AN ANALYSIS OF GAME MEAT PRODUCTION AND WILDLIFE-BASED LAND USES ON FREEHOLD LAND IN NAMIBIA: LINKS WITH FOOD SECURITY

PETER LINDSEY

A TRAFFIC EAST/SOUTHERN AFRICA REPORT

TRAFFIC
the wildlife trade monitoring network

This report was published with the kind support of

Federal Ministry for Economic Cooperation and Development

The Rufford Foundation www.rufford.org

Published by TRAFFIC East/Southern Africa.

Suggested citation: Lindsey, P. (2011). *An Analysis of Game Meat Production and Wildlife-based Land Uses on Freehold Land in Namibia: Links with Food Security.* TRAFFIC East/Southern Africa, Harare, Zimbabwe.

ISBN 978-1-85850-249-6

Front cover photograph: Greater Kudu *Tragelaphus strepsiceros* and Springboks *Antidorcas marsupialis*, Namibia.

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Printed on FSC-certified paper and according to FSC-certified processes.

AN ANALYSIS OF GAME MEAT PRODUCTION AND WILDLIFE-BASED LAND USES ON FREEHOLD LAND IN NAMIBIA: LINKS WITH FOOD SECURITY

by Peter Lindsey

Credit: Tiemen Rhebergen

Namibian-produced game meat, photographed during survey work, 2010

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ACKNOWLEDGEMENTS

Thanks are due to TRAFFIC East/Southern Africa, especially Tom Milliken, for instigating and co-ordinating this project and to the *Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung* (Federal Ministry for Economic Co-operation and Development—BMZ) for providing the funds which made this study possible, and to the Rufford Foundation for supporting report production. Thanks to the African Wildlife Conservation Fund for providing additional funds to enable expansion of the scope of field work. Appreciation is extended to the Ministry of Environment and Tourism, the Namibian Agricultural Union, Namibian Professional Hunters Association, CANAM, and WWF-Namibia for their valuable support, and specifically to Annetjie du Preez, Harrald Marggraff, Elly Hamunyela, Amut Kronsbein, Danica Shaw, Laurie Marker and Chris Weaver for their help. Thanks are also due to Jon Barnes and Peter Erb for comments on earlier versions of this manuscript, and to the anonymous reviewers whose comments also served to improve the report. Thanks to Cornelis Van Der Waal, C.J. Havemann, Tarryn Retief, Tiemen Rhebergen, Aaron Price, Uapii Kazahe, and Robin Lines for assistance with field work and for the provision of photographs. And finally, an expression of gratitude to the Namibian farmers for providing time and information to make this study possible, and particularly to Sakkie Van Der Merwe and Wilfried Pack for their hospitality.

Please note that the views expressed in this report are those of the author and do not necessarily represent the views of TRAFFIC or BMZ.

ACRONYMS

BMZ	*Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung* (Federal Ministry for Economic Co-operation and Development)
CANAM	Conservancies Association of Namibia
EU	European Union
FMD	Foot-and-mouth disease
GNI	Gross National Income
MET	Ministry of Environment and Tourism
NAD	Namibian dollars
NAPHA	Namibian Professional Hunting Association
USD	United States dollars
VAT	Value-added Tax
WBLU	Wildlife-based land use(s)

EXECUTIVE SUMMARY

This project forms a component of the BMZ-funded programme with TRAFFIC entitled "Vulnerable People, Diminishing Wildlife: Addressing priority bushmeat trade, livelihood and food security issues in Africa".

The illegal trade in bushmeat represents a severe conservation threat in several African countries. However, in Namibia, wildlife-based land uses (WBLU) and the legal production of game meat have potential to contribute significantly to conservation, food security and the economy of the country. A structured questionnaire survey of farmers in Namibia was used to gain insights into WBLU on freehold land in the country and links with food security.

Results

Land use

Livestock farming is the most prevalent form of land use on freehold farms in Namibia. This situation contrasts with that in parts of South Africa and (formerly) Zimbabwe in areas of similar rainfall where WBLU has largely replaced livestock farming in some semi-arid areas. However, WBLU is increasingly common in Namibia. Approximately 288 000 km^2 of freehold land is used for WBLU and ~32 000 km^2 is used exclusively for wildlife production (i.e. without livestock). Owing to the expansion of trophy hunting and ecotourism, the economic output of wildlife on freehold land is approaching that of livestock (despite veterinary policies which favour the latter and which markedly reduce potential returns from WBLU). WBLU are more popular among younger farmers, tourist and hunter arrivals are likely to continue increasing in future and WBLU is likely to be less affected by climate change than livestock farming. Consequently, WBLU is likely to continue to increase in prevalence in future and may exceed the economic contribution of livestock farming in the near or medium term. Employment is positively correlated with the percentage of farmers' income from WBLU, and negatively correlated with the percentage of farmers' income from livestock. This finding is in keeping with work from South Africa, Zimbabwe and southern Namibia which suggests that WBLU are associated with both more and higher quality employment than livestock farming in semi-arid areas. Employment was also positively correlated with wildlife biomass: suggesting that where there is more wildlife, more jobs are created.

Trophy or safari hunting is the most important form of WBLU on freehold land. Farmers' income from safari hunting is positively correlated with wildlife diversity. Wildlife populations, their biomass and diversity are increasing on freehold land in most areas, with larger and more diverse populations occurring within conservancies. In some areas, however, where off-takes among neighbouring farmers are not co-ordinated (outside conservancies in some areas), populations are declining. However, WBLU has not been developed to anything near potential in Namibia and,

unlike the situation in the former cattle-ranching areas of South Africa (and previously Zimbabwe), most wildlife farmers have retained livestock.

Namibian commercial "conservancies" are fractured, retain internal fencing and livestock, and lack the large and high-value wildlife species necessary for exploiting WBLU to its full potential. Most Namibian wildlife ranchers offer low-value ecotourism, biltong hunting (hunting animals for the purposes of making dried meat) or trophy-hunting experiences, based on the same few antelope species. Consequently, the Namibian trophy-hunting industry generates some of the lowest returns per hunting client in Africa.

The development and expansion of WBLU to its full potential on freehold land in Namibia is significantly hampered by three aspects of legislation: veterinary restrictions preventing reintroduction of buffaloes (the single-most important species for generating returns from WBLU); failure to devolve user rights over wildlife to land owners more fully (or to the same extent as in South Africa and Zimbabwe); and preferential allocation of permits to use wildlife to farmers with perimeter game fencing, rather than to those farmers whose land is part of larger, open, co-managed conservancies. Emerging farmers are greatly under-represented in WBLU on freehold land.

Game meat production

Considerably more game meat is produced on Namibian farmlands than previously recognized (16–26 million kg/year). Oryx *Oryx gazella*, Greater Kudu *Tragelaphus strepsiceros* and Springbok *Antidorcas marsupialis* are responsible for producing approximately two thirds of game meat on freehold farms. Trophy hunting is responsible for the production of more meat than other forms of harvest (36.5%), followed by own use (22.5%). A relatively small proportion of game meat is produced through harvest specifically for meat to sell (e.g. "shoot-and-sell" [19.3%] and wildlife culling [7.3%]).

Off-take as proportion of a species population is increasing, although still well within sustainable limits (on a national level). Farmers sell ~52% of the game meat they produce (including that sold to biltong hunters). Prices paid to farmers for game meat have increased by 45% in the last two to three years, though they are still 13–17% lower than prices they are paid for meat from livestock. Nonetheless, game meat is sold in stores for higher prices than those for meat from livestock. The price of game meat is enhanced significantly through processing and exports to the European Union. Approximately NAD200 million [USD23.7 million] is generated by farmers through the sale of game meat (not including value addition by meat processors and exporters after the meat has been purchased from farmers). Game meat production comprises a more significant component of the economic output of WBLU than previously recognized.

Game meat from freehold farms is a high-value product not readily accessible by the rural poor. However, game meat does contribute significantly to food security because more game meat from freehold land is used within Namibia than meat from formal domestic stock production, since the

majority of the latter is exported. Furthermore, game meat is the primary source of rations for agricultural workers (22 855 workers are fed >4500 t of game meat/year). Making supplies of affordable game meat available to residents of communal land and/or informal settlements in freehold farming areas may help reduce wildlife poaching in the minority of areas where illegal hunting is a serious problem.

WBLU also contributes significantly to food security on a national level through the creation of foreign currency and employment. However, the value of WBLU on Namibian freehold land to the national economy (and to national food security) is much lower than it could be, as mentioned above, because of the rarity of large and high-value species, the lack of fully integrated conservancies, and veterinary restrictions preventing the reintroduction of buffaloes.

Recommendations

Steps that could be taken to increase the economic and social contributions of WBLU

- The promotion of the reintroduction of the full range of indigenous mammal fauna where possible on freehold land, including large, high-value species (which are currently largely absent).
- The exploration of possible alternative veterinary control strategies that would permit the reintroduction of buffaloes to some areas under certain conditions.
- The reintroduction of foot-and-mouth disease (FMD)-free buffaloes on freehold, and consideration of creation of wildlife-production (and regulated FMD-endemic) zones in areas where WBLU has clear comparative economic/financial advantages over livestock production, to permit the reintroduction of FMD-buffaloes (which are much cheaper and more affordable than FMD-free individuals).
- In addition, export markets should be encouraged to accept commodity-based trade (whereby meat processed in a manner proven to provide minimal risk of transmitting FMD would be considered acceptable for export) as an alternative to costly and damaging veterinary restrictions based on FMD-free zones.
- Changes in legislation to promote the development of fully-integrated conservancies (i.e. with all internal fencing removed) in which the full complement of indigenous mammals is reintroduced (e.g. by devolving full user rights over wildlife to conservancies following the submission of an acceptable management plan, while retaining current permit-requirements for farms not part of conservancies).
- The organization of the wildlife industry to protect the interests of wildlife ranchers and lobbying for policies conducive to profitable WBLU and against policies that are prejudicial toward the industry.
- The integration of the development of WBLU with the process of land reform and promotion of participation of emerging farmers in wildlife-ranching.
- The use of commercial conservancies as a vehicle for the integration of emerging farmers into WBLU (by using the economies of scale and centralized management to make it easier for new entrants to break into the industry).

- The increase in the value of game meat sales through the development of export markets, the development of infrastructure necessary to process high quality game meat, and measures to improve the consistency of supply of game meat to abattoirs.

Research required

- An assessment of the scale and food-security contribution of game meat production in communal areas.
- An in-depth financial and economic analysis of the pros and cons of various potential alternative veterinary control strategies and scenarios to explore the advisability or otherwise of various possible options for buffalo reintroductions on freehold land.
- A financial and economic analysis of the comparative profitability of various land use options in various scenarios in Namibia, including mixed livestock/wildlife production systems, pure wildlife systems, current conservancy models and more integrated conservancy systems (i.e. those lacking internal fencing and where the full range of indigenous species have been reintroduced).
- A review of co-management systems, conservancy constitutions and systems in place in Namibia, South Africa, Zimbabwe and Kenya to identify those that are most effective, profitable and which yield the greatest gains for conservation and social development.
- An assessment of wildlife movement and migration patterns on freehold land to prevent disruption through inappropriately placed fence lines.

Credit: Tiemen Rhebergen

Namibia's spectacular scenery improves prospects for successful ecotourism and hunting tourism

INTRODUCTION

During the 19th and 20th centuries, wildlife populations in Southern Africa were greatly depleted by outbreaks of bovine pleuropneumonia (1850) and rinderpest (1896) and by over-hunting by European explorer-hunters and settlers (Bond *et al.*, 2004). Early colonial administrations responded to declining wildlife populations by establishing protectionist legislation which centralized control over wildlife and limited commercial and subsistence use (Murombedzi, 2003; Bond *et al.*, 2004). These policies were effective at slowing unsustainable hunting, but made wildlife a financial burden for landowners by preventing them from deriving income from hunting (Murombedzi, 2003; Bond *et al.*, 2004). Under these conditions, wildlife populations continued to wane as a result of a mixture of persecution, competition with livestock, benign neglect and, in some areas, bushmeat poaching (Bond *et al.*, 2004; Barnett and Patterson, 2006). During the 1960–70s, legislative changes occurred in several Southern African countries granting varying degrees of user rights over wildlife to landowners. These changes (occurring in Namibia in 1967, Zimbabwe in 1960 and 1975, and South Africa at varying times depending on the province) enabled landowners to use wildlife occurring on their land for hunting and live capture and trade (Bond *et al.*, 2004).

The *South West Africa Wildlife Ordinance* passed in Namibia in 1967 provided farmers on private land with conditional rights to use wildlife on their properties (Barnett and Patterson, 2006). This legislation effectively conferred ownership over "huntable" species—Greater Kudu *Tragelaphus strepsiceros*, Oryx *Oryx gazella*, Springbok *Antidorcas marsupialis* and Common Warthog *Phacochoerus africanus*—in addition to extra-limital species introduced from elsewhere in the region (Erb, 2004). Landowners could then benefit from wildlife through consumptive use and ecotourism. Consumptive wildlife use is governed primarily by the Ministry of Environment and Tourism (MET) through the *Nature Conservation Ordinance No. 4* of 1975. This legislation was amended in 1996 with the *Nature Conservation Amendment Act of 1996* (MET, 1998), which conferred similar user-rights to residents of communal land conservancies as enjoyed by freehold farmers (Barnett and Patterson, 2006). The Parks and Wildlife Management Bill is being drafted to repeal the *Nature Conservation Ordinance no. 4* of 1975, but has not yet come into operation (Laubscher, 2007). Several forms of consumptive use of wildlife are permitted on Namibian farmlands, including (summarized primarily using information from Gödde, 2008):

a) "Shoot-and-sell"—where ranchers are allocated permits to shoot wildlife to sell the meat. Shoot-and-sell permits are allocated to farmers during July and August, unless their wildlife is encompassed by a game fence, in which case the season is extended from June to September.
b) Safari hunting—the sale of guided hunting safaris to mainly foreign hunting tourists resulting in the removal of animals (primarily males) with trophy horns, skulls, teeth or bodies. A farm must be registered as a hunting farm in order for permits for safari hunting to be issued, and all hunting must be conducted in the company of a qualified hunting guide or professional hunters (Lamprechts, 2009). The safari hunting season runs from 1 February to 30 November (NAPHA, www.natron.net).

c) Management hunts—guided hunts sold to hunting tourists in a similar fashion to safari hunting, but with a focus on hunting of non-trophy animals.
d) Biltong hunting—where visitors (primarily hunting tourists from South Africa) are sold the right to hunt non-trophy individuals (primarily involving Greater Kudu, Oryx, Springbok and Common Warthog) for the production of biltong (dried meat). Biltong hunting is conducted under shoot-and-sell permits. The biltong hunting season is May–August on properties with perimeter wildlife-proof fencing and June and July for properties without perimeter fencing.
e) Wildlife harvesting—where wildlife is culled by specialized culling teams (under shoot-and-sell permits when conducted during the day or under specialized night culling permits when conducted after dark). Culling teams negotiate a price per kilogramme for wildlife meat with the farmer and then sell the meat on to abattoirs and meat-processing companies.
f) Shooting for own use—where animals may be shot for personal use. Permits are only required for specially protected species. No transport of meat away from the farm is permitted when animals are shot for own use.
g) Live capture and sale—where wildlife is captured and sold live to farmers or institutions wishing to re-stock other areas, or exported for sale in South Africa.

Credit: Peter Lindsey

Professional hunter and his client

Wildlife species are categorized as "specially protected", "protected" and "huntable", based on their degree of scarcity. Species from all categories can be hunted under some permits in some circumstances (Barnett and Patterson, 2006). Safari hunting quotas are established by the Department of Wildlife and National Parks, whereas all other wildlife use quotas are issued by regional or Windhoek offices of the Ministry of Environment and Tourism (Gödde, 2008). Quotas are allocated on the basis of management plans drafted by farmers or conservancies, taking into account wildlife numbers counted in the previous year and subsequent permits issued, and current estimated wildlife numbers (Gödde, 2008). MET inspects wildlife numbers on freehold farms every four years, except for properties encompassed by wildlife-proof fencing, where counts are not conducted (Gödde, 2008). According to Gödde (2008), quotas usually allow for maximum off-takes of 20% of the populations of huntable species and 10% of specially protected species, based on numbers provided in management plans.

Trends in wildlife-based land use on freehold land

Enabling legislation turned wildlife from being a burden to landowners into an asset. As in South Africa and Zimbabwe, land owners started to switch from livestock production to wildlife-based land use (WBLU) on a large scale. By 2004, wildlife was responsible for the generation of gross economic outputs of NAD1.5 billion in Namibia [USD177 million], of which 1.02 billion [USD121 million] were from WBLU on freehold land (Barnes *et al.*, 2009). Ecotourism, followed by hunting tourism, are estimated to be the most significant components economically of WBLU on freehold land, comprising 62.7% and 20.6% of economic output from wildlife, respectively (Barnes *et al.*, 2009). Attracted by Namibia's exceptional scenic beauty and diverse wildlife populations, tourist arrivals have increased rapidly in recent years, growing from 695 211 in 2003 to 928 912 in 2007 (www.namibiatourism.com.na). Similarly, the numbers of visiting hunters have increased from 1918 in 1994 to 5845 in 2006, and by 2007, revenues from safari hunting had reached USD44.8 million (Erb, 2004; Bond *et al.*, 2004; Damm, 2005; Lamprechts, 2009; P. Erb, Namibian Ministry of Environment and Tourism, pers comm.).

The growth in WBLU resulted in a major increase in the diversity and biomass of wildlife on private land as farmers began to protect and actively reintroduce wild ungulates (Barnes and de Jager, 1996). During 1972 and 1992, wildlife diversity, numbers and biomass on freehold land increased by 44%, 70% and 84% respectively (Barnes and de Jager, 1996). Similar increases were observed with the expansion of WBLU on private land in South Africa and Zimbabwe (Bond *et al.*, 2004). Other conservation benefits associated with the expansion of WBLU that have been observed in Southern Africa include: the recovery of populations of threatened and endangered species in some areas (including Bontebok *Damaliscus pygargus*, White Rhinoceros *Ceratotherium simum*, Black Wildebeest *Connochaetes gnou*, Hartmann's Mountain Zebra *Equus zebra hartmannea* and Cape Mountain Zebra *Equus zebra zebra*, etc.); the recovery of degraded rangelands due to reduction/removal of pressure from livestock (and resultant reduction in soil erosion and improvements in water-retention); management plans designed to remove alien plants in some areas (e.g. the Eastern Cape of South Africa); increases in predator populations in some areas (e.g. Cheetahs *Acinonyx jubatus* on ranchlands in South Africa, African Wild Dogs *Lycaon pictus* in Zimbabwean

conservancies); effective expansion of protected area networks to include under-represented biomes (e.g. the thicket biome in the Eastern Cape of South Africa); the development of increased capacity and improved techniques for wildlife management; the provision of wildlife from private ranches for re-stocking of depleted state protected areas (e.g. as is planned for Gonarezhou NP in Zimbabwe); and the conservation of large areas of natural woodlands and associated benefits relating to carbon sequestration and watershed protection (Pole 2004; Turpie *et al.*, 2005; Langholz and Kerley 2006; Marnewick *et al.*, 2007; Carruthers 2008; Child 2008; Cousins 2008; Lindsey *et al*., 2009).

Credit: Cornelis van der Waal

Characteristic sign board denoting entry to a commercial conservancy

As part of the expansion of WBLU on freehold land a number of conservancies have emerged during recent years (commencing in 1991). In Namibia, a conservancy is defined as: "*a legally protected area of a group of bona fide land-occupiers practicing co-operative management based on a sustainable utilization strategy, promoting conservation of natural resources and wildlife, and striving to re-instate the original bio-diversity with the basic goal of sharing resources amongst all members*" (Conservancies Association of Namibia [CANAM], www.canam.iway.na). There are 25 commercial conservancies, comprising 1008 farms and covering an area of ~43 250 km^2. Within conservancies, the consumptive use of wildlife is typically co-ordinated by the central conservancy, with quotas established on the basis of annual counts. There are another 50 conservancies occurring on communal land, covering ~119 000 km^2 (Jones and Weaver, 2007).

Challenges to WBLU in Southern Africa

Despite strong growth during recent decades, the private-land wildlife industry in Southern Africa faces a number of challenges which threaten its future. These challenges include:

a) Uncertainty among some politicians about the acceptability of using large areas of agricultural land for wildlife production. The development of WBLU in Southern Africa has been accompanied by a marked reduction in livestock numbers on private land. For example, cattle numbers on Namibian freehold land fell from 1.6 million in 1980 to one million in 2005, the result in part of the switch by some farmers to WBLU (MAWF, 2007). Such shifts have led to

erroneous concern among some Southern African politicians that WBLU may represent a threat to food security (du Toit, 2004).

b) Land reform. The independent nations of Southern Africa inherited colonial (and in the case of Namibia and South Africa, apartheid) land tenure systems where ownership of private land was skewed greatly in favour of white farmers. Consequently there is an imperative to undertake land reform to provide access to land ownership for previously disadvantaged groups. With the process of land reform, there is the risk that land uses will shift back from WBLU to livestock production unless specific efforts are made to introduce emerging farmers to wildlife ranching. In Zimbabwe, for example, the fast-track land reform programme resulted in the conversion of as much as 20 000 km^2 of game ranch land to livestock production and agriculture (Lindsey *et al.*, 2009).

c) Illegal bushmeat trade. In some parts of Southern Africa, illegal hunting for bushmeat represents a serious threat to WBLU on private land. In Zimbabwe, and parts of South Africa, snaring for bushmeat imposes significant financial impacts on wildlife ranchers, threatening the viability of WBLU (Lindsey *et al.*, 2009). The illegal bushmeat trade is emerging as a severe threat to widespread wildlife populations in Africa, owing to food insecurity among rural communities, high potential earnings from the sale of meat, and weak penal systems which fail to create deterrents for illegal use (Barnett, 1998; Lindsey *et al.*, 2009).

