, R. & GUBB, A. 1994. Feeding competition between springbok and merino sheep. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds) *Wildlife Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 87–90.
- LIVERSIDGE, R. & VAN ECK, H. 1994. The biomass/carrying capacity conundrum in game ranching. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds) *Wildlife Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 51–55.
- LUNDHOLM, B. 1952. Game farming: is it a feasible proposition? *African Wildlife* 6(2):121–128, 137–138.
- LUXMOORE, R. 1985. Game farming in South Africa as a force in conservation. *Oryx* 19(4): 225–231.
- MACKENZIE, J. M. (Ed.) 1990. *Imperialism and the Natural World*. Manchester, Manchester University Press. 216 pp.
- MACKENZIE, J.M. 1988. *The Empire of Nature: Hunting, Conservation and British Imperialism*. Manchester, Manchester University Press. 340 pp.
- MARCHANT, A.N. 1985. Problems in game ranching in Natal. In Coastal Subregion, Department of Agriculture, *Proceedings Hlabisa Beef and Game Symposium*. September 1985, pp.68–72.
- MEINE, C. 1988. *Aldo Leopold: His Life and Work*. Madison, University of Wisconsin Press. 638 pp.
- MOE, H. 1953. Letter to editor. *African Wildlife* 7(1): 68–69.
- MOSSMAN, A.S. 1975. International game ranching programs. *Journal of Animal Science*, 40: 993–999.
- MOSSMAN, S. & MOSSMAN, A. 1976. *Wildlife Utilization and Game Ranching: Report on a Study of Recent Progress in this Field in Southern Africa*. IUCN Occasional Paper No. 17. Morges, IUCN.
- NELL, D. D'A. 2003. The development of wildlife utilisation in South Africa and Kenya, c.1950–1990. Unpublished DPhil. thesis, University of Oxford. 234 pp.

- NIXON, R. 1999. *Dreambirds: The Natural History of a Fantasy*. London, Transworld. 289 pp.
- NORTON-GRIFFITHS, M. 2007. How many wildebeest do you need? *World Economics* 8(2): 41–64.
- OVINGTON, J.D. (Ed.) 1963. *The Better Use of the World's Fauna for Food*. London, Institute of Biology. 175 pp.
- PIENAAR, U. DE V. 1983. Management by intervention: the pragmatic/economic option. In Owen-Smith, R.N. (Ed.) *Management of Large Mammals in African Conservation Areas. Proceedings of a Symposium held in Pretoria, South Africa, 29–30 April 1982*. Pretoria, HAUM. pp. 23–36.
- POLLOCK, N.C. 1974. *Animals, Environment and Man in Africa*. Lexington MA, and Westmead Hants, Lexington Books and Saxon House. 159 pp.
- POLLOCK, N.C. & AGNEW, S. 1983. *An Historical Geography of South Africa*. London, Longmans. 242 pp.
- POSSELT, J. 1963. The domestication of the eland. *Rhodesian Journal of Agricultural Research* 1(2): 81–87.
- RABIE, A. 1976. *South African Environmental Legislation*. Pretoria, University of South Africa. 199 pp.
- RABIE, M.A. 1973. Wildlife conservation and the law. *The Comparative and International Law Journal of Southern Africa*, August: 145–198.
- REILLY, B.K., SUTHERLAND, E.A. & HARLEY, V. 2003. The nature and extent of wildlife ranching in Gauteng Province, South Africa. *South African Journal of Wildlife Research* 33: 141–144.
- REPUBLIC OF SOUTH AFRICA. 1980. Department of Agriculture and Fisheries, Opsomming van Verslag Direktooraatskomitee vir Wildboerdery, Julie 1980. Unpublished manuscript.
- REPUBLIC OF SOUTH AFRICA. 2005. Department of Environmental Affairs and Tourism, Final draft: Report to the Minister of Environmental Affairs and Tourism, Panel of experts on professional and recreational hunting in South Africa. 63 pp.