To address these concerns and threats, there is a need to demonstrate the positive contributions of WBLU to the economy and to national food security, to integrate the development of WBLU with the land reform process, and to demonstrate or create links between WBLU and food security in areas where the illegal bushmeat trade is prominent. Consumptive forms of WBLU result in the production of large quantities of game meat with the potential to contribute significantly to food security. Several authors have reviewed the potential for and barriers to the generation of income from the export of game meat from Namibia (Gödde, 2008; Laubscher, 2007; MET, 2008). However, little effort has been made to document the scale of meat production on Namibian farmlands, to document how game meat is used, or to document the economic and social benefits resulting from game meat production, which is the focus of this report.

This project forms a component of the BMZ-funded programme with TRAFFIC entitled “Vulnerable People, Diminishing Wildlife: Addressing priority bushmeat trade, livelihood and food security issues in Africa”.

METHODS

A structured questionnaire survey was designed and pre-tested thoroughly before use (**Appendix I**). Four interviewers were trained in the survey technique. A list of the farmers unions in Namibia (104 of them) was obtained from the Namibian Agricultural Union, and a sample of 60 randomly selected for sampling. The chairperson for each selected farmers union was then contacted and the contact details for farmers requested. From each of the 60 farmers unions, four farmers were randomly sampled and contacted via telephone to request an interview. All interviews were conducted in English (the national language), Afrikaans or Herero during the period July–September 2009.

The biomass of wildlife was estimated by assuming that the average mass of individuals within a species equalled 0.75 of standard female mass, after Coe *et al.* (1976), and then multiplying that figure by respondents' estimates of the number of individuals of each species present on their properties. When estimating meat production from wildlife on each respondent's property, the mean dressing percentage (Bothma, 2002) was multiplied by the number of individuals killed. In the case of safari hunting, biltong hunting, management hunts, shoot-and-sell and own use, all animals killed were assumed to be adults, whereas for culling, the mean mass for individuals in a population was used.

Credit: Tiemen Rhebergen

Vehicle used for wildlife harvesting (culling)

To estimate meat production and revenue from meat sales on a national scale, the mean percentage off-takes of populations of each species (based on farmers' estimates of wildlife numbers on their farm and numbers of animals that they remove via each form of consumptive use) were calculated. These percentages were then multiplied against national population estimates of each species on freehold land (after Barnes *et al.*, 2009) to provide an estimate of the number of individuals of each species removed via each form of use. This value was then multiplied by the mean mass of meat produced by an individual of each species from each form of use (taking into account the mean gender ratio of the different forms of use as recorded during the survey, to factor in the different masses of male and female animals). For species for which population estimates were not available (Kirk's Dik-dik *Madoqua kirkii*, Steenbok *Raphicerus campestris*, Common Duiker *Sylvicapra grimmia*, White Rhinoceros, Nyala *Tragelaphus angasi*, Common Tsessebe *Damaliscus lunatus*, Klipspringer *Oreotragus oreotragus*, Blesbok *Damaliscus pygargus phillipsi*), the percentage of total meat production from this sample was calculated and the national meat production estimate was adjusted upwards accordingly.

When estimating earnings from the sale of meat, warthog meat was assumed not to be sold, except for cases where the species was shot under "shoot-and-sell" permits. The sale of warthog meat is not permitted unless farmers are in possession of a special permit, to reduce the risk of transmission of swine fever to domestic pigs (Francois Joubert, directorate of Veterinary Services, pers. comm., 2010). In cases where farmers sold meat as rations to their workers (in most cases, rations were just given, but occasionally extra meat is sold to workers), income generated was excluded from the estimate of earnings from the sale of game meat as the prices are typically greatly subsidized. The mean proportion of meat sold from various forms of use was calculated, as was the proportion sold in

each form (i.e. as whole carcasses, unselected cuts, selected cuts, processed meat, etc). The kilogrammes of meat sold in each form were then multiplied by the mean prices obtained for each. This provided an estimate of the Namibian dollar earnings per km^2 per year from the sale of meat in each region. To provide an estimate of the national revenues from the sale of game meat, the mean earnings per year per km^2 in each region were multiplied by the area of freehold land in each region.

Statistical analyses

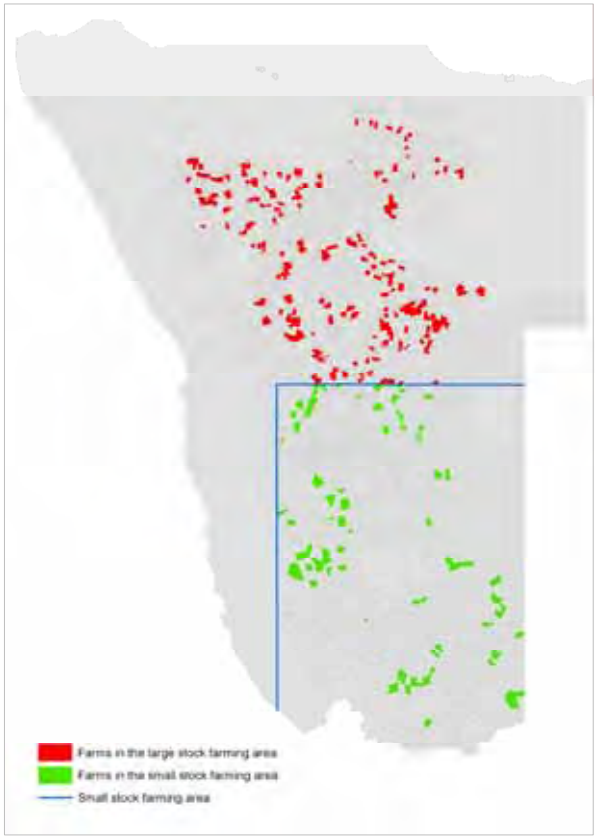
In the initial sample, farmers in conservancies were over-represented. When estimating land use, wildlife and livestock densities, and meat production on a national scale, surveys of farmers in conservancies were randomly selected and removed until the proportion of farms in conservancies equalled recorded proportions.

Survey data were analysed using multiple logistic regressions, chi-squares and analyses of variance as appropriate (JMPIN, 2000). Where logistic regressions or multiple analyses of variance were used, *p* values were presented for the whole model. When commencing with multiple logistic regressions or multiple analyses of variance, all variables that might logically be expected to influence the dependent variable were included in the models and then removed following a backwards stepwise procedure until all variables included were statistically significant (i.e. with a *p* value of <0.05).

Data on rainfall, human densities, estimates of the nearest distance of farms from towns and national roads and estimates of the land area under commercial farming in each region were calculated from a Geographic Information Systems (GIS) database (ConInfo, www.met.gov.na/dea), using ArcInfo. The "area" of Namibia was one variable included in several analyses: land was categorized as falling in the "small stock" or "large stock" farming areas, following Erb (2004), see **Figure 1**.

Figure 1

The "small stock" and "large stock" farming areas used in statistical analyses



RESULTS

A sample of 250 farmers was interviewed, including respondents from eight regions (Erongo—*n*=16; Hardap—*n*=20; Karas—*n*=28; Khomas—*n*=42; Kunene—*n*=56; Omaheke—*n*=23; Oshikoto—*n*=6; Otjozondjupa—*n*=59). Owing to multiple farm ownership and the leasing of additional farms by respondents or the consolidation of multiple farms (sometimes owned by several individuals) into single management units, the sample covered 412 farms and 28 038 km^2. There are believed to be 3500 commercial farms (or, more accurately, management units, sometimes including multiple farms combined) in Namibia (Giel Schoombee, Namibian Agricultural Union, pers. comm., 2010) and so the sample covered 11.8% of the "population". The refusal rate was 4.8%. Refusal rates of <10% are not considered to be problematic in terms of non-response bias (Lindner, 2002). Eighty-seven per cent (87.1%) of respondents interviewed where white, of which 54.2% were Afrikaans-speaking, 42.1% were German-speaking and the remainder English-speaking. Of the black respondents (12.9% of the sample), the majority (75.0%) were Otjiherero-speaking, the remainder spoke a variety of languages including Damara (9.4%), Oshiwambo (6.3%), Tswana (3.1%), Himba (3.1%), or Kavango (3.1%).

Number of farms and farm sizes

Respondents owned (or managed on behalf of owners) an average of 1.51 ± 0.07 and leased an additional 0.15 ± 0.03 farms. The mean combined size of management units controlled by respondents was 120 ± 13 km^2 and the mean size of individual farms was 69.5 ± 3.03 km^2. The size of landholdings was larger in the small stock (241 ± 42 km^2) than large stock farming area (75.4 ± 4.7 km^2) (F Ratio 39.9, d.f.=1, p<0.001). Eighty-five per cent of respondents were full-time farmers, the remainder had other jobs.

Land use

Spatial patterns in land uses are presented in **Figure 2**.

Livestock

Livestock production was the most frequently practised form of land use (92.3% of respondents) (**Table 1**), and generated the largest mean proportion of respondents' income (**Table 2**). Cattle were the most frequently farmed livestock (93.4% of respondents, mean density where cattle are kept—5.1 ± 0.36 individuals/km^2), followed by sheep (72.7%, 13.6 ± 2.3/km^2), and goats (61.6%, 2.20 ± 0.19). Whether livestock farming was practised or not was related to: wildlife biomass (where livestock farming occurred, wildlife biomass was lower—1,101 ± 110 kg/km^2 c.f. 3,512 ±1,076 kg/km^2 where no livestock were present); the percentage of income from safari hunting —(respondents with livestock derived a lower proportion of income (12.4 ± 1.4%) from safari hunting than those without livestock (41.8 ± 9.4%); and percentage of income from ecotourism (respondents with livestock derived lower proportion (4.2 ± 0.9%) of income from ecotourism, c.f. 28.0 ± 9.5% for respondents without livestock) ($\chi 2$=48.0, *d.f.*=3, p<0.001, JMPIN, 2000).

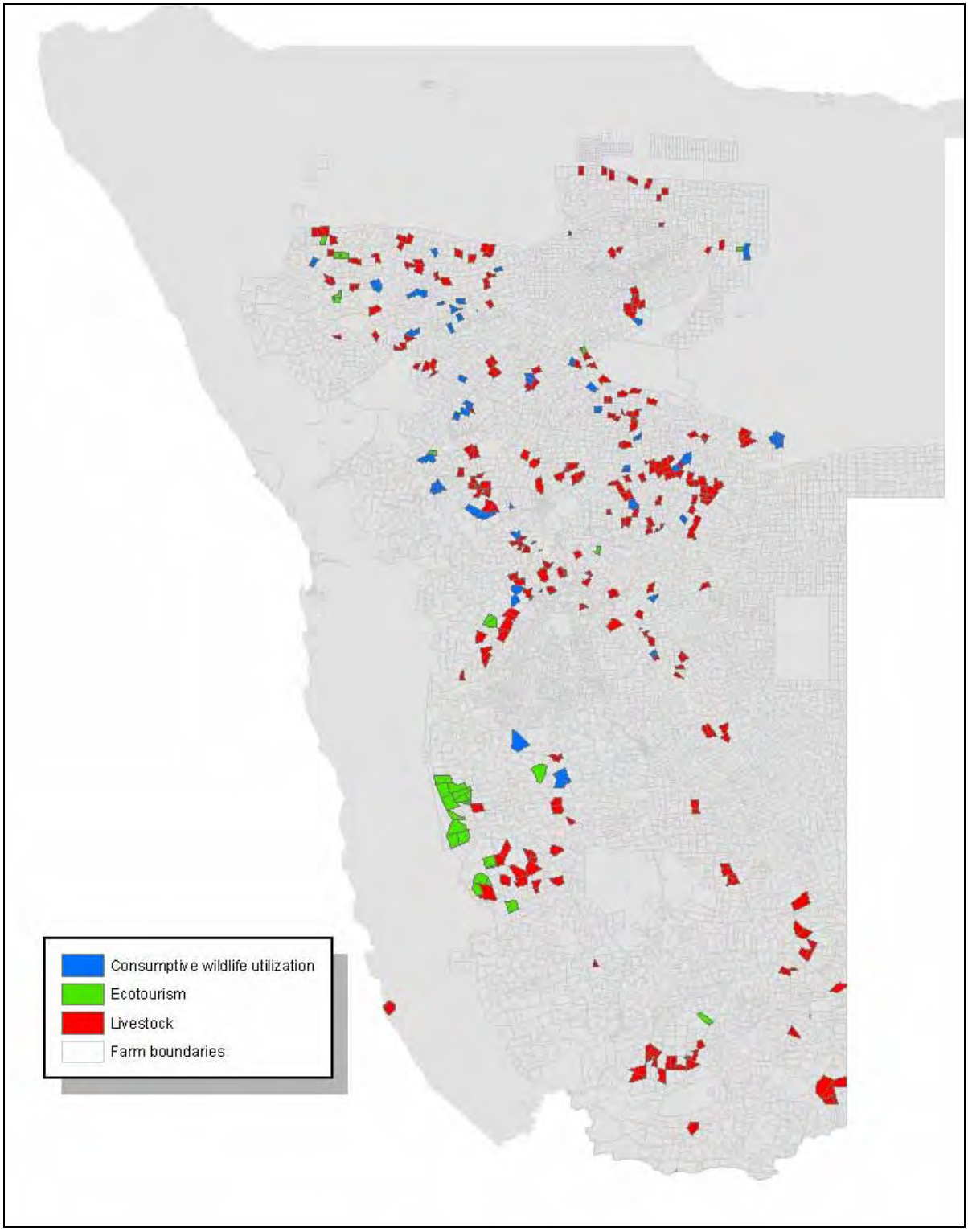
The percentage of income derived from livestock was influenced by the region (the highest proportions of income from livestock were among farmers from Kunene, Oshikoto, and Otjozondjupa, **Table 2**), and by the age of the respondent, older farmers typically deriving a higher proportion of income from livestock (**Figure 3**) (F Ratio=3.69, *d.f.*=8, $p<0.001$, JMPIN, 2000).

Credit: Peter Lindsey

Cattle on a Namibian commercial farm

Figure 2

Spatial patterns in primary land use (i.e. that accounting for the majority of farmers' income) on freehold land in Namibia



Wildlife-based land uses

Seventy-five per cent of respondents practised some form of wildlife-based land use (commercial consumptive or non-consumptive use of wildlife, excluding harvesting of wildlife for their own use). Approximately 288 000 km^2 of freehold land is used for WBLU, and ~32 000 km^2 is used exclusively for wildlife production (i.e. without livestock) (**Table 3**). Whether WBLU is practised was related to: whether the respondent's property was part of a conservancy (94.0% of respondents in conservancies practise WBLU, c.f. 69.4% of respondents not belonging to a conservancy); and wildlife diversity (higher on land of respondents practising WBLU—9.0 ± 0.32 wild ungulate species—than on land of those not practising WBLU—5.2 ± 0.26 species).

The percentage of income from WBLU was related to the following factors: whether the respondent's property was part of a conservancy (conservancy members derived a higher proportion of income [35.3 ± 3.0%] from WBLU than those not part of conservancies [19.1 ± 2.4%]); the number of employees/km^2 (there was a positive relationship between the percentage of income from WBLU and the number of employees/km^2) (see section below on employment); and the race of the respondent (the mean percentage income from WBLU was higher among white respondents than black respondents (29.6 ± 2.2% c.f. 6.6 ± 1.6%)).

Table 1

Percentage of farmers engaging in various land use types

	Livestock production	Ecotourism	Safari hunting	Shoot-and-sell	Wildlife harvesting	Biltong hunting	Live sales	Management hunts
Overall	92.3	25.2	35.7	39.9	16.1	23.8	17.3	13.7
Zone								
Small stock	88.9	34.1	44.4	51.1	20.0	22.8	24.4	17.8
Large stock	93.5	22.0	32.5	35.7	14.6	26.7	14.6	12.2
Region								
Erongo	90.0	20.0	50.0	40.0	0	30.0	0	0
Hardap	90.0	20.0	30.0	55.0	10.0	15.0	20.0	15.0
Karas	89.3	40.7	50.0	46.4	25.0	28.6	25.0	17.9
Khomas	83.3	29.2	29.2	41.7	8.3	4.2	8.3	8.3
Kunene	100	40.7	14.8	37.0	22.2	51.9	7.4	11.1
Omaheke	83.3	8.3	8.3	8.3	0	8.3	0	0
Oshikoto	100	33.3	50.0	50.0	16.7	50.0	16.7	33.3
Otjozondjupa	97.6	9.76	48.8	36.6	22.0	17.1	31.7	19.5
In conservancy?								
Yes	89.7	30.2	75.9	41.4	10.3	19.0	30.2	15.5
No	94.0	23.9	29.1	38.1	15.7	24.7	13.4	11.9

Table 2

Relationships between respondents' region and whether their property lay within a conservancy, and the percentage of income coming from various types of land use

	Mean % income from livestock	Mean % income from ecotourism	Mean % income from safari hunting	Mean % income from shoot-and-sell	Mean % income from wildlife harvesting	Mean % income from biltong hunting	Mean % income from live sales	Mean % income from management hunts
Overall	66.9±2.8	6.8±1.6	9.2±1.6	2.7±0.7	1.0±0.3	1.3±0.3	1.8±0.7	0.2±0.01
Zone								
Small stock	66.2±5.3	7.7±3.4	11.1±3.2	5.5±0.8	2.4±1.0	1.7±0.7	3.1±1.9	0.2±0.1
Large stock	67.1±3.3	6.5±1.9	8.6±1.9	1.7±0.4	0.5±0.2	1.0±0.2	1.3±0.7	0.2±0.1
Region								
Erongo	54.2±12.1	0.9±0.9	22.8±12.1	5.2±2.8	0±0	2.5±1.3	0±0	0±0
Hardap	73.8±8.2	6.1±5.4	5.8±3.0	7.8±5.3	1.1±1.1	1.6±0.1	0.4±0.3	0.2±0.2
Karas	64.2±6.7	8.3±4.1	14.0±4.7	3.4±1.1	3.1±1.5	0.8±0.4	4.8±3.0	0.2±0.1
Khomas	61.7±8.2	14.2±6.6	4.5±2.5	2.8±1.0	0.9±0.7	0.3±0.3	0.2±0.2	0.2±0.2
Kunene	79.6±4.3	5.8±2.7	3.0±2.7	1.0±0.4	0.3±0.2	1.8±0.5	0.1±0.1	0.2±0.1
Omaheke	51.8±13.5	8.3±8.3	1.3±1.3	0.2±0.2	0±0	1.7±1.7	0±0	0±0
Oshikoto	71.2±12.5	13.7±13.3	8.6±6.4	0.7±0.5	0.2±0.2	3.6±1.9	0.1±0.1	0±0
Otjozondjupa	67.1±5.6	12.3±2.0	13.7±3.9	1.3±0.4	0.7±0.0	0.8±0.4	3.7±2.0	0.3±0.2
Conservancy membership								
Yes	60.3±3.1	7.2±1.6	22.6±2.2	3.0±0.7	0.3±0.3	0.8±0.3	1.9±0.5	0.2±0.06
No	67.6±3.2	5.0±1.7	7.5±2.1	2.7±0.7	1.1±0.4	1.4±0.3	2.0±0.9	0.3±0.1

Table 3

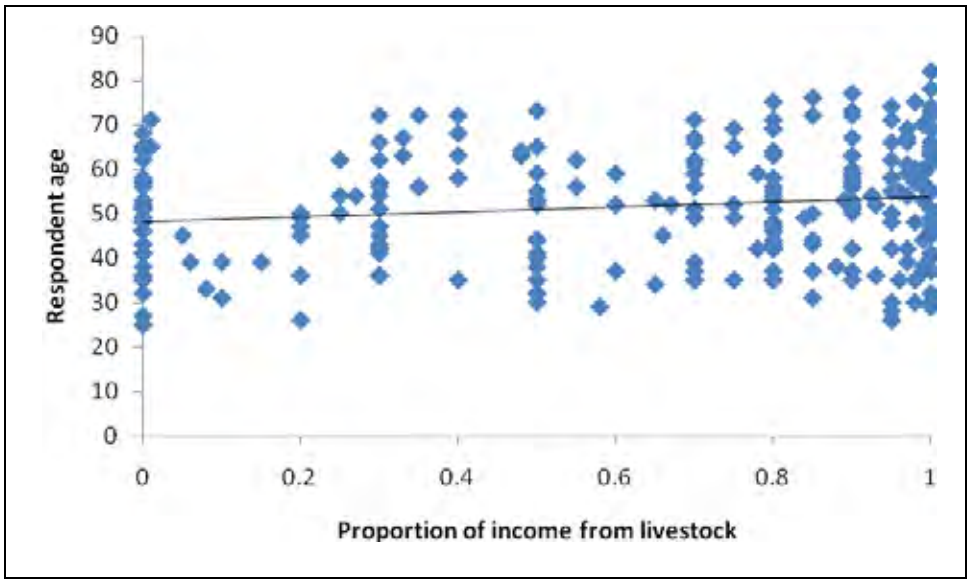
Land area used for safari hunting, ecotourism, wildlife-based land uses, and for pure wildlife production

Region *	Total area	Safari hunting		Ecotourism		Wildlife based land uses		Pure wildlife (livestock absent)	
		% of farms	km^2	% of farms	km^2	% of farms	km^2	% of farms	km^2
Erongo	21 729	50.0	10 865	20.0	4346	80	17 383	10.0	2173
Hardap	78 156	30.0	23 447	20.0	15 631	95	74 248	10.0	7816
Karas	86 764	50.0	43 382	40.7	35 313	100	86 764	10.7	9284
Khomas	32 349	29.2	9446	29.2	9446	83.3	26 947	16.7	5402
Kunene	26 199	14.8	3877	40.7	10 663	44.4	11 632	0	0
Omaheke	36 690	8.3	3045	8.3	3045	50	18 345	16.7	6127
Omusati	802	14.8	119	40.7	326	44.4	356	0	0
Oshana	550	14.8	81	40.7	224	44.4	244	0	0
Oshikoto	7054	14.8	1044	40.7	2871	44.4	3132	0	0
Otjozondjupa	66 239	48.9	32 391	9.8	6491	73.2	48 487	2.4	1590
Total/average	**356 532**	**35.8**	**127 697**	**29.1**	**88 357**	**80.7**	**287 539**	**9.1**	**32 392**

Note: *Assuming that the percentage in Oshikoto, Oshana and Omusati equal that in Kunene, the nearest region for which density estimates are available (averages exclude Oshikoto, Oshana and Omusati).