- RINEY, T. & KETTLITZ, W.L. 1964. Management of large mammals in the Transvaal. *Mammalia* 28: 188–248.
- RITVO, H. 1987. *The Animal Estate: The English and Other Creatures of the Victorian Age*. Cambridge MA, Harvard University Press. 347 pp.
- RITVO, H. 1997. *The Platypus and the Mermaid and Other Figments of the Classifying Imagination*. Cambridge MA, Harvard University Press. 288 pp.
- ROTH, H.H. 1970. Studies on the agricultural utilisation of semi-domesticated eland (*Taurotragus oryx*) in Rhodesia: 1. Introduction. *Rhodesian Journal of Agricultural Research* 8: 67–77.
- SKEAD, C.J. 1948. What price your game. *African Wildlife* 3(2): 18–21.
- SKEAD, C.J. 1950. The game goes to market. *African Wildlife* 4(1): 72–74.
- SKINNER, J.D. 1966. An appraisal of the eland (*Taurotragus oryx*) for diversifying and improving animal production in southern Africa. *African Wild Life* 20(1): 29–40.
- SKINNER, J.D. 1967. An appraisal of the eland as a farm animal in Africa. *Animal Breeding Abstracts* 35: 177–186.
- SKINNER, J.D. 1970. Game-ranching in Africa as a source of meat for local consumption and export. *Tropical Animal Health and Production* 2: 151–157.
- SKINNER, J.D. 1971a. Productivity of the eland: an appraisal of the last five years' research. *South African Journal of Science* 67: 534–539.
- SKINNER, J.D. 1971b. The real lowdown on farming with game. *Farmer's Weekly* 3 December 1971: 12–17.
- SKINNER, J.D. 1972a. Eland vs beef. *African Wildlife* 26(1): 4–9.
- SKINNER, J.D. 1972b. The springbok: a farm animal for the future. *African Wildlife* 26(3): 114–115.
- SKINNER, J.D. 1973. An appraisal of the status of certain antelope for game farming in South Africa. *Zeitschrift für Tierzucht und Züchtungsbiologie* 90: 263–277.
- SKINNER, J.D. 1975a. Game farming in South Africa. *Journal of the South African Biological Society* 6: 8–15.
- SKINNER, J.D. 1975b. Technological aspects of domestication and harvesting of certain species of game in South Africa. *Proceedings of the 3rd Congress on Animal Production*. Sydney, Sydney University Press. pp. 119–125.
- SKINNER, J.D. 1984a. Mating and calving seasons, sex ratios and age groups, and monitoring ungulate populations for game farming. In Richardson, P.R.K. & Berry, M.P.S. (Eds) *Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land*. Pretoria, Southern African Wildlife Management Association. pp. 64–69.
- SKINNER, J.D. 1984b. Two decades of research on game farming. In South African Agricultural Union, National Game Committee, *Report of the 2nd National Game Congress, Pretoria 13–15 September 1984*. pp. 5–9.
- SKINNER, J.D. 1985. Wildlife management in practice: conservation of ungulates through protection or utilisation. *Symposia of the Zoological Society of London*, 54: 25–46.
- SKINNER, J.D. 1989. Game ranching in southern Africa. In Hudson, R.J., Drew, K.R. & Baskin, L.M. (Eds) *Wildlife Production Systems: Economic Utilisation of Wild Ungulates*. Cambridge, Cambridge University Press, 1989. pp. 286–306.
- SKINNER, J.D. n.d. Selected species of ungulates for game farming in southern Africa. Unpublished paper.
- SKINNER, J.D., VON LA CHEVALLERIE, M. & VAN ZYL, J.H.M. 1971. An appraisal of the springbok for diversifying animal production in Africa. *Animal Breeding Abstracts* 39: 215–224.
- SMALL, C.P. 1992. An attempt to prove the economic viability of wildlife ranching in the semi-arid savannas of southern Africa. Unpublished Research Report, Master of Business Leadership, University of South Africa.