Figure 3

Relationship between respondent age and the proportion of income derived from livestock



Ecotourism

Twenty-five per cent (25.2%) of respondents derived income from ecotourism (**Table 1**). Ecotourism is practised over ~88 000 km^2 of freehold land (**Table 3**). Whether ecotourism was practised was related to: the region (the highest proportions of respondents practising ecotourism were in Karas, Kunene and Khomas); and by wildlife diversity (diversity was higher on the land of respondents who do practise ecotourism than on those who do not (9.42 ± 0.56 wild ungulate species c.f. 7.9 ± 0.32) ($\chi 2$=26.7, *d.f.*=8, p<0.001).

Mean percentage income from ecotourism across all respondents was 6.8%. The percentage of income derived from ecotourism was related to: the area of Namibia (percentage of income from ecotourism was higher in the small stock than large stock farming area, **Table 2**); and the ethnicity of respondents (black farmers derived a mean of 0.006% ± 0.03 of income from ecotourism; Afrikaans-speaking farmers—4.93% ± 0.02; German [or English] speakers—8.8% ± 0.02) (F Ratio =3.76, *d.f.*=4, p=0.005). Ranchers conducting ecotourism attracted a mean of 353 ± 99 tourists per year to their properties and recorded a mean of 725 ±186 bed nights.

Safari hunting

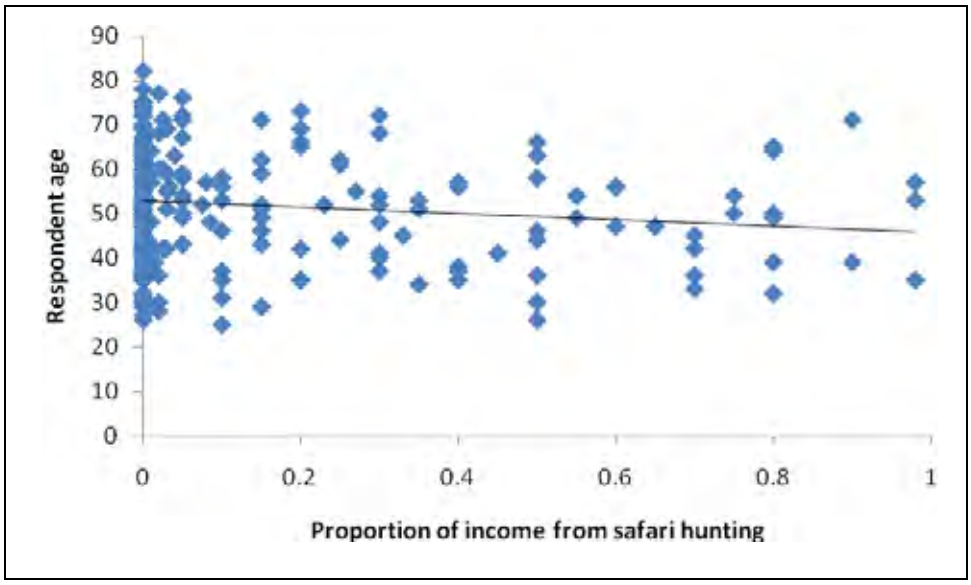
Safari hunting was the second-most widely practised form of WBLU and generated the highest proportion of farmers' income from WBLU (**Tables 1** and **2**). Safari hunting is practised over ~128 000 km^2 of freehold land (**Table 3**). Whether safari hunting was practised was related to: whether respondents were part of a conservancy (69.3% of conservancy members practise safari hunting c.f. 30.7% of non conservancy members); wildlife diversity (diversity was higher on properties where safari hunting was practised—11.0 ± 0.38 wild ungulate species c.f. 5.46 ± 0.22);

and by the percentage of income from ecotourism (where safari hunting was practised, the percentage of income from ecotourism was 2.8 ± 0.7% c.f. 9.4 ± 0.2% where safari hunting was not practised).

The percentage of income from safari hunting was related to respondent age (younger respondents tending to derive a higher percentage of income from safari hunting, **Figure 4**), region (respondents in Erongo, Karas and Otjozondjupa deriving the highest percentage of their income from safari hunting, **Table 2**), and whether respondents' properties were within conservancies or not (respondents in conservancies derived a higher percentage of income from safari hunting [22.6 ± 2.5%] than those not part of conservancies [7.5 ± 1.7%]) **Table 2**) (F Ratio=14.4, *d.f.*=2, $p<0.001$).

Figure 4

Relationship between age and proportion of income derived from safari hunting



Management hunts

Fourteen-per cent (13.7%) of respondents sold management hunts (**Table 1**). Whether management hunts were practised was related to: the area of Namibia (17.8% of respondents in the small stock farming area conduct management hunts, c.f. 12.2% in the large stock area) and wildlife diversity (ranches where management hunts are practised had a mean diversity of 11.8 ± 0.88 wild ungulate species, c.f. 7.7 ± 0.28 where management hunts are not practised) ($\chi 2$=27.8, *d.f.*=2, $p<0.001$). There was a positive relationship between wildlife diversity and the percentage of respondents' income from management hunts (F Ratio 6.87, d.f.=1, p=0.009).

Shoot-and-sell

Forty per cent (39.9%) of respondents practised shoot-and-sell (**Table 1**). Whether shoot-and-sell was practised or not was related to the mean diversity of wild ungulates (wild ungulate diversity was higher where shoot-and-sell was practised (9.41 ± 0.48 species c.f. 7.56 ±0.34) ($\chi 2$=10.1, *d.f.*=1,

$p<0.001$). There were no statistically significant determinants of the proportion of income derived from shoot-and-sell.

Biltong hunting

Twenty-four per cent (23.8%) of respondents derived income from selling biltong hunts (**Table 1**). Whether or not biltong hunting was practised was related to: the percentage of income derived from ecotourism (where biltong hunting is practised, 1.0 ± 0.3% of income is from ecotourism, c.f. 7.4 ± 1.5% where biltong hunting is not practised); and the region—biltong hunting is most commonly practised in Kunene, Oshikoto and Erongo) ($\chi 2$=56.1, *d.f.*=1, $p<0.001$). The proportion of income from biltong hunting was higher in the small stock area (2.7 ± 0.2%) than in the large stock area (0.9 ± 0.2) (F Ratio 9.18, d.f.=1, $p<0.001$).

Wildlife harvesting (culling)

Sixteen per cent (16.1%) of respondents derived income from wildlife harvesting (**Table 1**). Whether or not respondents culled wildlife was related to: wildlife diversity (diversity was higher on land where respondents culled—8.67 ± 0.92 species, c.f. 8.24 ± 0.30 species where they did not cull); and the area of Namibia—culling was more common in the small stock area (17.8% of respondents) than the large stock area (12.2%) ($\chi 2$=17.6, *d.f.*=2, $p<0.001$). The percentage of income from wildlife culling was higher in the small stock (2.4 ± 1.0%) than the large stock area (0.5 ± 0.2%) (F Ratio 8.11, d.f.=1; $p=0.005$).

Own use

Ninety-three per cent (92.9%) of respondents used wildlife for their own use. Whether or not respondents harvested wildlife for their own use was related to: the percentage of income from livestock (respondents who shoot for own use are more reliant on livestock for their income (67.0 ± 3.0% of income from livestock) than those who do not (42.8 ± 7.2% income from livestock)); wildlife biomass (which is higher on land of respondents who do not shoot for own use—3.031 ± 937 kg/km^2—than on the land of those who do—1048 ± 73 kg/km^2); and whether respondents were members of conservancies or not (80.1% of conservancy members shoot for own use, c.f. 93.3% of non conservancy members) ($\chi 2$=27.6, *d.f.*=3, $p<0.001$).

Live sales

Seventeen per cent (17.3%) of respondents sold live wild animals (**Table 1**). The percentage of income from live sales was related to: percentage of income from livestock (inverse relationship—the higher the percentage of income from livestock, the lower the percentage from live sales); the percentage of income from safari hunting (positive relationship—the higher the percentage of income from safari hunting, the higher the proportion from live sales); and wildlife diversity (positive relationship, the higher the diversity, the higher the percentage of income from live sales) (F Ratio 13.9, d.f.=4; $p<0.001$). Live sales are typically undertaken every three to five years. The most

commonly sold species among farmers are: Oryx (42.3% of farmers who sell wildlife); Hartebeest *Alcelaphus buselaphus* (38.5%); Common Eland *Tragelaphus oryx* (34.6%); Springbok (30.8%) and Blue Wildebeest *Connochaetes taurinus* (30.8%).

Guest accommodation

Fifty-three per cent (52.6%) of respondents had guest accommodation on their properties. Guest accommodation was most commonly used for hunters (74.7%), ecotourism clientele (45.9%), businesspeople and conferences (16.2%), and friends and family (5.4%).

Employees

Respondents employed a mean of 10.4 ± 1.14 workers, or 0.28 ± 0.12 workers/km^2. The number of employees was related to: the proportion of income derived from livestock (inverse relationship—i.e. the greater the percentage of income from livestock, the fewer employees, see **Figure 5**); the proportion of income from wildlife-based land uses (positive relationship—the greater the proportion of income from WBLU, the higher the number of employees, **Figure 6**); the proportion of income from ecotourism (positive relationship, **Figure 7**); the wildlife biomass (positive relationship, **Figure 8**), and the rainfall (employees per km^2 increasing with increasing rainfall—in areas with <200 ml of rain/year, the mean number of employees per km^2 was 0.04 ± 0.004; 201-300 ml—0.11 ± 0.01; 301–400 ml—0.11 ± 0.02; >400 ml—0.17 ± 0.03) (F Ratio 18.1, d.f.=7, p=<0.001). The number of employees/km^2 was greater on farms inside conservancies, but the effect was not statistically significant (farms in conservancies—0.13 ± 0.01 employees/km^2, farms not in conservancies—0.10 ± 0.01, F Ratio 2.65, *d.f.* 1, p=0.105). Farmers typically housed an additional 1.46 ± 0.13 family members per worker, or a total of 25.8 ± 2.1 people (employees and family members) per management unit (0.46 ± 0.11 people/km^2).

Figure 5

Relationship between the proportion of income from livestock and the number of employees/km^2

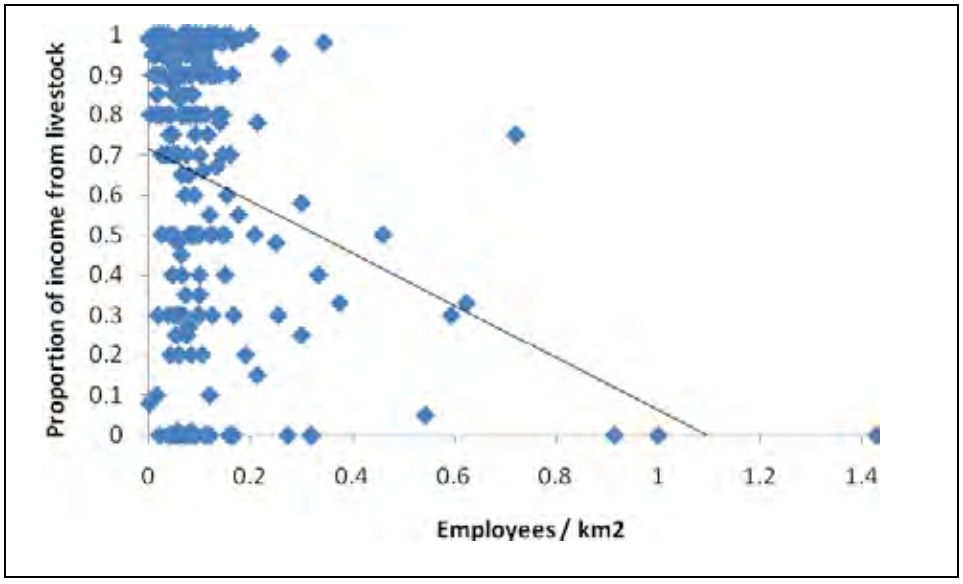


Figure 6

Relationship between the proportion of income from wildlife-based land uses (WBLU) and the number of employees/km^2

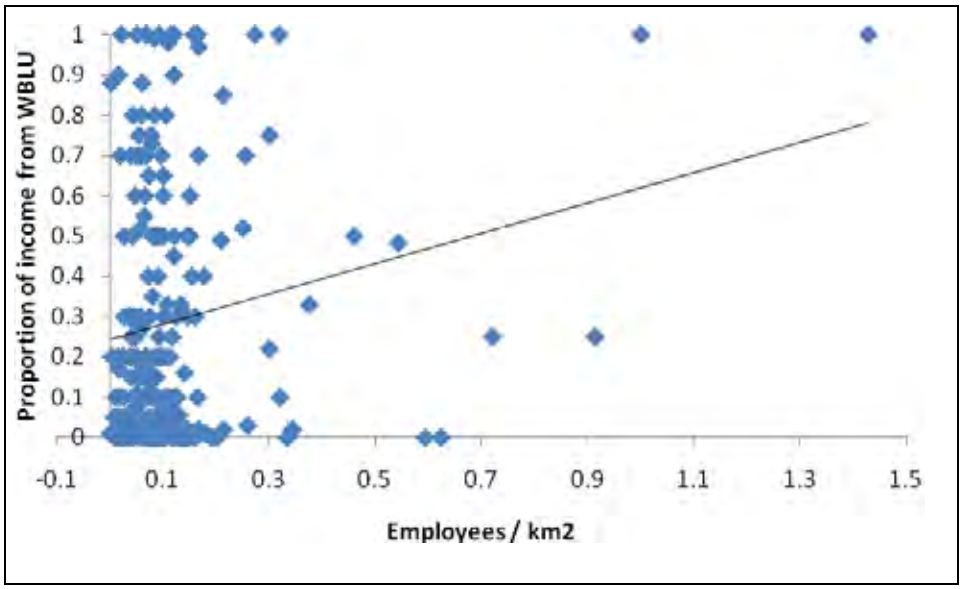


Figure 7

Relationship between the number of employees/km^2 and the proportion of respondent's income from ecotourism

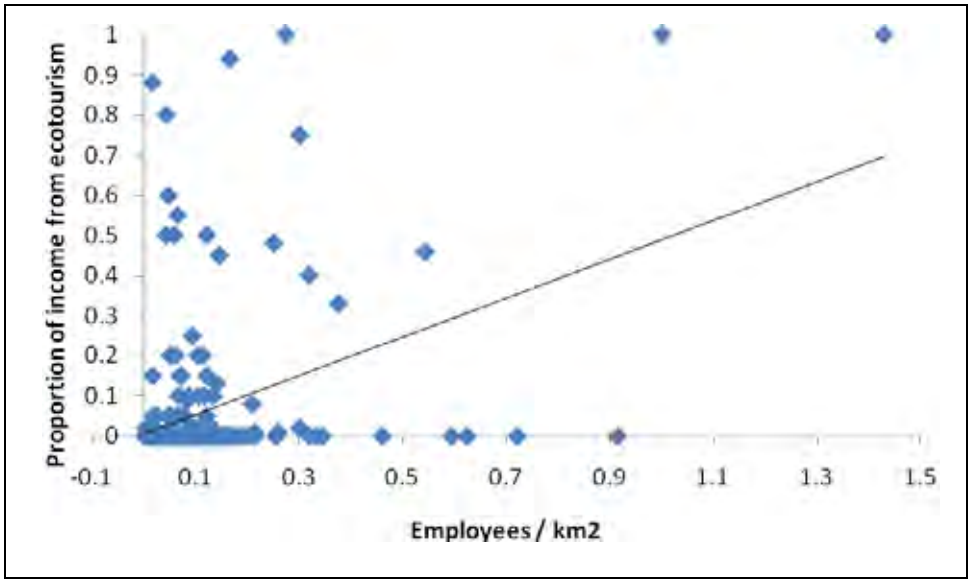
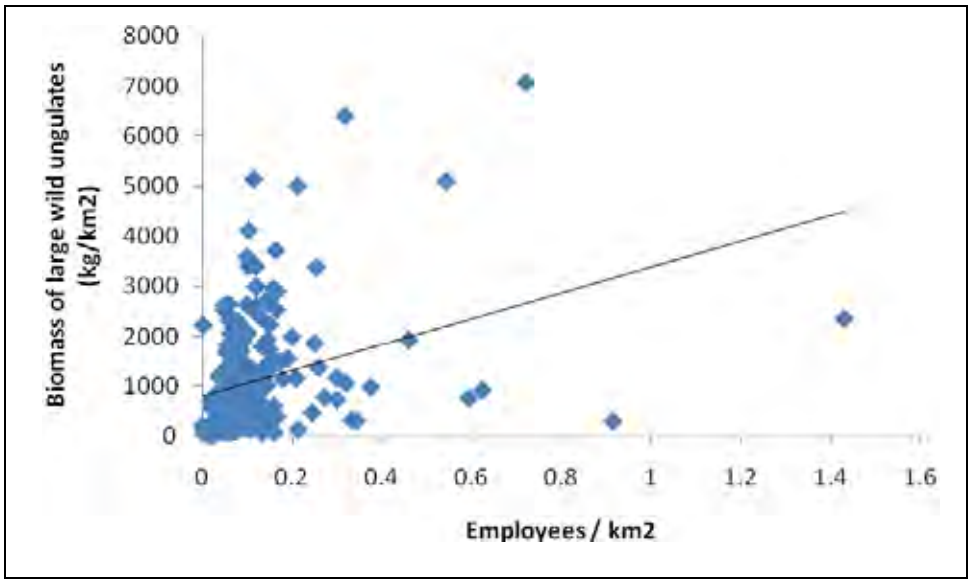


Figure 8

Relationship between the number of employees per km^2 and the biomass of large (>15kg) wild ungulates



Conservancies

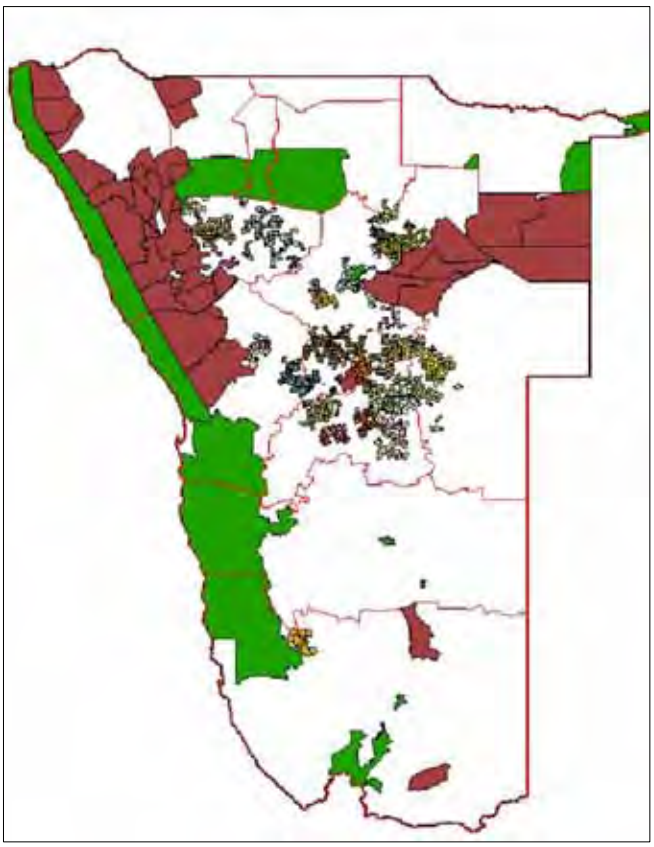
The majority of conservancies occur in the central and northern parts of the freehold farming area (**Figure 9**). Whether a respondent's property was part of a conservancy was related to: the percentage of income from livestock (mean percentage income from livestock was lower among respondents with land in conservancies); safari hunting (mean percentage income from safari hunting was higher among ranchers with land in conservancies) (**Table 2**); rainfall (conservancies were most commonly located in areas of intermediate rainfall); the distance from main roads (farms part of conservancies closer to main roads (mean distance—26.4 ± 2.3 km) than farms not part of conservancies—37.4 ± 2.6 km); the biomass of wildlife (mean biomass was higher in conservancies—1663 ± 216kg/km^2—than out of conservancies—978 ± 174 kg/km^2); livestock biomass (mean biomass was lower in conservancies—2587 ± 173 kg/km^2—than outside of conservancies—3377± 884 kg/km^2); and the race of respondents: 3.1% of black respondents were members of conservancies c.f. 52.8% of white respondents (before adjustment of the sample to ensure that the proportion of respondents in the sample equalled that observed in reality) ($\chi 2$=105.3, *d.f.*=8, p<0.001, JMPIN 2000). Conservancy membership did not affect the diversity of wildlife, nor the presence/absence of large wildlife (i.e. African Elephants *Loxodonta africana*, Hippopotamuses *Hippopotamus amphibius*, rhinoceros species, or Lions *Panthera leo*).

Credit: Tiemen Rhebergen

Greater Kudu are one of the commonest ungulates on Namibian farmlands and are a key species for wildlife-based land uses

Figure 9

Communal (in dark red/brown) and commercial conservancies (cluster of farms in various colours) in Namibia



Source: CANAM

The most common reasons cited for joining conservancies were: to provide for improved/co-ordinated wildlife management and to conserve wildlife (**Table 4**).

Table 4

Reasons for joining or staying out of conservancies

Reasons for joining a conservancy	*n*	%	Reasons for not being part of a conservancy	*n*	%
For improved/co-ordinated wildlife management	45	38.8	No conservancies in the area	50	37.3
To conserve wildlife	40	34.5	Not invited into/informed about conservancies	11	8.21
To streamline interactions with government/obtaining permits easier/reduce government interference	24	20.7	I'm a livestock farmer/not interested in wildlife	10	7.46
For improved wildlife counts	13	11.2	Don't know/no particular reason	9	6.72
Increases area of land one can hunt on	12	10.3	Can't see the benefit of being part of a conservancy	8	5.97
Due to peer pressure	5	4.31	I have no interest in being part of a conservancy	7	5.22
To help control poaching	4	3.45	The conservancy concept is not working	3	2.24
To improve neighbour relations	4	3.45	Co-operating with neighbours is difficult	2	1.49
Due to fear that government would take over ownership of wildlife on isolated farms	3	2.58			
Due to a belief that membership of a conservancy would provide protection from loss of land during land reform	3	2.58			

During the surveys, farmers belonging to conservancies frequently voiced dissatisfaction and disillusionment with conservancies which was not quantitatively captured by the survey. Primary reasons for such disillusionment included:

1) Frustration over the lack of legal recognition of commercial conservancies
2) The belief that membership of conservancies provided no protection from land restitution
3) A fear previously held by some farmers was that government would take over ownership of wildlife on farms not belonging to conservancies—that did not happen, thus negating one of the reasons farmers joined conservancies
4) A feeling that conservancies only really benefited land owners who conducted safari hunting
5) The belief that conservancies did not provide significant benefits for wildlife conservation (i.e. they facilitated increased off-takes, not improved protection)
6) Problems associated with equitable sharing of the pooled wildlife resource and the failure of conservancy structures to take into account differential investments in wildlife
7) A feeling that the membership fees were not reflected in commensurate service provision by the conservancies
8) Problems associated with internal politics and neighbour relations
9) Dissatisfaction among Afrikaans-speaking members of conservancies over the predominance of the German language at conservancy meetings

In the Kunene region, some black farmers were under the misconception that they did not qualify for conservancy membership because they did not have wildlife-proof fencing, which they believed to be a prerequisite for membership.

Fencing

Eighty-nine per cent (88.7%) of respondents had livestock-proof fencing on their properties, (of which 28.0% had jackal-proof fencing). Twenty-seven (26.8%) had game fencing around their properties (of which 17.8% indicated they had game fencing designed only to hold non-jumping wildlife species) and 35.6% indicated that they had only part of their properties encompassed by game fencing. Only 1.2% of farmers indicated that they had no fencing on their properties. Game fencing was more common within conservancies than outside and stock-proof (including jackal-proof) fencing less common (**Table 5**).

Table 5

Prevalence of various forms of fencing on Namibian commercial farmlands

	No fence	Stock-proof	Jackal-proof	Partial game-proof	Jumping game-proof	Non-jumping game-proof
Overall	1.2	88.7	28.0	10.7	26.8	5.4
Area						
Small stock	0	93.3	84.4	0	22.2	0
Large stock	1.6	86.9	7.3	14.6	21.1	7.3
In conservancy?						
Yes	2.6	76.7	3.4	6.0	38.8	6.0
No	0	91.0	32.8	24.1	22.3	6.0

Credit: Tiemen Rhebergen

Livestock-proof fencing (designed only to constrain the movement of livestock)

Credit: Peter Lindsey

Wildlife-proof fencing (of the type not designed to constrain the movement of predators)

Changes in land use

When respondents farming with livestock were asked if they would ever consider removing livestock and farming purely with wildlife, 21.4% indicated that they would, and the remainder said they would not. The most frequently cited comments from respondents who indicated that they would consider such a change were: if the financial viability could be demonstrated, they would make the change (37.5%); because wildlife is more profitable than livestock (18.7%); if funds were provided to assist with the necessary infrastructure development, they would make the change (12.5%). The most frequently cited reasons from respondents for not wishing to switch purely to wildlife ranching were: that wildlife alone is unviable/too risky (43.5%); the start-up costs were too high; because they loved farming with cattle/were raised farming cattle or were too old to change from cattle (14.3%); because they considered their property to be too small (11.7%); and the perceived riskiness of farming with wildlife, owing to the frequency of droughts (wildlife, unlike cattle, cannot be moved easily) (7.8%).

The willingness of respondents to shift to remove all livestock and shift to wildlife-based land uses was influenced by: respondents' race (30.8% of black respondents were willing to shift, c.f. 20% of white respondents); proportion of income from ecotourism (respondents willing to remove all livestock derived 0.08 ± 0.03% of income from ecotourism, c.f. 0.04 ± 0.01% among respondents unwilling to remove all livestock); proportion of income from safari hunting (respondents willing to remove all livestock derived 22 ± 5.0% of income from safari hunting, c.f. 11 ± 2.0% among respondents unwilling to remove all livestock); and respondents' distance from town (respondents willing to remove all livestock were 142 ± 20 km from the nearest town, c.f. 192 ± 11.4 km for among respondents unwilling to remove all livestock).

Farmers with land inside conservancies were asked:

"If the conservancy proposed that all farmers switch to purely game farming, remove all internal fences, and that the conservancy constructed a single fence around the perimeter and reintroduced all indigenous animals that the law permitted to the area, would you be supportive of such a move and be willing to include your land?"

Seventy-four per cent of respondents indicated that they would not be supportive of such a change, citing the following reasons: livestock is a safer form of income (59.3%); the conservancy is too fragmented to enable such a development (24.7%); unwillingness to give up livestock farming (18.5%); the difficulty of working together effectively with neighbours (13.6%); such a form of land use would not be viable or would be too risky (12.3%). Comments given by respondents who indicated that they would consider such a change included: if neighbours participated, they would too (23.1%); comments on the improved marketing opportunities that would arise (11.5%); if the financial viability of such an option could be demonstrated, they would be interested in making the change (11.5%); and comments related to the opportunities for improved wildlife management (7.6%).

The willingness of respondents to form a fully integrated conservancy was related to the proportion of income derived from safari hunting: respondents willing to form such a conservancy derived 30 ±

6.0% of their income from safari hunting, c.f. 14 ± 2.0% for respondents not willing to form such a conservancy ($\chi 2$=7.3, *d.f.*=1, p<0.001).

Wildlife abundance and diversity

Spatial patterns in the diversity of wild ungulates are presented in **Figure 10**. The mean diversity of wild ungulates (plus Ostriches *Struthio camelus* where present) per management unit was 7.69 ± 0.35 species. Wild ungulate diversity was influenced by: whether respondents' properties were within conservancies (mean diversity in conservancies—10.1 ± 0.39 species, out of conservancies—6.72 ± 0.36); the proportion of income from livestock (inverse relationship—**Figure 11**); the proportion of income from trophy hunting (positive relationship—**Figure 12**); age of the respondents (inverse relationship, **Figure 13**); distance of respondents' farms from town (inverse relationship—i.e. diversity was higher on farms close to town, **Figure 14**); and the vegetation (**Table 6**) (F Ratio—11.7, d.f.=14, p<0.001).

Figure 10

Spatial patterns in the diversity of wild ungulates (i.e. the number of species, also including Ostriches)

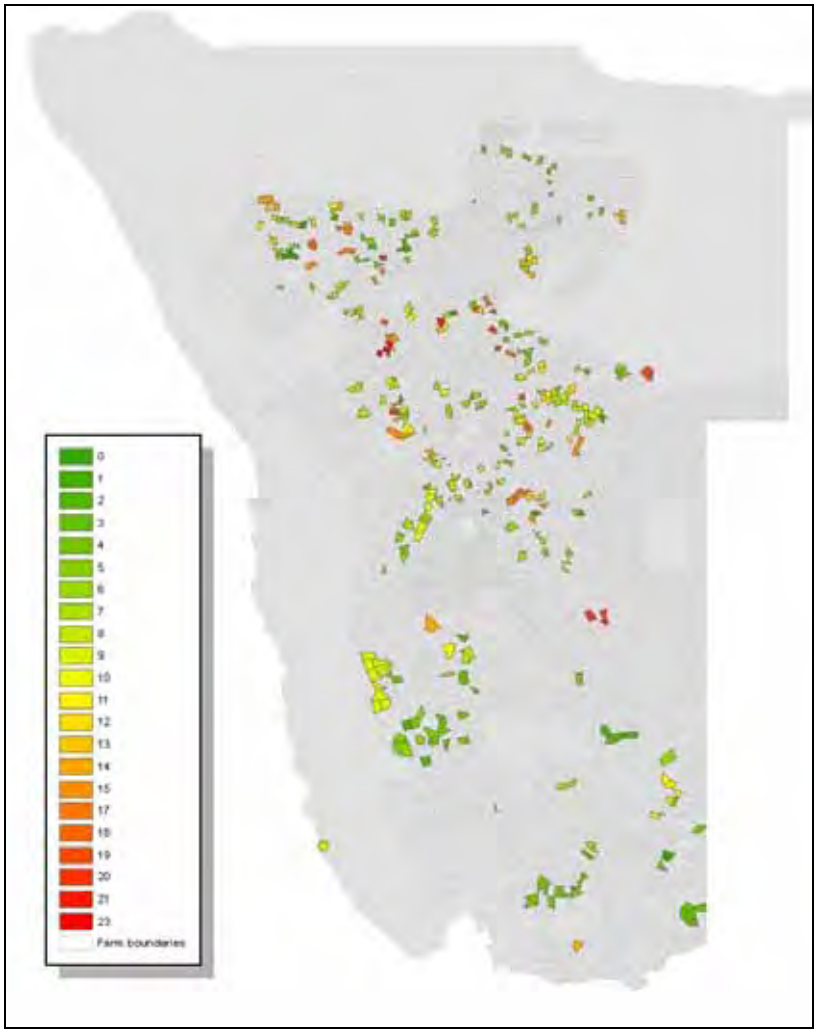


Figure 11

Relationship between the diversity of wild ungulates and the proportion of income from livestock

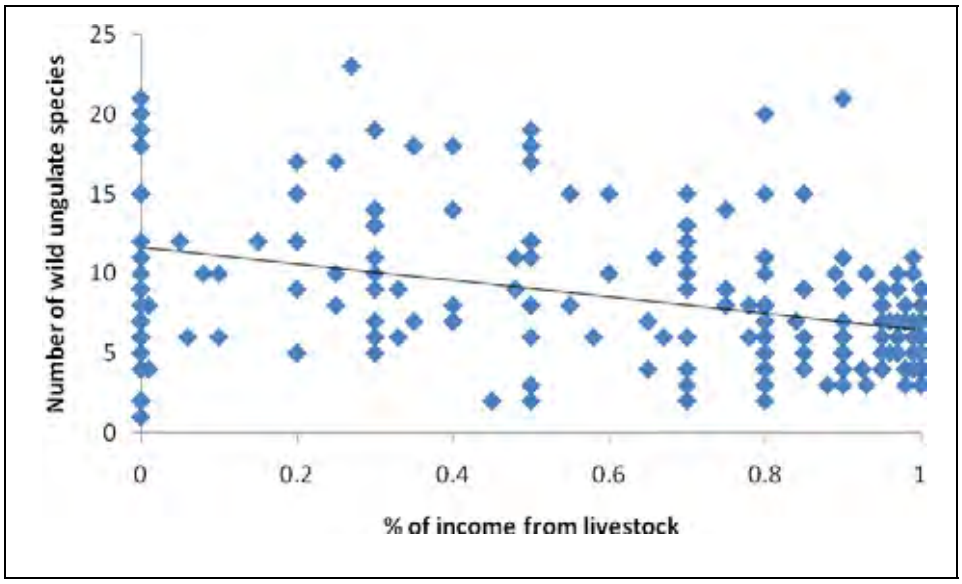


Figure 12

Relationship between the diversity of wild ungulates and the proportion of income from safari hunting

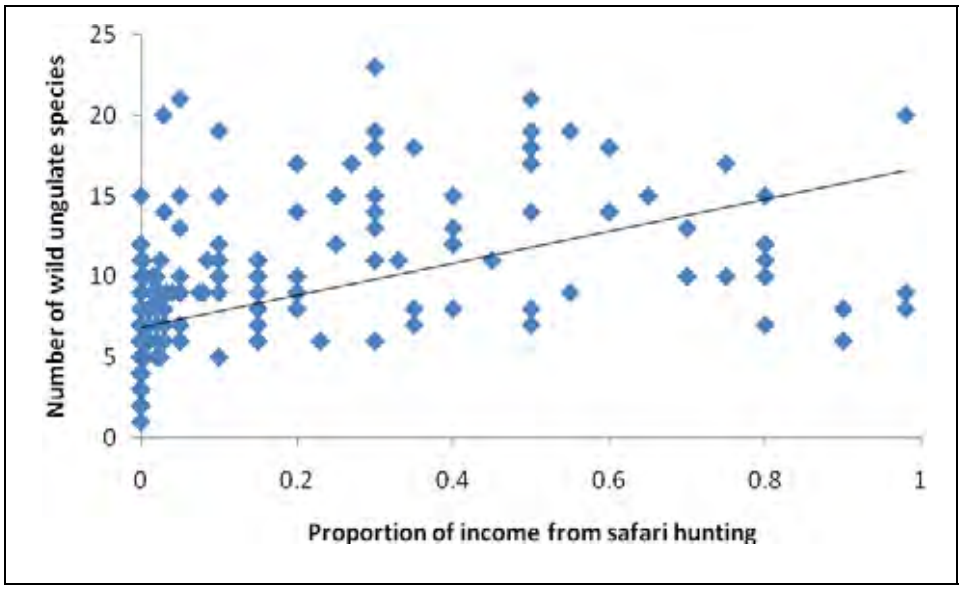


Figure 13

Relationship between the diversity of wild ungulates and respondent age

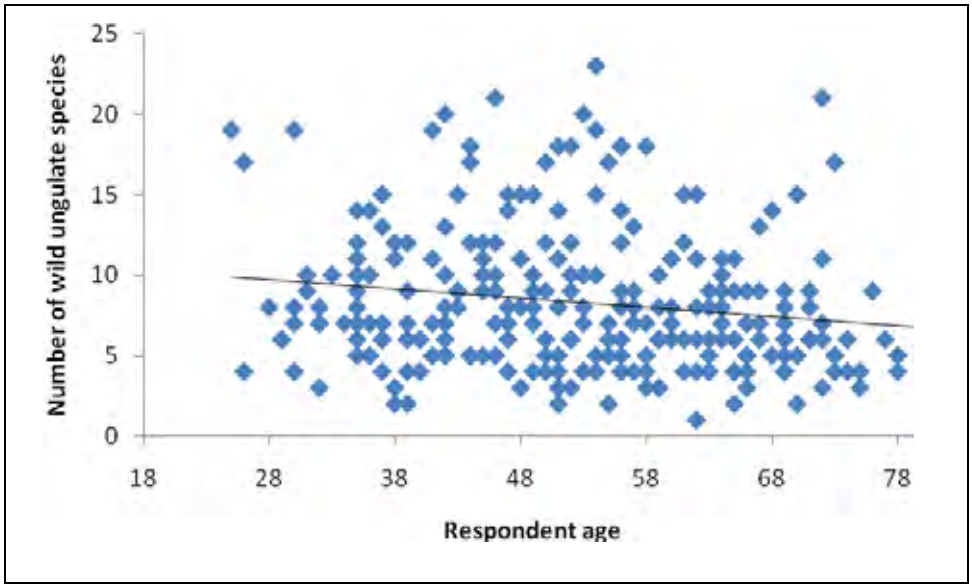


Figure 14

Relationship between diversity of wild ungulates and the distance of respondents' farms to the nearest town

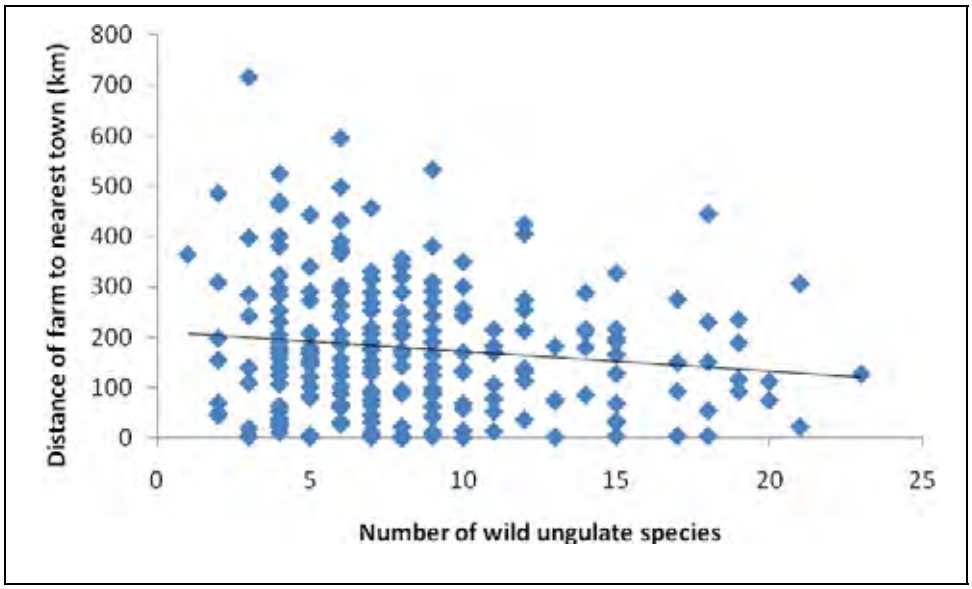


Table 6

Mean number of wild ungulate species occurring on farms in different vegetation types in Namibia

Vegetation type	Number of wild ungulate species
Thornbush shrubland	6.84±0.65
Southern Kalahari	7.67±2.19
Highland shrubland	7.94±0.80
Central Kalahari	7.17±1.03
Western highlands	8.71±1.64
Northern Kalahari	6.83±1.72
Karstveld	8.11±0.73
Desert/dwarf shrub transition	5.00±?
Dwarf shrub savannah	7.50±3.57
Dwarf shrub/southern Kalahari transition	18.0±?
Karas dwarf shrubland	12.5±4.50

Note: For more information on vegetation in Namibia, see Mendelsohn *et al*., 2002

Mean wild ungulate diversities on a district basis from this study were generally higher than those of reported by Erb (2004) (F Ratio 2.09, *d.f.*=1, *p*=0.158) (**Table 7**). Conversely, the percentage occurrence of most (79.2%) species as reported by Erb (2004) was higher than these results indicate (**Figure 15**), though the difference was not statistically significant (F Ratio 0.1487; d.f.=1; *p*=0.701). Greater Kudu, Steenbok, Oryx and Common Warthog are the most widespread wildlife species on Namibian farms (**Figure 15**). The percentage occurrence of all wild ungulate species was higher on farms within conservancies (**Tables 8** and **9**). Of large predators, Cheetahs were most commonly present (78.7% of farms), followed by Leopards *Panthera pardus* (71.9%), Brown Hyaenas *Hyaena brunnea* (60.7%), Spotted Hyaenas *Crocuta crocuta* (27.3%), Lions (8.1%) and African Wild Dogs (6.1%).

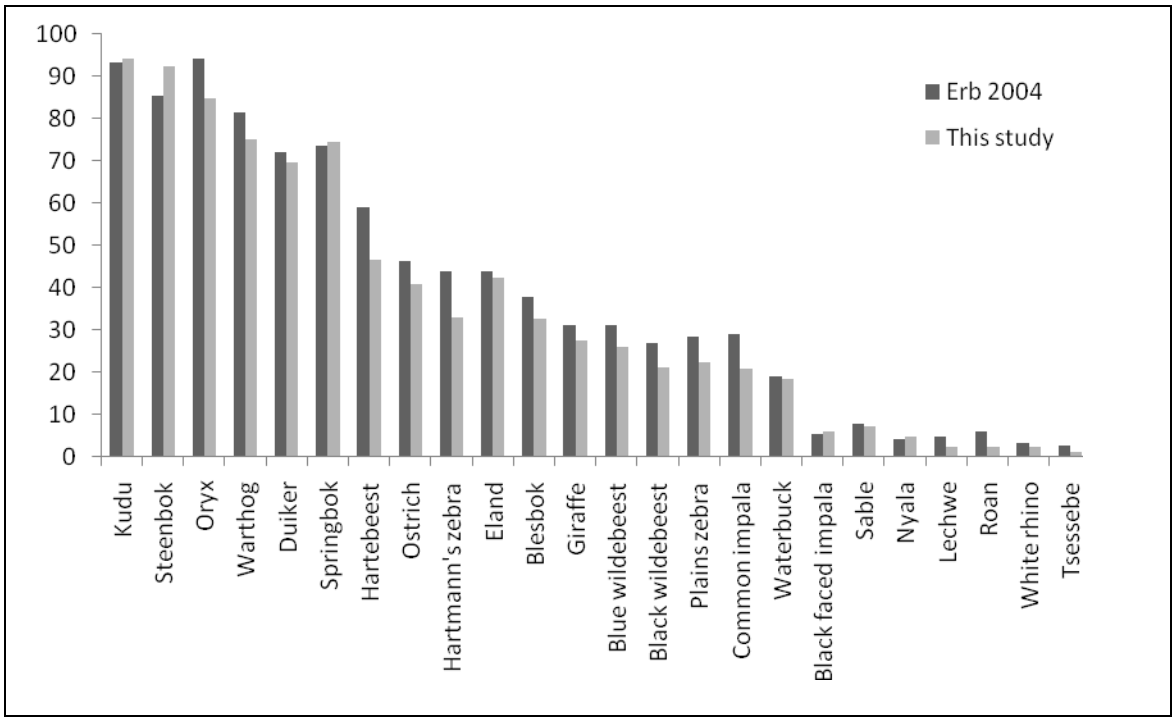
Table 7

Mean diversity of wild ungulates in various districts of Namibia

	Present study	Erb (2004)	Present study *n*	Erb (2004) *n*
Karibib	11.4	5.5	10	20
Omaruru	10.7	6.4	7	49
Otjiwarongo	10.2	5.8	22	73
Mariental	9.6	4.6	9	7
Windhoek	9.5	6.9	43	122
Luderitz	9.0	?	3	0
Gobabis	9.0	8	20	49
Okahandja	8.7	6	15	67
Outjo	8.1	5.6	53	55
Maltahöhe	7.5	4.8	11	12
Grootfontein	6.7	6.3	19	44
Kamanjab	6.0	9.5	1	2
Tsumeb	5.0	9.2	4	5
Keetmanshoop	4.4	3.8	10	4
Karasburg	4.0	6	8	2
Bethanie	3.7	6	7	2
Otavi	?	6.5	0	8
Leonardsville	?	7	0	1

Figure 15

The percentage occurrence of various wildlife species on farms on which safari hunting is conducted in Namibia according to Erb (2004) and from the results of the present study



Springbok, Oryx, Common Warthog and Greater Kudu are the wildlife species that occur at the highest densities on Namibian farmlands (**Figure 16**). According to Barnes (2009), ~621 000 Springbok, 350 000 Oryx, 345 000 Greater Kudu and 174 000 Common Warthog occur on commercial farmland in Namibia (**Table 10**). However, extrapolating from the estimate of mean regional densities from this study (based on respondent estimates of wildlife numbers), populations could potentially be higher (**Table 10**).