- SMITH, F.C. 1937. Preservation of game on farms. *Farming in South Africa*, October: 403.
- SMITH, N. & WILSON, S.L. 2002. *Changing Land Use Trends in the Thicket Biome: Pastoralism to Game Farming*. Report No. 38. Port Elizabeth, Terrestrial Ecology Research Unit, University of Port Elizabeth. 22 pp.
- SPENCELEY, A. 2007. Economic impacts of wildlife tourism in southern Africa; A review. Draft report from IUCN Southern Africa Sustainable Use Specialist Group, 29 April 2007. 51 pp.
- STEVENSON-HAMILTON, J. 1947. *Wild Life in South Africa*. London, Cassell. 364 pp.
- STEYN, T.J. 1961. Farm planning and nature conservation. *Fauna and Flora* 12: 4–7.
- STEYN, T.J. 1966. Game farming and hunting areas. *Fauna and Flora* 17:1–3.
- STROLENY-FORD, Y. 1990. *Aspects of Game Ranching in South Africa*. Bulletin 420. Pretoria, Department of Agricultural Information. 32 pp.
- TALBOT, L.M., LEDGER, H.P. & PAYNE, W.J.A. 1962. The possibility of using wild animals for animal production in the semi-arid tropics of East Africa. *Proceedings of the 8th International Congress on Animal Production*. Hamburg. pp. 205–210.
- TALBOT, L.M., PAYNE, W.J.A., LEDGER, H.P., VERDCOURT, L.D. & TALBOT, M.H. 1965. *The Meat Production Potential of Wild Animals in Africa: A Review of Biological Knowledge*. Technical Communication No.16, Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh. Farnham Royal, Commonwealth Agricultural Bureau. 42 pp.
- THOMAS, K. 1984. *Man and the Natural World: Changing Attitudes in England, 1500–1800*. Harmondsworth, Penguin. 424 pp.
- TRANSVAAL PROVINCE. 1945. *Report of the Game Commission of Inquiry*. TP6-1945. Pretoria, Government Printer. 30 pp.
- UNIVERSITY OF PRETORIA ARCHIVES. n.d. [1965]. Undated summary of progress in respect of new Wildlife Management Course at the University of Pretoria. File C-3-, Stigting van Leerstoel. Unpublished.
- VAN DER MERWE, P. & SAAYMAN, M. 2003. Determining the economic value of game farm tourism. *Koedoe* 46(2): 103–112.
- VAN DER MERWE, P. & SAAYMAN, M. 2004. *Managing Game Farms from a Tourism Perspective*. 2nd edn. Potchefstroom, University of the North West, Institute for Tourism and Leisure Studies. 287 pp.
- VAN DER MERWE, P. & SAAYMAN, M. 2008. *National Profile and Economic Impact of Biltong Hunters in South Africa*. Potchefstroom, University of the North West, Institute for Tourism and Leisure Studies. 39 pp.
- VAN DER MERWE, P., SAAYMAN, M. & KRUGELL, W. 2004. Factors that determine the price of game. *Koedoe* 47(2): 105–113.
- VAN DER MERWE, P.J. 1945. *Trek*. Cape Town, Nasionale Pers. 312 pp.
- VAN DER MERWE, P.J. 1995. *The Migrant Farmer in the History of the Cape Colony, 1657–1842*. (Translated by Roger B. Beck.) Athens, Ohio University Press. 315 pp.

- VAN RENSBURG, L.R.J. 1994. A cost evaluation of game cropping methods and certain necessary cost factors in the marketing of venison. In Van Hoven, W., Ebedes, H. & Conroy, A. (Eds) *Game Ranching: A Celebration of Diversity: Proceedings of the Third International Game Ranching Symposium*. Pretoria, Promedia. pp. 206–211.