Figure 16

Mean densities of wildlife species on Namibian commercial farms where each species occurs (individuals/km^2)

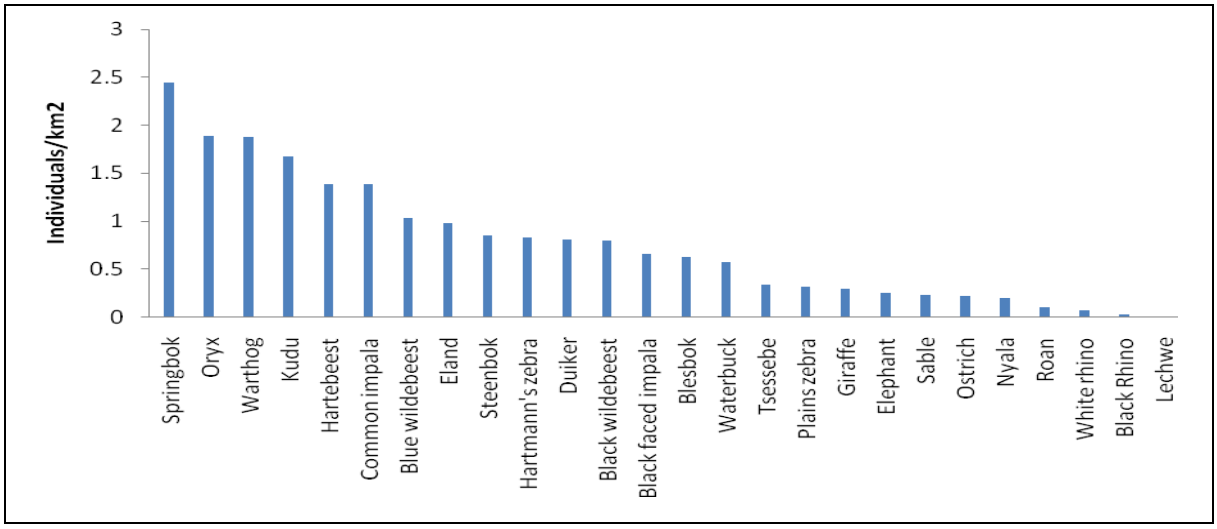


Table 8

The percentage occurrence of various wildlife species on Namibian farmlands

	Blesbok	Common Duiker	Common Eland	African Elephant	Giraffe*	Hartebeest	Common Impala*	Impala, Black-faced*	Greater Kudu	Lechwe, Red*	Nyala	Ostrich
Area												
Small stock	22.2	20.5	13.3	0	11.1	15.6	4.4	2.2	75.0	0	0	28.9
Large stock	25.8	91.4	44.5	11.4	34.2	50.8	19.2	9.2	78.3	2.4	4.9	40.3
Region												
Erongo	22.2	100	33.3	20.0	50.0	33.3	22.2	11.1	100	0	10.0	55.6
Hardap	35.0	33.3	10	0	10.0	30.0	10.0	0	80	0	0	50.0
Karas	14.3	17.9	14.3	0	7.1	7.1	0	3.6	74.1	0	0	17.9
Khomas	43.5	81.8	39.1	4.2	33.3	78.3	17.4	4.4	100	0	4.2	60.9
Kunene	11.5	88.0	34.6	33.3	29.6	23.1	11.5	15.4	100	0	0	16.0
Omaheke	33.3	90.9	41.7	0	33.3	58.3	25.0	0	100	8.3	16.7	66.7
Oshikoto	0	100	83.3	0	16.7	0	0	0	100	0	0	0
Otjozondjupa	26.8	96.8	55.0	4.9	41.5	63.4	26.8	12.2	100	4.9	4.9	36.6
In a conservancy?												
Yes	29.5	93.3	45.6		44.3	75.9	24.1	8.1	98.2	2.65	3.54	31.8
No	22.7	64.5	27.3		18.9	28.0	9.1	6.1	91.6	2.27	3.03	48.7

Note: On all but one property in Hardap, elephants were recorded as being sighted "occasionally" and so density estimates were not made.

* Common Impala *Aepyceros melampus melampus;* Black-faced Impala *A. m. petersi;* Giraffe *Giraffa camelopardalis;* Red Lechwe *Kobus leche leche*

Table 9

The percentage occurrence of various wildlife species on Namibian farmlands, continued

	Roan*	Rhino, Black	Rhino, White	Sable*	Springbok	Tsessebe	Common Warthog	Waterbuck*	Wildebeest, Black	Wildebeest, Blue	Zebra, Hartmann's	Zebra, Plains*
Area												
Small stock	0	0	0	0	100	0	28.9	6.7	11.1	15.6	20.0	8.9
Large stock	1.7	1.6	2.4	5.0	57.6	1.6	98.2	19.0	21.0	26.1	34.8	24.4
Region												
Erongo	0	10.0	0	0	77.8	0	100	10.0	22.2	33.3	55.6	22.2
Hardap	0	0	0	0	100	0	60.0	5.0	15.0	25.0	25.0	20.0
Karas	0	0	0	0	100	0	14.3	7.1	7.1	7.1	14.3	0
Khomas	0	0	0	0	96.7	0	100	29.2	40.9	50.0	54.6	40.9
Kunene	0	3.7	0	3.9	32.0	3.9	91.3	7.7	7.7	11.5	34.6	7.7
Omaheke	0	0	0	16.7	58.3	0	100	25.0	25.0	25.0	33.3	33.3
Oshikoto	0	0	0	0	0	0	100	0	0	0	0	0
Otjozondjupa	4.9	0	7.3	7.3	52.5	2.4	100	25.0	22.0	26.8	27.5	29.3
In a conservancy?												
Yes	3.57	3.54	2.65	5.36	76.7	1.8	95.4	23.4	26.1	26.1	47.8	29.7
No	0.76	0	0.76	2.27	65.4	1.52	75.0	9.85	15.9	15.9	28.2	12.9

* Roan Antelope *Hippotragus equines;* Sable Antelope *Hippotragus niger;* Waterbuck *Kobus ellipsiprymnus;* Plains Zebra *Equus quagga*

Table 10

Wildlife population estimates for freehold land, based on mean densities for each species derived from farmers' estimates of population sizes, relative to those of Barnes (2009)

	Erongo	Hardap	Karas	Khomas	Kunene	Omaheke	Otjozondjupa	Oshikoto/Oshana /Omusati	Total	Barnes	Ratio
Springbok	38 243	332 946	239 470	71 491	14 409	25 683	35 769	4623	762 635	621 561	1.23
Oryx	66 057	111 764	32 970	83 460	36 155	41 093	119 230	11 599	502 328	350 092	1.43
Greater Kudu	52 150	60 962	29 500	52 082	54 756	41 093	141 089	17 567	449 199	345 801	1.30
Common Warthog	52 585	37 515	2 603	78 931	30 129	72 279	139 765	9666	423 472	174 115	2.43
Hartebeest	8474	35 170	3471	54 023	5764	39 258	38 419	1849	186 428	122 805	1.52
Common Eland	4129	2345	781	7117	8646	7705	56 303	2774	89 798	37 216	2.41
Hartmann's Zebra	11 299	22 665	868	17 468	9 956	1834	13 910	3194	81 195	55 520	1.46
Blue Wildebeest	1304	17 976	1041	11 646	5764	6971	29 145	1849	75 696	16 623	4.55
Ostrich	1521	15 631	11 366	8087	4391	7705	19 209	1409	69 320	36 336	1.91
Impala Common*	3107	7034	0	8411	2358	6971	33 120	756	61 757	15 442	4.00
Black Wildebeest	1956	6253	781	10 675	1834	8439	15 434	588	45 959	?	
Waterbuck	43	1563	347	4205	1310	8806	12 254	420	28 949	4475	6.47
Plains Zebra	435	3908	0	4432	576	2201	7949	185	19 686	25 421	0.77
Impala, Black faced**	326	1563	434	0	2201	972	7286	706	13 488	3370	4.00
Sable Antelope	0	0	0	0	157	73	1987	50	2268	1233	1.84
Lechwe ***	0	0	0	0	79	0	795	25	899	1188	0.76
Tsessebe	0	0	0	0	629	0	66	202	897	162	5.54
Roan Antelope	0	0	0	0	0	0	331	0	331	1090	0.30
Total	**241 628**	**657 295**	**323 631**	**412 027**	**179 112**	**271 083**	**672 063**	**57 464**	**2 814 303**	**1 812 450**	**2.47**

Notes: Assuming an area of 356 533 km^2 of freehold land (Mendelsohn 2006) with the proportion of freehold farmland in each region matching that presented in the ConInfo database (www.met.gov.na/dea) Assuming that wildlife densities in Oshikoto, Oshana and Omusati equal those in Kunene, the nearest region for which density estimates are available. * *Aepyceros melampus melampus;* ** *A. m.petersi* *** *Kobus* sp.

Wildlife and livestock biomass

The biomass of livestock (mean: 2251 ± 140 kg/km^2) was higher than that of wild ungulates (and Ostriches) (936 ±84.1 kg/km^2) (F Ratio 64.0, *d.f.*= 1, p<0.001). Wildlife biomass comprised 29.4% of the total on freehold farms. The wildlife biomass on respondents' properties was related to: the proportion of income derived from livestock (inverse relationship, **Figure 17**); safari hunting (positive relationship, **Figure 18**) and ecotourism (positive relationship, **Figure 19**); livestock biomass (positive relationship, **Figure 20**); wildlife diversity (positive relationship); and vegetation (**Table 11**) (F Ratio 45.0, *d.f.*=15, p<0.001). Livestock biomass varied by region (**Table 12**) and the proportion of income derived from safari hunting (inverse relationship) (F Ratio 7.72, *d.f.*=8, p<0.001). Spatial patterns in wildlife and livestock biomass are presented in **Figures 21** and **22**.

Figure 17

Relationship between wildlife biomass and the proportion of respondents' income from livestock

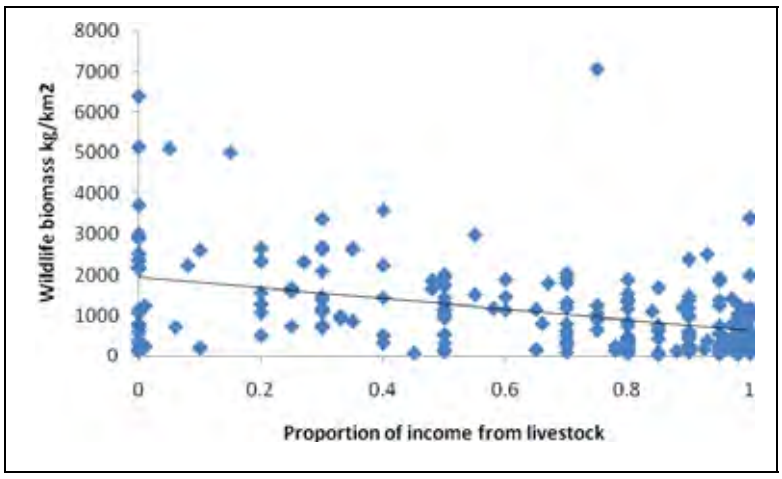


Figure 18

Relationship between wildlife biomass and the proportion of respondents' income from safari hunting

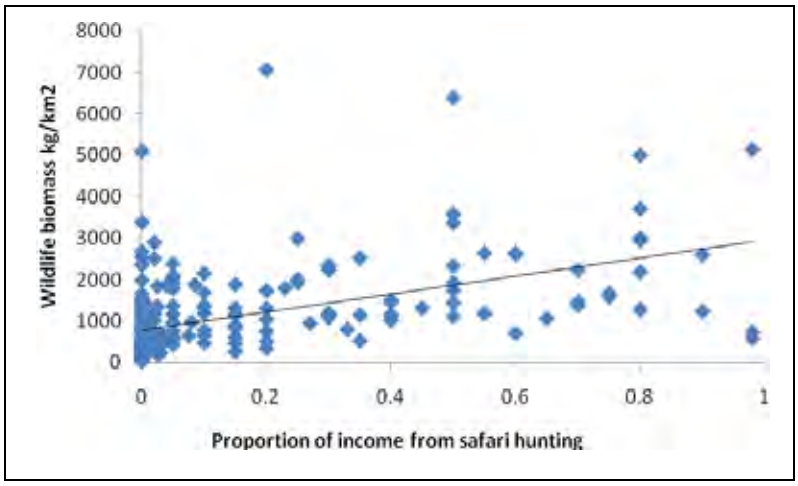


Figure 19

Relationship between wildlife biomass and the proportion of respondents' income from ecotourism

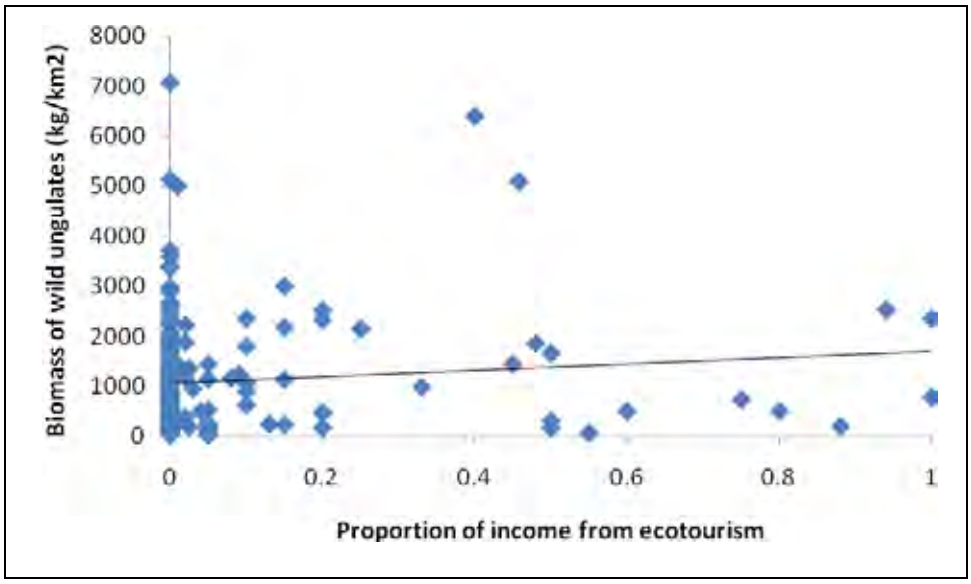


Figure 20

Relationship between the biomass of wildlife and the biomass of livestock

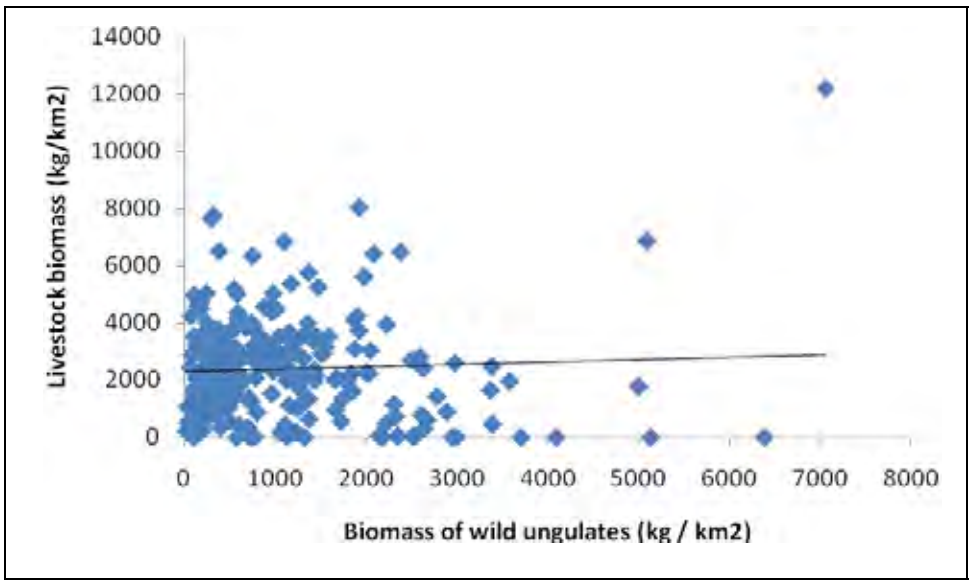


Table 11

Relationship between vegetation type and the biomass of wild ungulates

Vegetation type	Wildlife biomass (kg/km^2)
Northern Kalahari	1741 ± 444
Thornbush shrubland	1638 ± 316
Highland shrubland	1092 ± 155
Southern Kalahari	1048 ± 321
Karstveld	913 ± 240
Western highlands	882 ± 138
Central Kalahari	549 ± 161
Dwarf shrub savanna	523 ± 109
Desert/dwarf shrub transition	391 ± 111
Karas dwarf shrubland	172 ± 28
Dwarf shrub/southern Kalahari transition	140 ± 65

Table 12

Livestock and wildlife biomass by region

Region	Livestock biomass (kg/km^2)	Wildlife biomass (kg/km^2)	Ratio
Karas	957 ± 1411	185 ± 22.5	5.17
Hardap	1858 ± 1670	515 ± 84.2	3.61
Omaheke	3144 ± 602	783 ± 224	4.02
Otjozondjupa	2410 ± 267	1531 ± 219	1.57
Khomas	2909 ± 329	1136 ± 175	2.56
Erongo	1971 ± 563	1346 ± 182	1.46
Kunene	2432 ± 267	888 ± 281	2.74

Figure 21

Spatial patterns in wildlife biomass in Namibia

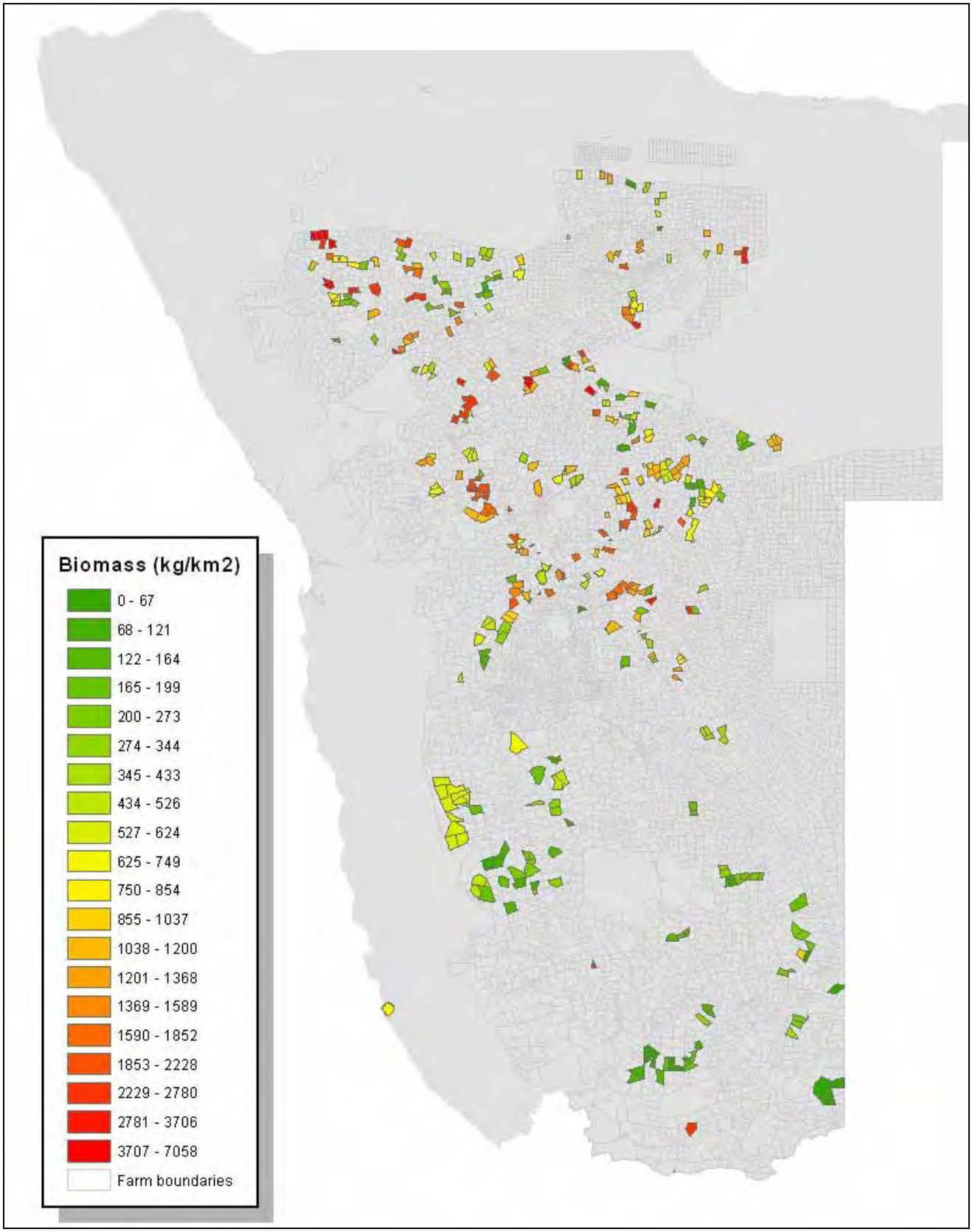
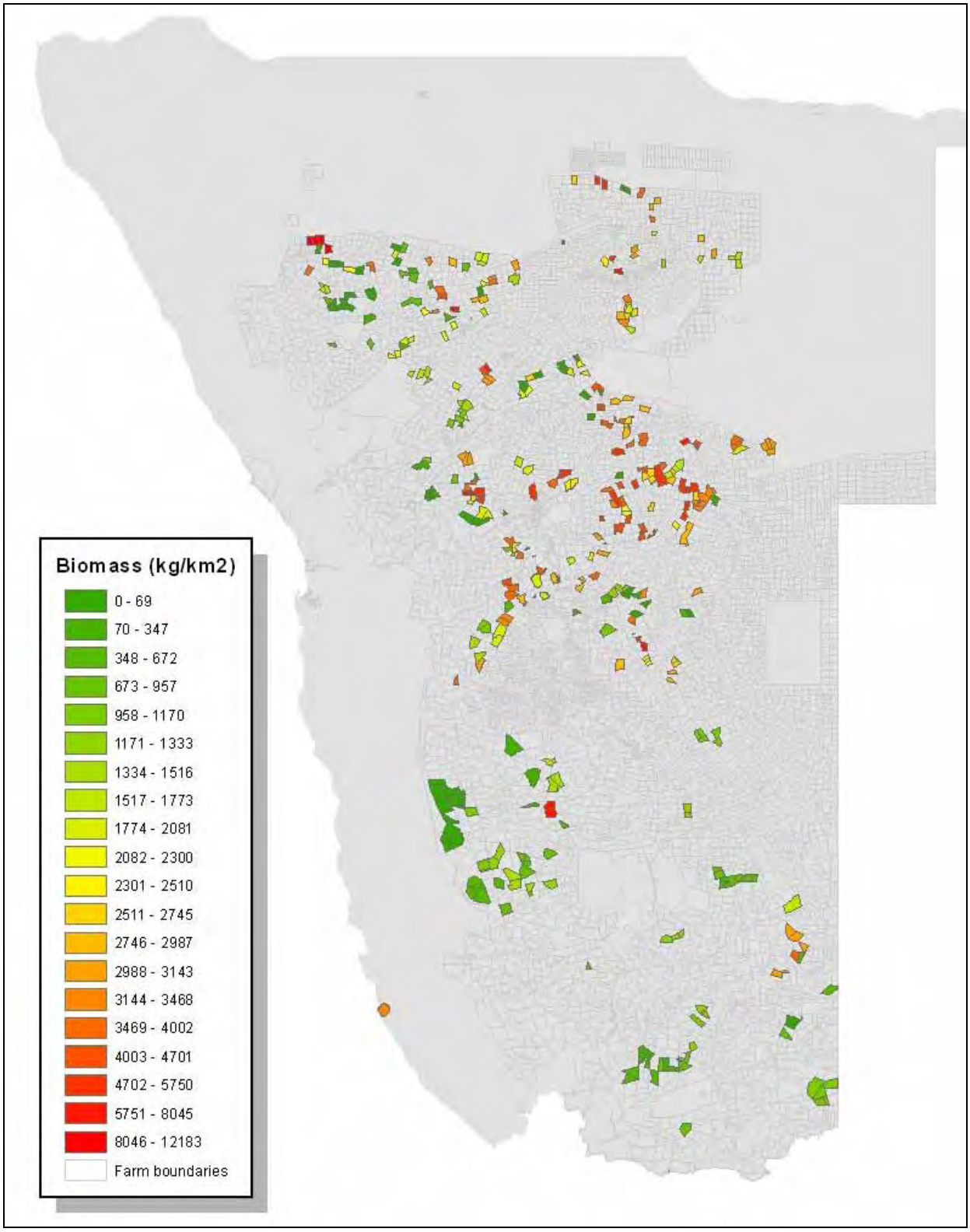


Figure 22

Spatial patterns in livestock biomass in Namibia



Wildlife population trends

Fifty-eight per cent of (57.6%) respondents considered wildlife populations to be increasing on their land, 23.7% felt wildlife populations were stable, and 18.6% felt that they were declining. There was a positive relationship between the percentage of income from safari hunting and trends in wildlife populations (the percentage of income from safari hunting was higher on properties with stable or increasing wildlife populations—18.7 ± 2.8%—than on properties with declining populations (1.50 ± 0.76%) ($\chi 2$=12.1, *d.f.*=4, p<0.001)). Wildlife populations were more commonly stable or increasing on farms within conservancies (87.9%) than on properties outside conservancies (75.0%), though the difference was not quite statistically significant ($\chi 2$=3.3, *d.f.*=1, p=0.068). The severity of poaching did not influence wildlife population trends ($\chi 2$=0.22, *d.f.*=1, p=0.631): see below for discussion of poaching. The most common explanations provided for increasing wildlife populations were: favourable rainfall (35.3%); good management (26.4%); conservative wildlife harvest (19.1%); the instalment of artificial water points (10.3%); and incentives for wildlife conservation through benefits from safari hunting (8.8%). The most common reasons provided for declining wildlife populations were: excessive harvesting (50.0%); drought (13.6%); poaching (9.1%); culling by livestock farmers to reduce competition for grazing (4.5%); and excessive numbers of predators (4.5%).

Meat production

The majority of game meat produced on Namibian farmlands is from safari hunting, followed by shooting for own use and shoot-and-sell (**Tables 13** and **14**). Relative to the situation in 1997 (Erb 2004), a greater proportion of animals are removed via safari hunting, live sales, night culls, biltong hunting and management hunts, and a lower proportion for farmers' own use (**Table 13**). Off-takes as proportions of the populations of Oryx, Greater Kudu, Springbok and Hartebeest appear to be higher in 2009 than 1997 (**Table 14**) and are higher than those estimated by Brown (2007) (presented in MAWF, 2008), though well below intrinsic rates of increase (**Table 16**).

Table 13

Percentage of wildlife meat produced from various sources

	Safari hunting	Own use	Shoot-and-sell	Biltong hunting	Wildlife harvest	Management hunts
Overall	36.5	22.5	19.2	12.7	7.3	1.9
Area						
Small stock	13.6	15.6	22.1	27.2	18.2	3.4
Large stock	46.2	25.4	17.9	6.6	2.6	1.3
Region						
Erongo	42.2	33.6	6.4	17.8	0.0	0.0
Hardap	26.4	15.5	21.1	14.7	18.9	3.3
Karas	2.5	16.4	22.2	39.5	15.5	3.9
Khomas	55.3	21.9	16.3	3.5	0.5	2.4
Kunene	17.6	71.0	11.4	0	0	0
Omaheke	48.3	28.4	2.6	13.2	7.5	0.0
Otjozondjupa	48.9	14.8	26.3	5.1	3.7	1.1
In a conservancy?						
Yes	52.1	22.4	14.9	6.1	2.8	1.6
No	31.4	21.5	19.9	16.5	9.4	1.3

Table 14

Game meat production (kg/km^2) from various sources

	All	Safari hunting	Own use	Shoot-and-sell	Biltong hunting	Wildlife harvest	Management hunts
Overall	67.7±6.8	21.9±3.9	21.1±3.0	13.9±2.6	6.5±1.5	4.1±1.2	1.0±0.5
Area							
Small stock	38.8±5.9	4.4±1.9	7.7±3.9	7.8±2.3	10.1±2.9	7.7±2.3	0.9±0.39
Large stock	78.3±8.9	28.4±5.3	26.0±4.0	16.1±3.4	5.1±1.8	2.8±1.4	1.0±0.7
Region							
Erongo	91.2±28	30.9±9.7	33.6±12	7.7±7.7	19.0±16	0±0	0±0
Hardap	51.3±11	15.2±5.2	10.1±2.3	8.9±3.9	7.4±2.7	8.6±0.5	1.1±0.4
Karas	34.3±6	0.6±3.1	6.7±1.5	7.1±2.7	12.6±3.5	6.2±1.4	1.1±0.1
Khomas	94.0±18	46.4±14.4	23.0±4.7	18.9±6.3	5.7±3.1	0.4±0.4	3.6±3.5
Kunene	49.5±26	8.9±7.9	34.4±15	6.2±3.7	0±0	0±0	0±0
Omaheke	68.5±18	23.2±11.5	28.1±8.9	3.2±2.2	3.8±3.8	10.3±6.3	0±0
Otjozondjupa	94.9±15	35.7±10.7	21.4±4.7	28.9±8.7	5.3±3.3	5.2±3.3	0.7±0.7
In a conservancy?							
Yes	112.0±10.5	53.6±6.3	27.2±4.6	18.7±3.6	7.3±3.0	1.9±1.0	1.3±0.78
No	55.9±5.5	14.9±3.1	16.6±1.8	12.4±2.8	6.5±1.4	4.9±1.5	0.4±0.16

Table 15

Proportions of the total off-takes of key meat-producing species in 1997 and 2009

	Safari hunting	Own use	Shoot-and-sell	Live sale	Biltong hunting	Wildlife harvest	Management hunts	Total	Proportion of populations used	
1997 *									Large stock area	Small stock area
Oryx	0.19	0.46	0.16	0.09	0.10	0.00	0.00	1.00	0.11	0.11
Springbok	0.09	0.40	0.21	0.04	0.17	0.09	0.00	1.00	0.04	0.16
Hartebeest	0.42	0.28	0.08	0.22	0.00	0.00	0.00	1.00	0.06	0.04
Greater Kudu	0.14	0.62	0.12	0.00	0.12	0.00	0.00	1.00	0.08	0.12
Average	0.21	0.44	0.14	0.09	0.10	0.02	0.00			
2009										
Oryx	0.20	0.21	0.21	0.15	0.13	0.08	0.02	1.00	0.14	0.14
Springbok	0.06	0.12	0.13	0.19	0.20	0.29	0.03	1.00	0.15	0.18
Hartebeest	0.47	0.08	0.16	0.21	0.02	0.07	0	1.00	0.09	0.14
Greater Kudu	0.22	0.35	0.15	0.12	0.11	0.05	0.002	1.00	0.09	0.15
Average	0.24	0.19	0.16	0.17	0.12	0.12	0.01			

*Adapted from Erb (2004), removing animals shot as “donations” from calculations

Table 16

Percentage off-takes of various species from various forms of consumptive use (safari hunting, own use, shoot-and-sell, management hunts, biltong hunting, wildlife harvesting and live capture and sale)

	% off-takes	** Intrinsic rates of increase
	This study	* Brown, 2007	
Impala, Common	22.5		38.1
Springbok	17.9	8.7	40.9
Wildebeest, Blue	17.1		23.1
Oryx	14.3	6.8	21.9
Zebra, Plains	10.6		18.8
Common Eland	9.9		16.5
Waterbuck	9.7		23.1
Hartebeest	9.4	4.6	26.8
Greater Kudu	9	3	24.4
Common Warthog	8.3		34.4
Zebra, Hartmann's	8.2	2.6	19.8
Sable Antelope	7.6		21.9
Giraffe	4.3		13.3
Impala, Black-faced	2		38

*Presented in MAWF (2008)
The intrinsic growth rate (r_m) of each population was calculated using $1.5W^{-0.36}$ (Caughley and Krebs, 1983) where W is the standard female weight of each prey item (Bothma *et al.*, 2002).**

Game meat production/km^2 was related to: wildlife biomass (positive relationship, **Figure 23**); wildlife diversity (positive relationship, **Figure 24**); and livestock biomass (positive relationship, **Figure 25**) (F Ratio 48.9, d.f.=3, p<0.001). Meat production was higher on farms in conservancies than those not part of conservancies (mean kg meat production/km^2) 110.8 ± 10.5 kg/km^2/year) or not (mean 55.2 ± 5.5 kg/km^2/year), but the difference was not statistically significant (F Ratio 0.13, *d.f.*=1, p=0.1272). Spatial patterns in game meat production are depicted in **Figure 26**.

Figure 23

Relationship between annual game meat production and the biomass of wild ungulates

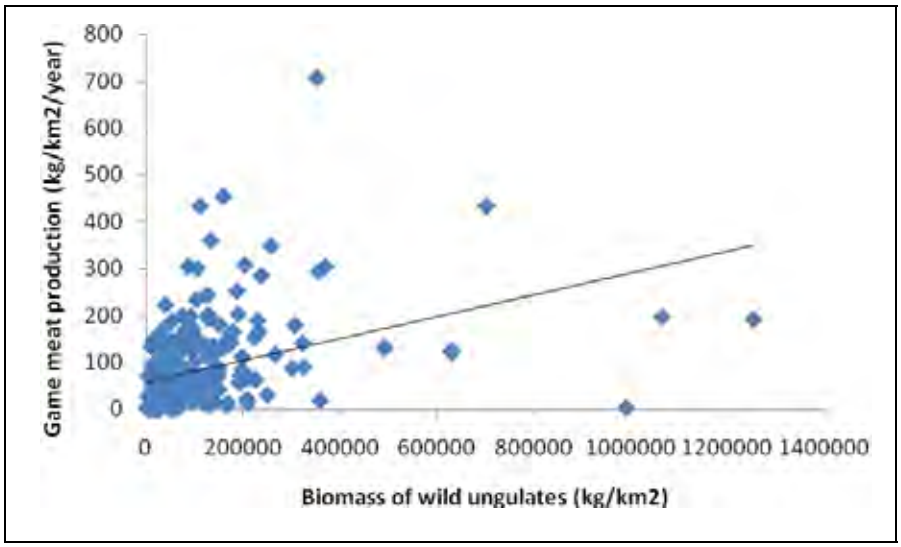


Figure 24

Relationship between game meat production and wild ungulate diversity

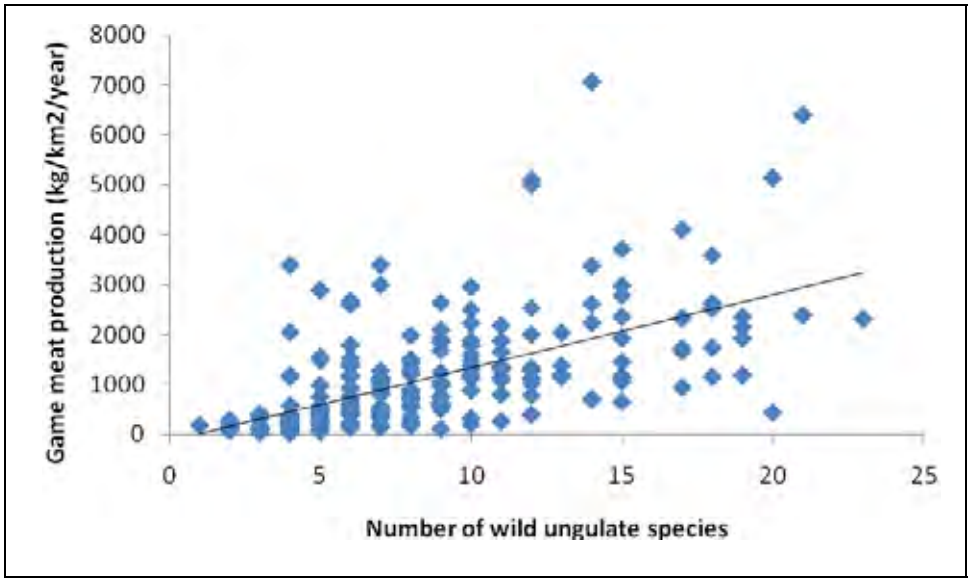


Figure 25

Relationship between game meat production and livestock biomass

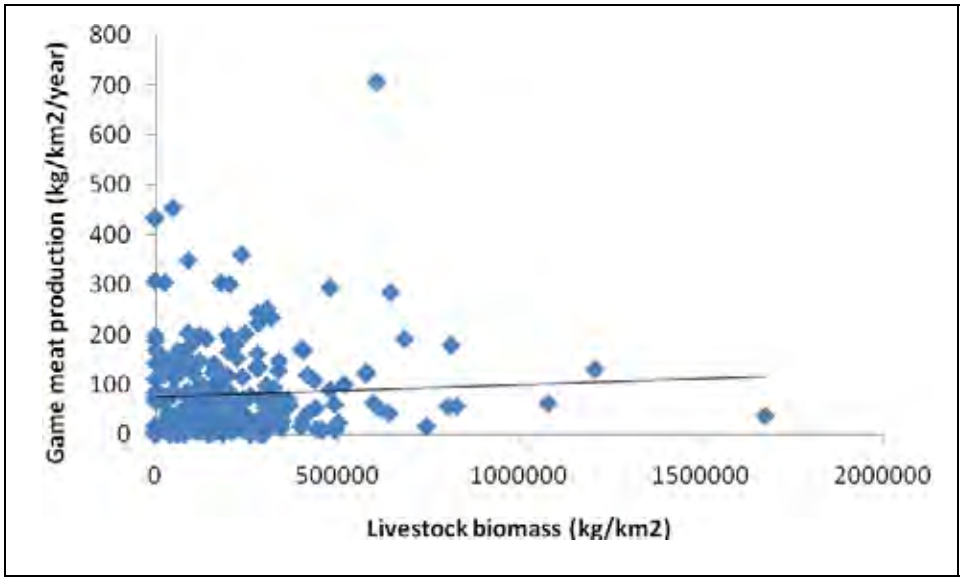
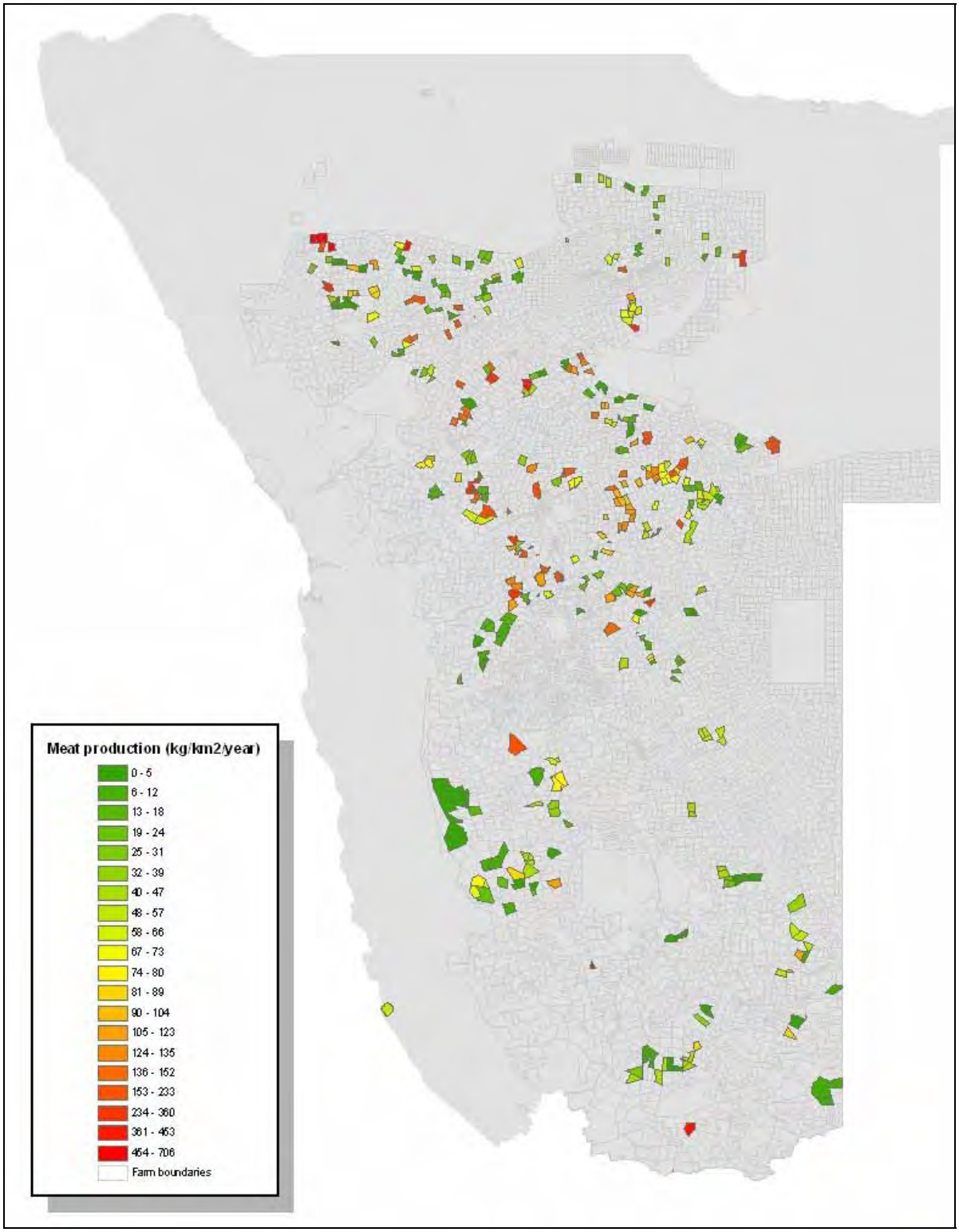


Figure 26

Spatial patterns in game meat production



The wildlife species that are harvested to produce most meat are Oryx, Greater Kudu, and Springbok (**Table 17**). Extrapolating to the whole country from the sample of respondents, based on population estimates of wildlife on freehold lands, ~16 000 t of game meat are produced on commercial farmlands (**Table 17**). Extrapolation based on the amount of freehold land available increases the estimate of game meat production on freehold land to ~23 000 t (**Table 18**). By contrast, 93 045 t of meat from domestic stock are produced in Namibia annually (through formal production primarily on freehold land, but including some produced on communal land), of which 80 901 t are exported (W. Schutz, Meat Board of Namibia, pers. comm., January 2010).