- VAN SITTERT, L. 2005. Bringing in the wild: the commodification of wild animals in the Cape Colony/Province ca. 1850–1950. *Journal of African History* **46**: 269–291.
- VAN ZYL, J.H.M. & SKEAD, D.M. 1964. The meat production of South African game animals 2: The African buffalo. *Fauna and Flora* **15**:34–40.
- VAN ZYL, J.H.M. 1962. The meat production of South African game animals 1: The eland. *Fauna and Flora* **13**: 35–40.
- VAN ZYL, J.H.M. 1968. Vleisproduksie van Suid-Afrikaanse wildsoorte 3: Die springbok. *Fauna and Flora* **19**: 51–57.
- VAN ZYL, J.H.M., VON LA CHEVALLERIE, M. & SKINNER, J.D. 1969. A note on the dressing percentage in the springbok, (*Antidorcas marsupialis* (Zimmerman) and impala, (*Aepyceros melampus*). *Proceedings of the South African Society for Animal Production* **8**: 199–200.
- VENTER, E.J., NAIMAN, R.J., BIGGS, H.C. & PIENAAR, D.J. 2008. The evolution of conservation management philosophy: science, environmental change and social adjustments in Kruger National Park. *Ecosystems* **11**: 173–192.
- VINCENT, J. 1962. The distribution of ungulates in Natal. *Annals of the Cape Provincial Museums* **2**: 110–117.
- VISAGIE, G.P. 1968. Die vervoer van lewende blesbokke. *Fauna and Flora* **19**: 58–60.
- VON LA CHEVALLERIE, M. & VAN ZYL, J.H.M. 1971. Growth and carcass development of the springbok *Antidorcas marsupialis marsupialis* (Zimmermann). *Agroanimalia* **3**: 115–124.
- VON RICHTER, W. 1971. Past and present distribution of the black wildebeest, *Connochaetes gnou* Zimmermann (*Artiodactyla*: Bovidae) with special reference to the history of some herds in South Africa. *Annals of the Transvaal Museum*, **27**(4): 35–48.
- VON RICHTER, W., LYNCH C.D. & WESSELS, T. 1972. Status and distribution of the larger mammal species on farmland in the Orange Free State. *Nature Conservation Research Report 1*. O.F.S. Provincial Administration. p. 28.
- VRAHIMIS, S. 2001. Black wildebeest (*Connochaetes gnou*) conservation success: An historical perspective. In Penzhorn, B.L. (Ed.) *Proceedings of a Symposium on the Relocation of Large African Mammals, Onderstepoort, 12 and 13 October 2001*. Onderstepoort, Wildlife Group of the South African Veterinary Association. pp. 42–45.
- WESTCOTT, J. 1984. Meat production and marketing. In Richardson, P.R.K. and Berry, M.P.S., eds, *Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land*. Pretoria, Southern African Wildlife Management Association, 1984. pp. 48–53.
- WILD EN JAG. February 2008: 46–47.
- WILDLIFE TRADE MONITORING UNIT. n.d. Game farming. Unpublished mimeograph.
- WOLMER, W. 2005. Wilderness gained, wilderness lost: wildlife management and land occupations in Zimbabwe's southeast lowveld. *Journal of Historical Geography* **31**(2): 260–280.
- WORLD CONSERVATION MONITORING CENTRE. 1992. *Development of a National Biodiversity Index: A Discussion Paper Prepared by World Conservation Monitoring Centre. Report of the WCMC, 15 September 1992*. Cambridge, WCMC.
- WORTHINGTON, E.B. [1958] *Science in the Development of Africa: A Review of the Contribution of Physical and Biological Knowledge South of the Sahara*. 462 pp.
- WORTHINGTON, E.B. 1938. *Science in Africa: A Review of Scientific Research relating to Tropical and Southern Africa*. London, Oxford University Press. 746 pp.
- YOUNG, E. 1992. *Game Farming and Wildlife Management*. Nylstroom, Eddie Young, 204 pp.