Table 17

Meat production on a national scale following extrapolation based on mean proportional off-takes and population estimates for wildlife on freehold land

Present study	% of populations used	Populations*	Meat produced	% of meat
Oryx	0.14	350 092	5 993 803	37.8
Greater Kudu	0.09	345 801	3 477 249	21.9
Springbok	0.18	621 561	2 210 013	13.9
Common Eland	0.1	34 743	1066 053	6.7
Hartebeest	0.09	122 805	842 772	5.3
Zebra, Hartmann's	0.08	55 520	718 593	4.5
Common Warthog	0.08	173 866	559 702	3.5
Wildebeest, Blue	0.17	16 623	350 133	2.2
Giraffe	0.04	5769	159 051	1.0
Ostrich	0.07	36 336	148 585	0.9
Zebra, Plains	0.11	7303	141 386	0.9
Impala, Common	0.23	14 980	116 310	0.7
Waterbuck	0.1	4475	63 993	0.4
Sable Antelope	0.08	902	9029	0.1
Impala, Black - faced	0.02	1870	1367	0.0
Other species**			58 675	0.4
		1 792 646	15 916 710	

*From Barnes *et al.*, 2009
**Black Wildebeest, Nyala, Tsessebe, White Rhinoceros, Klipspringer, Kirk's Dik-dik, Common Duiker, Blesbok

Table 18

Estimated amount of game meat produced on commercial farmlands in Namibia from various sources based on mean meat production per km^2 for various forms of wildlife use (following extrapolation from the results of this survey)

	Area of farms*	Safari hunting	Biltong hunting	Wildlife harvest	Shoot-and-sell	Management hunts	Own use	Total	% of total
Otjozondjupa	66 239	2 364 738	351 068	344 444	1 914 312	46 367	1 417 518	6 438 446	28.2
Hardap	78 156	1 187 976	578 357	672 144	695 591	85 972	789 379	4 009 420	17.6
Khomas	32 349	1 500 985	184 388	12 940	611 393	116 456	744 023	3 170 184	13.9
Karas	86 764	52 059	1 093 232	537 940	616 028	95 441	581 322	2 976 021	13.0
Omaheke	36 690	851 204	139 421	377 905	117 407	0	1 030 984	2 516 923	11.0
Erongo	21 729	671 430	412 854	0	167 314	0	730 099	1 981 697	8.7
Kunene	26 199	233 172	0	0	162 434	0	901 247	1 296 853	5.7
Oshikoto**	7054	62 778	0	0	43 733	0	242 648	349 159	1.5
Omusati**	802	7135	0	0	4971	0	27 578	39 684	0.2
Oshana**	550	4894	0	0	3410	0	18 918	27 222	0.1
	356 532	6 936 372	2 759 320	1 945 373	4 336 593	344 236	6 483 716	22 805 609	100

*Based on an estimate of the total area of freehold land made by Mendelsohn (2006) (which excludes re-settlement farms) and using the proportional breakdown of farms in each region as derived from the ConInfo database (www.met.gov.na/dea). ** Assuming that meat production values in these regions equalled those in Kunene, the nearest region with available data

How game meat is used

The most common use of game meat was to sell it to other butcheries, to give to workers as rations, or use for personal consumption by farmers and their families (**Table 19**). When game meat was sold, 64.6 ± 3.77% was in the form of whole carcasses, 22.5 ± 3.3% as unselected cuts (e.g. in weighed packets of meat of no particular cut), 6.8 ± 19% as processed meat (e.g. biltong, *droëwors* [dried sausage], sausage, etc.), 5.4 ± 1.6% as selected cuts and 0.74 ± 0.67 in other forms (**Table 20**).

Table 19

The percentage of game meat from various sources used in different ways by farmers

	Safari hunting	Biltong hunting	Wildlife harvest	Shoot-and-sell	Management hunts	Own use	Overall %
Sell to other butcheries	45.9	5.0	49.7	78.5	42.5	0.6	37.0
Rations	26.0	1.7	0.0	3.6	23.0	56.5	23.5
Personal use	13.9	1.7	0.0	0.2	1.3	37.1	13.7
Taken by biltong hunters	0.0	90.0	0.0	0.0	0.0	0.3	11.5
Sell privately	5.7	0.0	16.7	16.2	11.4	0.6	6.8
Taken by culling team	6.0	0.0	0.0	0.2	2.9	4.7	3.3
Use to feed guests	0.0	0.0	33.6	0.0	0.0	0.0	2.4
Donate/sell to communities	2.5	1.7	0.0	1.3	19.4	0.1	1.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 20

Forms of game meat sold and corresponding prices

	% of meat sold	Mean price NAD/kg	USD price
Whole carcasses	64.6 ± 3.77%	15.7 ± 0.21	1.86
Unselected cuts	22.5 ± 3.3%	17.4 ± 0.74	2.06
Selected cuts	5.4 ± 1.6%	31.2 ± 3.7	3.70
Processed meat	6.8 ± 19%	80.4 ± 12.9	9.53
Other	0.74 ± 0.67%	40.2 ± 12.8	4.76

Sixty per cent (59.8%) of respondents sold game meat. Game meat sold was derived from the following forms of harvest: shoot-and-sell (41.2%); safari hunting (40.8%); harvest (culling) of wildlife (15.3%); management hunts (2.1%) and own use (0.2%). Whether respondents sold game meat or not was related to: livestock biomass—livestock biomass was lower on land of respondents who sold game meat (2237 ± 160 kg/km^2) than on the land of respondents who did not sell game meat (3270 ± 648 kg/km^2); and the diversity of wild ungulates (diversity was higher where respondents did sell game meat—9.61 ± 0.39 species—than where they did not—5.98 ± 0.28 species) ($\chi 2$=54.2, *d.f.*=2, p<0.001). The quantity of game meat sold was related to: wild ungulate diversity (positive

relationship: **Figure 27**) and the proportion of respondents' income that was derived from livestock (inverse relationship: **Figure 28**) (F Ratio 21.5, d.f.=2, $p<0.001$).

Figure 27

Relationship between the amount of game meat sold per year and the diversity of wild ungulates

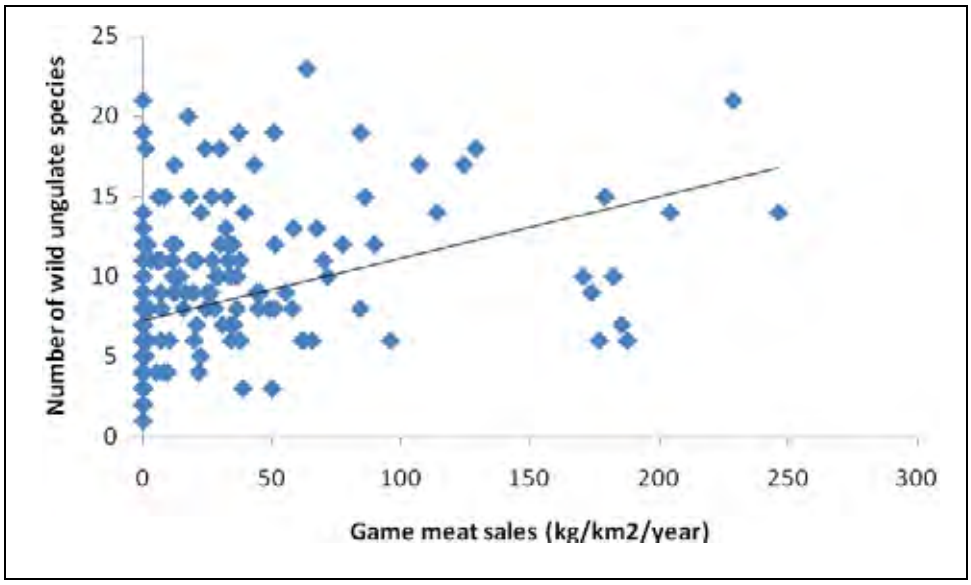
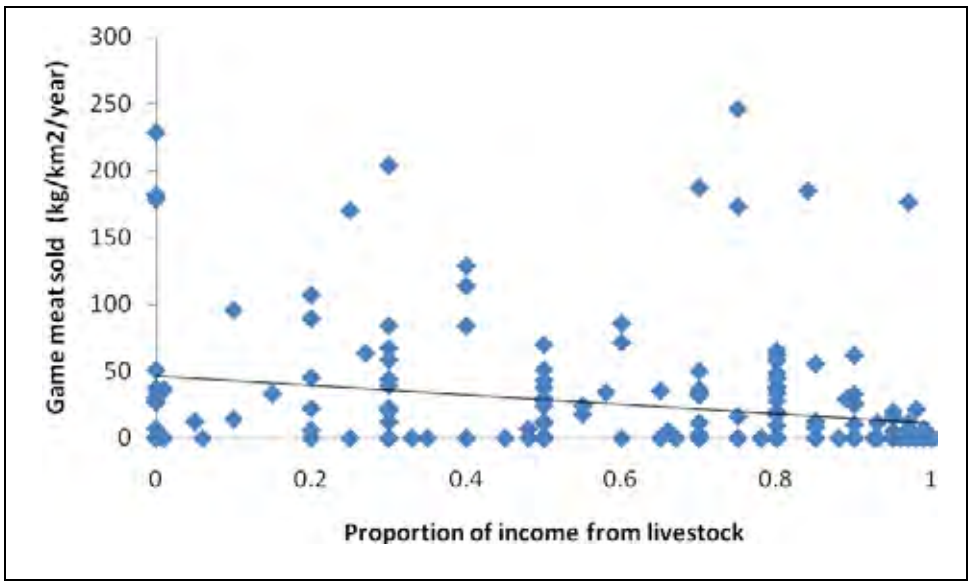


Figure 28

Relationship between the amount of game meat sold and the proportion of respondents' income from livestock



The price of meat varies, depending on the form in which it is sold, with un-butchered carcasses fetching the lowest prices (**Table 20**). Sixty-eight per cent (67.6%) of respondents felt that the price of meat varied by species (**Table 21**) and 36.0% felt that the price obtained for game meat varied

seasonally (74.1% of whom considered prices to be lower during the hunting season and 8.6% of whom considered prices to be higher during the hunting season).

Table 21

Variation in price of meat obtained by farmers among wildlife species (actual NAD value depends on the form in which the meat is sold)

	Deviation from overall mean price/kg
Common Eland	+14.1 ± 2.6%
Springbok	+9.8 ± 3.1%
Oryx	+1.1 ± 1.3%
Greater Kudu	-0.21 ± 0.6%
Zebra	-43.6 ± 2.0%
Giraffe	-44.6 ± 3.4%
Common Warthog	-45.6 ± 3.8%

Mean annual earnings from the sale of game meat ranged from NAD100 to NAD977/km^2 (USD11.8–USD116 at mean 2008 rates), depending on the region, extrapolating from which an estimated ~NAD200 million (USD23.8 million at mean 2008 rates) is generated annually from the sale of game meat on freehold land in Namibia (**Table 22**).

Table 22

Gross income from meat sales on commercial farmlands in Namibia

Region	Area of farms	Mean NAD/km^2	Total NAD	Total USD
Otjozondjupa	66 239	977 ± 239	64 715 503	7 667 714
Hardap	78 156	598 ± 316	46 737 288	5 537 593
Khomas	32 349	879 ± 267	28 434 771	3 369 049
Omaheke	36 690	692 ± 524	25 389 480	3 008 232
Erongo	21 729	783 ± 355	17 013 807	2 015 854
Karas	86 764	104 ± 168	9 023 456	1 069 130
Kunene	26 199	257 ± 62	6 733 143	797 766
Oshikoto *	7054	257	1 812 878	214 796
Omusati *	802	257	206 114	24 421
Oshana *	550	257	141 350	16 748
Average/total	**356 532**	**640 ± 125**	**200 207 790**	**23 721 302**

* Values from Kunene were used for Oshana and Omusati (because farmers from those regions were not sampled) and for Oshikoto (because the sample size of farmers from that region was low and thus potentially misleading

Based on estimates of the production of meat from the harvest of Common Eland, Hartebeest, impala *Aepyceros* spp., Greater Kudu, Oryx and Springbok via wildlife harvesting and shoot-and-sell, a potential ~5500 t of game meat could be exported (**Table 23)**.

Table 23

Current production of meat that is potentially suitable for export

	Area of farms	Potential meat for export (kg/km^2) *	Meat produced
Otjozondjupa	66 239	27.1 ± 41	1 795 077
Hardap	78 156	16.2 ± 5.7	1 266 127
Karas	86 764	13.2 ± 3.2	1 145 285
Khomas	32 349	16.1 ± 5.7	520 819
Omaheke	36 690	12.2 ± 10.6	447 618
Erongo	21 729	6.4 ± 6.4	139 066
Kunene	26 199	5.1 ± 2	133 615
Oshikoto **	7054	12.7	35 975
Omusati **	802	12.7	4090
Oshana **	550	12.7	2805
Total	**356 532**		**5 490 477**

*Including meat produced from culling and shoot-and-sell of Common Eland, Hartebeest, impala, Greater Kudu, Oryx, Springbok and Hartmann's Zebra
** Data were not available for these regions and so values were assumed to equal those in the nearest region, Kunene

The prices of game meat in stores were found to be generally higher than prices of meat from livestock (**Table 24**). Processed game meat (biltong and *droëwors*) is sold for NAD120–150/kg (USD14.2–17.8 at mean 2008 rates) in the shops (or NAD84–NAD105 [USD10.0–12.4] given that meat loses ~30% of its mass during the drying process when biltong is made) (D. Museler, Hartlief meat processing company, pers. comm., 2010).

Table 24

Prices of meat (NAD) (Farmers Meat Market, Windhoek, February 2010)

	Whole carcass	Fillet	Rump	Sirloin/loin
Beef	21.5–28.4*	84.9	52.0	54.0
Sheep	20.0–33.4*	?	?	?
Pork	22.8	46.8	?	27.0–34.0
Springbok	30.2	?	?	100.0
Large game	30.2	100.0	70.0	70.0
Zebra	?	46.0	?	25.0

*Depending on the grade of the meat

Export of game meat

In 2005, 11 214 Springbok were slaughtered for export (MET, 2008). Assuming that Springbok of all ages were culled during harvesting, and assuming a mean mass of 27.7 kg for all individuals in a Springbok population and a dressing percentage of 56% (15.5 kg of meat per Springbok), then ~173 817 kg

of meat was produced through harvesting for export. Given the putative meat production estimates of 16–23 000 t from this study, Springbok meat exported would account for 0.8–1.1% of game meat produced, or 3.2% of the potential game meat available for export (5500 t).

Latest estimates suggest that ~85 t of Springbok meat are exported to the European Union (EU) annually (D. Museler, Hartlief meat processing company, pers. comm., 2010). In addition, permits were allocated for the export of ~160 t of game meat to South Africa during 2006 (Laubscher, 2007). However in reality, quantities exported to South Africa are likely to be much higher due to the prevalence of smuggling of game meat (D. Museler, Hartlief meat processing company, pers. comm., 2010). Export of game meat to South Africa is attractive because the individuals involved would avoid Namibian value-added tax (VAT) and gain access to a larger market and elevated prices (e.g. biltong prices are 21.1–36.8% higher in South Africa than Namibia). A recent survey during 2009 indicated that approximately 60 t of game meat passed through the border during a single month, suggesting that hundreds of tonnes of game meat may be exported to South Africa per year (D. Museler, Hartlief meat processing company, pers. comm., 2010). Assuming that 60 t per month was typical, then ~720 t would be exported to South Africa per year (or 805 t exported in total, including that sent to the EU), approximating to ~3.0-5.0% of game meat produced (depending on how one estimates total game meat production). These estimates suggest that more game meat from freehold land remains in Namibia than meat formally produced from domestic stock on freehold land: 15 200–22 200 t c.f. 12 143 t (80 901 t of the 93 045 t of meat produced from domestic stock in Namibia are exported).

Factors limiting the profitability of game meat production

When asked if there were factors that limited the profitability of game meat production on farmlands, 72.5% of respondents answered in the affirmative. The most commonly identified factors were: insufficient wildlife populations; the difficulty and cost associated with harvesting wildlife; and a lack of/the cost of infrastructure for cooling or processing game meat (**Table 25**).

When asked if government regulations limited the profitability of game meat production, only 32.8% answered in the affirmative, the most common explanations being: a restrictive permitting system; limits imposed on the seasons in which hunting is permitted (6.8%); and restrictions on the export of meat.

The most frequently suggested means of enhancing the profitability of game meat production were to improve the marketing of game meat and to develop new markets for export (**Table 26**). Respondents were asked: “Would you be willing to participate in commercial game cropping enterprises if better systems were developed to export game meat to EU markets?” Seventy-three per cent (73.4%) responded in the affirmative. The most frequently cited reasons for wishing not to participate in such a scheme were: insufficient wildlife numbers (21.0%); a desire to conserve wildlife rather than kill more (12.9%); a lack of interest (9.7%); and because such off-take would affect safari hunting adversely (8.1%).

Table 25

Factors limiting the profitability of game meat production

Factors limiting profitability of game meat production	% of respondents identifying limiting factors
Wildlife population sizes not sufficient	26.8
Harvesting wildlife is time consuming	13.4
Lack/cost of facilities required for cooling/processing meat	12.1
Difficulty associated with obtaining permits	9.4
Preference for conserving rather than harvesting for meat	7.4
Game meat demand is too low	6.7
Harvesting wildlife is difficult	6.7
Prices obtained for game meat are too low	6.0
Export issues (excessive regulation, lack of access to markets) are difficult to manage	4.7
Drought	4.7
Cost of transport/distance of markets	4.7
Game meat production is unprofitable	3.4
Lack of trained labour	2.7
Too many permits are issued and so wildlife populations suffer due to over-harvesting	2.0
Oversupply of game meat at certain times of year	2.0
Bush encroachment	2.0
Farm too small	2.0
Farm is too far from markets	2.0
Cost/time processing meat	2.0

Table 26

The most commonly suggested means of enhancing the profitability of game meat production

Suggestions	% of respondents
Improve marketing of game meat	49.5
Develop export to Europe	38.1
Improve price paid to farmers for game meat	32.0
Process meat to add value	15.5
Develop new export markets	9.3
Cut out middlemen	8.2
If I develop facilities for meat storage/processing	8.2
Improve hygiene of meat handling	6.2
More government assistance	5.2
Less government interference in use of wildlife on private land	4.1
More professional culling	3.1
Develop game fences	3.1

Game meat rations

Farm workers receive more ration meat from wild ungulates than from domestic stock (3.82 ± 0.34 kg c.f. 2.11 ± 0.42 kg) (F Ratio 8.1, d.f.=1, p=0.005). There are an estimated 22 855 employees working on commercial farmland in Namibia (Giel Schoombee, Namibian Agricultural Union, pers. comm., 2010). Applying the mean estimate of rations from game meat allocated to workers for the whole country, ~4500 t of meat are used to feed workers annually, compared to ~2500 t of meat from domestic stock. Assuming that the mean number of dependents (1.94 individuals per worker) recorded in this survey applies throughout the freehold farming areas, 33 342 workers and their dependents potentially benefit from game meat rations.

Illegal wildlife use: poaching

Fifty-six per cent of respondents considered poaching to be not serious at all, 25.5% considered poaching to be moderately serious, and 17.8% felt that it was a very serious problem on their land. The severity of poaching was related to whether a respondent's land was part of a conservancy (inside conservancies, 25.9%, 23.2% and 50.9% considered poaching to be very serious, moderately serious, and not serious at all, respectively, c.f. 10.7%, 27.5% and 50.9%, respectively, outside conservancies) ($\chi 2$=5.7, $d.f.$=1, p=0.017). The severity of poaching was not related to the region, rainfall, the distance of respondents' land to the nearest settlements, human density, the proportion of income from wildlife or livestock, or the biomass or diversity of wildlife ($\chi 2$=10.7, $d.f.$=10, p=0.380).

Fifty-nine per cent of respondents had recorded poaching incidents during the last year. Respondents experiencing poaching recorded a mean of 10.2 ± 1.33 poaching incidents per year and lost a mean of 20.6 ± 2.07 animals/year (0.35 ± 0.06 animals/km^2). Greater Kudu and Oryx were the species most commonly affected by poaching (**Table 27**), resulting in a mean annual loss of 1.3 ± 0.5% and 3.5 ± 1.0% of populations, respectively. Spatial patterns in the severity of poaching are depicted in **Figure 29**.

Table 27

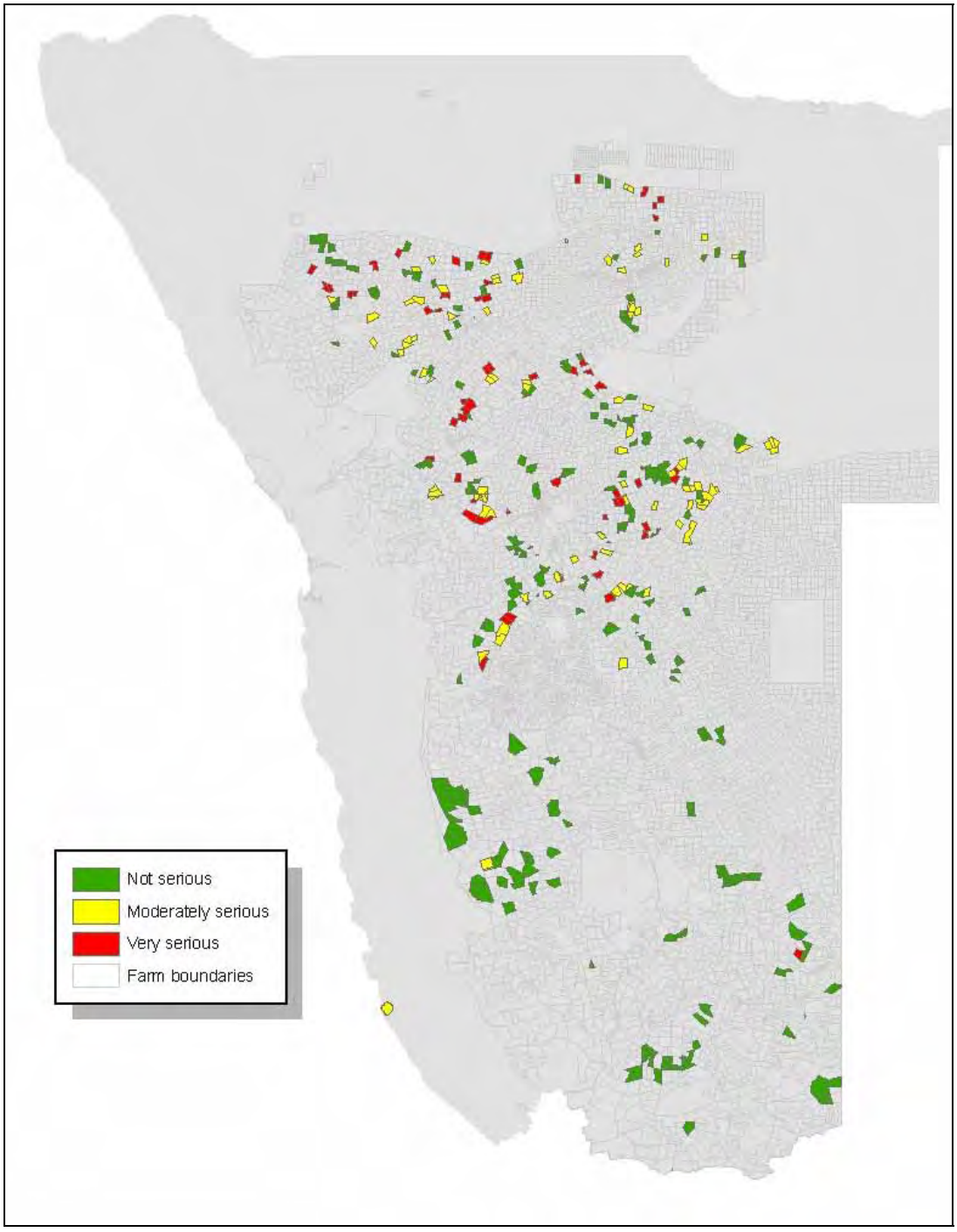
Species most affected by poaching/rustling

Species	% of farms with poaching /rustling reporting losses of the species	Mean losses/km2/year
Wildlife		
Greater Kudu	52.4%	0.11 ± 0.03
Oryx	45.0%	0.20 ± 0.03
Common Warthog	37.5%	0.10 ± 0.015
Hartebeest	10.0%	0.03 ± 0.004
Hartmann's Zebra	6.2%	0.09 ± 0.03
Springbok	3.9%	0.046 ± 0.009
Steenbok	3.1%	0.11 ± 0.05
Livestock		
Cattle	35.1%	0.06 ± 0.02
Sheep	15.6%	0.72 ± 0.37
Goats	6.5%	0.28 ± 0.19
Horses	0.6%	0.07 ± ?

Fifty per cent of respondents recorded livestock rustling on their properties and recorded a mean of 4.7 ± 0.6 incidents/year. Cattle were the livestock most frequently affected, though more sheep and goats/km^2/year were stolen (**Table 27**). Approximately 0.4 ± 0.1% of cattle, 0.5 ± 0.1% of sheep and 0.2 ± 0.001% of goat populations are stolen annually.

Figure 29

Spatial patterns in the severity of wildlife poaching in Namibia



The most common method of poaching was shooting (45.5% of poaching incidents, including 38.9% shooting from main roads passing farms and 6.9% shooting from within the farm); snaring (34.7%)

and poaching with dogs (20.0%). Whether or not the respondent's land was part of a conservancy had a bearing on the poaching method observed: shooting was more prevalent in conservancies (51.3% of poaching incidents were shooting incidents, c.f. 36.0% outside conservancies), whereas snaring (31.3% c.f. 40.0%) and poaching with dogs (16.5% c.f. 24.0%) were more common outside conservancies. The method of poaching was also related to the diversity of wild ungulate species: wild ungulate diversity was lowest where shooting was the most common form of poaching (8.20 ± 0.45 species), and was next-lowest where snaring was the most common form (9.43 ± 0.71 species) and highest where dog poaching was commonest (10.9 ± 1.05) ($\chi 2$=14.3, *d.f.*=2, p<0.001).

Credit: Aaron Price

Snares removed from a Namibian farm

Respondents considered most poachers to come from towns and cities (50.5%), but also to include people from neighbouring farms (17.5%), people from communal lands or resettlement farms (11.5%) and their own workers (8.0%). Most respondents (65.5%) felt that poachers sold the meat that they obtained, whereas 20.0% felt that they typically consumed it, and 14.5% felt that they used some and sold some.

In cases where respondents were aware of the outcome of court cases involving wildlife poachers they had caught (n=51 respondents), they reported that poachers had most often been released without punishment or fined (**Table 28**). Punishments were generally harsher for livestock thieves (**Table 27**). More respondents felt that the legal system governing stock theft was sufficient than thought the legal system governing wildlife poaching was sufficient (38.7% c.f. 20.0%) ($\chi 2$=13.8, *d.f.*=1, p<0.001). Reasons provided by respondents who considered the legal system for wildlife poaching to be insufficient included: punishments being insufficiently severe (26.4%); poor law enforcement (20.0%); the low cost of bail for wildlife poaching, resulting in poachers escaping

Credit: Aaron Price

Metal foot-trap confiscated from poachers on a Namibian farm

Credit: Aaron Price

Spears confiscated from poachers on a Namibian farm

punishment (18.6%); poor investigative work by the police (15.7%); involvement of the police in poaching (8.6%). Reasons provided by respondents for believing that the legal system governing livestock theft was inadequate included: poor law enforcement by the police (27.2%); cheap bail

resulting in stock thieves escaping (25.0%); poor investigative work by the police (25.0%); insufficient penalties (23.0%) and poor application of the law (18.4%).

Table 28

Punishments handed out to wildlife poachers and cattle rustlers in cases where the outcome of court cases known by respondents (*n*=48 and *n*=39)

	Punishments for wildlife poachers		*Punishments for livestock thieves*	
	% of cases	**Mean severity ± S.E.**	**% of cases**	**Mean severity ± S.E.**
Gaol terms	20.8	10.1 ± 6.4 months	47.5	42.0 ± 5.8 months
Fines	31.9	NAD5267 ± 1756	5.0	NAD975 ± 525
Community service	0		2.5	1 month
Released/case not processed	52.1		55.0	

Note: In a minority of cases, poachers received multiple punishments (e.g. a gaol term plus a fine), which is why the columns do not add up to 100%.

The most commonly suggested means of reducing poaching were through: more security and anti-poaching patrols (25.1%); through better support for wildlife poaching from the police (16.1%); through improvement of the penal system governing poaching (9.0%); and through the instalment of more roadblocks on national roads (6.6%).

DISCUSSION

Land use

Seventy-five per cent of commercial farmers now practise WBLU, which generates a mean of 23% of their income. Barnes (2009) estimated that wildlife-viewing was the most economically significant component of WBLU on freehold land in 2004, contributing 62.7% of economic output. However, according to the results of this survey, safari hunting is the most important form of WBLU on freehold land, being practised by a larger percentage of farmers, and generating a larger proportion of their income than ecotourism. That said, it is important to note that this study may have underestimated the contribution of ecotourism: farms practising large-scale ecotourism are localized (and so may have been missed in this survey), but generate significant revenues (J. Barnes, independent resource economist, pers. comm., 2010). After safari hunting, ecotourism was the most important form of WBLU identified by this study, followed by shoot-and-sell. Wildlife culling, management hunts and biltong hunting were found to be less significant forms of WBLU and more restricted geographically, occurring primarily in the south.

As part of the expansion of WBLU in Namibia, 25 conservancies have emerged on freehold land, incorporating 1008 farms and ~43 250 km^2. WBLU is more prevalent within conservancies, livestock biomass is lower, wildlife biomass is higher and the percentage occurrence of wild ungulates is typically higher than on farms not part of conservancies. Safari hunting is a particularly prevalent form of land use within conservancies.

Livestock farming is the most widespread form of land use on freehold farms in Namibia, and comprises the majority of income for most farmers. Beef production represents the primary form of livestock production, though small stock is also significant, particularly in the south. According to the Meat Board, 71 942 t of beef and 21 103 t from small stock in Namibia are produced annually in Namibia, from which 84% and 97% are exported, respectively. The livestock industry on freehold land contributed NAD1.97 billion [USD233 million at mean 2008 rates] to Gross National Income (GNI) in 2009 (GNI, Barnes *et al.*, in prep). Livestock numbers have declined significantly on freehold land in recent years: during 1970 and 2001, cattle numbers and small stock numbers declined by 49% and 41% respectively (Barnes and Jones, 2009), though by the mid-1990s output had not changed significantly, due to improved herd management (Lange *et al.*, 1997; Erb, 2004). Declining livestock populations are due to declining range quality caused by over-grazing (capacity has declined by 20–90% in some areas) (Bester, 1999 in Erb, 2004), and due to the rise of game farming as an alternative (MAWF, 2007; Barnes and Jones, 2009).

Wildlife and tourism contributed ~NAD1.4 billion (USD166 million at mean 2008 rates) to GNI in Namibia in 2009 (or NAD1.8 billion if all natural resources are taken into account [USD213 million]) (Barnes *et al.*, in prep.). This estimate is likely to be conservative, as the extent of the economic contribution of game meat production was not known prior to this study, which estimated that NAD200 million [USD23.7 million] was generated annually from game meat production (not including value-addition from export), compared to previous estimates of NAD4.5 million/year [USD533 175] (Barnes, 2009).

The economic contribution of wildlife and tourism on freehold land is rapidly approaching that of livestock (despite the policy environment favouring livestock and prejudicing against wildlife ranching, and despite the stunted development of WBLU on freehold land discussed below). With continued growth in tourist and hunter arrivals likely following the end of the recent global economic downturn, the economic contribution of wildlife will probably increase further in future. Prior to the downturn, from 2004 to 2007, tourist visitation to Namibia increased by 24% (www.namibiatourism.com.na) and the value of the safari hunting industry increased by 57.1% (~USD28.5 million to USD44.8 million) (Damm, 2005; Lamprechts, 2009). Furthermore, WBLU is more frequently practised by younger farmers, indicating that its prevalence will increase with time. By contrast, earnings from livestock are projected to decline significantly in the coming decades due to global warming (Barnes *et al.*, in prep). Though WBLU may also be affected, projected long-term reductions in revenues are 60% lower than the predicted losses to the livestock industry due to climate change (Barnes *et al.*, in prep).

Stunted development of wildlife ranching on freehold land

Despite ongoing growth in the wildlife industry, Namibian farmers have clearly not embraced WBLU to its full potential, or nearly as fully as their counterparts in former-cattle farming areas of South Africa and Zimbabwe. Most Namibian farmers (>90%) retain livestock, whereas by 2001 more than half of ranchers in the Limpopo Valley, Central Lowveld and Zululand areas of South Africa were

farming only with wildlife (Lindsey unpublished data). Similarly, in Zimbabwe (prior to land reform) at least seven large conservancies developed from which cattle were removed entirely (Bubi Valley, Bubiana, Gwayi River, Midlands, Chiredzi River and Savé Valley). Namibian conservancies are poorly developed, lacking perimeter fencing and lacking most of the high-value species. WBLU on freehold land in Namibia is dominated by low-end safari hunting (and other low-value forms of consumptive wildlife use), due primarily to the general absence of large, high-value species ("big game"). These factors are due in part to the fact that user-rights over wildlife have not been devolved as far as they were in South Africa or Zimbabwe, due to veterinary restrictions, due to lack of development of fully integrated conservancies, and due to lack of effective organization of, or vision within the wildlife industry. These factors are discussed in more detail in the section on increasing the food security and development value of WBLU, below.

Credit: C. Havemann

Mixed wildlife and livestock farms are the norm in Namibia, contrasting with the wildlife-only ranches common in South Africa and Zimbabwe

Wildlife population trends on freehold land

In keeping with suggestions by other authors, wildlife populations appear to be increasing on freehold land in most areas (Erb, 2004; Gödde, 2008). The percentage of mammal biomass comprised by wildlife has increased from 8% in 1972, to 18% in 1992 and 29% presently (Barnes and de Jager, 1996; Saltz *et al.*, 2004). During this survey, ranchers provided estimates of the numbers of wildlife on their land. Though these data must clearly be treated with caution, they suggest that the abundance of wildlife on freehold land is potentially higher for some species than suggested by other authors (Erb, 2004; Barnes, 2009). Furthermore, estimates of wild ungulate diversity from this study (which are likely to be reliable—ranchers' knowledge of the presence/absence of species on their properties should be accurate) suggest that the diversity of wild ungulates on freehold land has also increased during the last five years (Erb, 2004).

Wildlife diversity and biomass were positively correlated with income from safari hunting, and the number of species was typically higher on farms of younger respondents, and those living nearer towns, possibly due to higher potential returns from tourism on such properties. Wildlife biomass is positively correlated with livestock biomass (indicating that land that is good for livestock is also good for wildlife), but negatively correlated with income from livestock (indicating a degree of non-compatibility between livestock farming and WBLU). Wildlife biomass is ~58.4% lower than livestock biomass on private land. During this survey, farmers most commonly attributed increasing wildlife populations to favourable rainfall, good management, conservative wildlife harvests and the provision of artificial water-points. Other authors have also noted the key role of falling livestock populations, the importation of wildlife from South Africa and the continued suppression of predator populations on freehold land (Erb, 2004) (e.g. Lions only occur on 8.1% of freehold farms and wild dogs on 6.1%). In some areas, farmers felt that wildlife populations were declining, primarily due to excessive harvesting. Elevated levels of off-take are likely to be encouraged by the rapidly increasing game meat prices (the price for game meat obtained by farmers has increased by 45% during the last 2-3 years). Excessive off-takes are most likely to occur where wildlife harvests by adjacent farmers are not co-ordinated (especially given the relative rarity of wildlife-proof fencing on Namibian farms). Correspondingly, declining populations were more common outside conservancies.

Game meat production

Significant quantities of game meat are produced on Namibian freehold farms, and considerably more than was previously recognized. For example, Laubscher *et al.*, (2007) estimated that 4300 t of game meat were produced in Namibia annually during the period 2001–2005, compared to estimates from this study that 16–23 000 t are produced per year. The largest single source of meat is that produced (as a by-product) from safari hunting, followed by that obtained through hunting for farmers own use. Meat resulting from animals killed under shoot-and-sell and wildlife culling permits represents a relatively small proportion of the total (26.4%). The proportion of meat produced from all forms of off-take (except for own use) is increasing (relative to that reported by Erb [2004]), reflecting the high-value wildlife for safari hunting and game meat for sale. Off-takes as a proportion of species populations appear to be increasing (though they still appear to be well within sustainable limits). Oryx, Greater Kudu, and Springbok are the species producing most meat on freehold farms.

The sale of game meat and economic value of game meat production

Farmers typically sell their game meat to other butcheries, through their own butcheries or through private sales at their properties. Farmers most commonly sell game meat in the form of whole carcasses or unselected cuts of meat. The price of meat appears to have increased significantly in recent years, from ~NAD12/kg two or three years ago [USD1.42 at mean 2008 rates], to NAD17.4/kg presently [USD2.06]. The current mean price obtained by farmers for unprocessed meat (NAD17.4/kg) is 13.4% lower than that paid for beef (NAD20.5 [USD2.43]) and 17.0% lower than that for sheep (NAD21.0 [USD2.49]) (mean values for 2009 from the Meat Board of Namibia). Prices paid to farmers for meat from some species, notably Common Eland and Springbok (14.1% and 9.8% higher than other species) approximate more closely to the value of meat from domestic stock. Furthermore, farmers obtain better prices for selected cuts of game meat (mean price obtained:

NAD31.2/kg [USD3.70]) and for processed game meat products such as biltong and *droëwors* (mean price obtained: NAD80.4/kg [USD9.43]). Though farmers are paid less for game meat than for meat from domestic stock, prices in the shops are generally higher for game meat than for meat from domestic stock (by up to 33.7% for whole carcasses, and 15–46% for selected cuts).

Credit: Tiemen Rhebergen

***Droëwors*, often produced from game meat**

The value of game meat is enhanced significantly through export to South Africa, and particularly to the EU. Latest estimates suggest that ~85 t of Springbok meat are exported to the EU annually (D. Museler, Hartlief meat processing company, pers. comm., 2010). The price obtained for meat by companies distributing to the EU is approximately NAD80 [USD9.48], almost five times the prices paid to the farmers. In addition, approximately 720 t of game meat may be exported to South Africa per year (or 805 t exported in total including that sent to the EU), approximating to ~3.0–5.0% of game meat produced (depending on the estimates of total game meat production).

Contribution of game meat to rural food security

Game meat from freehold farms is an increasingly high-value product which is not readily accessible at low prices by the rural poor. This lack of accessibility is exacerbated by the fact that most of Namibia's rural population occurs in the far northern part of the country, a long distance from most of the freehold farming areas. Game meat from communal conservancies has greater potential for contributing to rural food security, especially those located north of the veterinary control line. Wildlife populations on communal conservancies are increasing rapidly in many areas and with the prevalence of consumptive wildlife use in such areas (Weaver and Petersen, 2008), large quantities of game meat are likely to be produced. The transport of game meat from north to south across the veterinary control line is generally not permitted (DVS, 2007). Consequently, game meat from communal conservancies in the north cannot be sold in the major urban markets in Namibia, or sold to key foreign markets. Game meat from communal conservancies in the north is thus not likely to attract such high prices as that from freehold areas and will be likely to be more affordable and accessible for the nearby rural communities. Research into the scale of game meat production on communal conservancies and its economic and social value is required.

Game meat from freehold land does contribute significantly to food security, as highlighted by the fact that larger quantities of meat from wildlife remain in Namibia than from domestic stock, because the majority of the latter is exported. Game meat produced on freehold land contributes most clearly to food security through its importance as a source of rations for farm workers. Farmers provide workers with an average of 3.8 kg of game meat as rations per week, which is 1.8 times greater than the quantity of domestic animal meat allocated as rations. Extrapolating this estimate to the estimate of the number of workers in freehold land (22 855), then ~4500 t of game meat are used by farmers to feed staff annually. Game meat rations potentially benefit >33 000 people, if one assumes that workers' dependents receive some of the meat. Rations are particularly important in the light of the fact that farm workers are earners of among the lowest cash wages in Namibia (LEAD, 2005). The food security benefit provided through rations is unlikely to be threatened by the rising value of game meat because meat from lower meat-value species (such as Common Warthog, Plains Zebra *Equus quagga*, Hartmann's Mountain Zebra, Giraffe *Giraffa camelopardalis* and Waterbuck *Kobus ellipsiprymnus*) and damaged meat from body-shots during safari hunting is always likely to be available for allocation to workers.

Rural food security benefits could be enhanced through the provision of affordable supplies of game meat to informal settlements and communal lands within or near commercial farms. In some areas, farms adjacent to such settlements experience poaching. The illegal trade in bushmeat from poaching could potentially be countered through the provision of legal supplies of game meat, as is currently being attempted in Savé Valley Conservancy in Zimbabwe (Lindsey *et al.*, 2009). The affordability of such supplies could be ensured by focussing supply on meat from lower meat-value species, or from meat damaged aesthetically during safari hunting. Poaching is not, however, a particularly serious problem in most freehold farming areas in Namibia, presumably due to the low human population densities. The lack of severity of poaching on most farms is reflected by the fact that most ranchers do not employ anti-poaching staff, contrasting with the situation on Zimbabwean game

ranches (Lindsey *et al.*, 2007). Where it does occur, the majority of poaching on Namibian farms is conducted by individuals shooting from vehicles along public roads passing farms. Clearly, to afford firearms and vehicles, such individuals are food-secure, indicating that the motives are likely to be the obtaining of meat for sale, rather than for subsistence. Such poaching can be expected to increase in prevalence as the value of game meat increases. To limit such escalation, in Namibia as in various other Southern African nations, there is a need for adjustment of the penal structure such that punishments for illegal hunting reflect the value of the resource being affected (Barnett, 1998; Lindsey *et al*., 2009).

Enhancing the contribution of WBLU to food security and social development

Due to the high value of game meat and the distance between freehold farms and the bulk of Namibia's rural population, there is a limit to which WBLU contributes directly to rural food-security. However, there is significant scope for WBLU to contribute to national food security indirectly, through creation of employment (WBLU creates more employment per unit area than livestock farming, and evidence from South Africa suggests that the quality of employment [e.g. salaries, training, working conditions] associated with WBLU is higher than that associated with livestock farms (Langholz and Kerley 2006)), through the generation of foreign currency revenues, and by providing an entry point for emerging black farmers into the potentially lucrative tourism industry. However, at present, several factors limit the profitability of WBLU and the extent to which these contributions are provided:

1. Failure to exploit potential for export of meat products

There is significant potential to increase foreign currency earnings from game meat through the value-addition associated with exporting to European and other overseas markets. At present, only 6.1% of potentially available Springbok meat and none of the potentially available high-quality meat from other species is exported to the EU. Several factors limit the potential for the export of game meat, including (Erb, 2004; Gödde, 2008):

- Consistency of supply is prevented by the limitation of some forms of harvest to specific seasons.
- Lack of facilities for the storage of meat (and thus to deal with the surge in production during the hunting season).
- Wildlife culling is difficult and costly, especially in some types of terrain.
- The absence of EU-approved facilities for processing large game species (at the moment export to the EU is limited to Springbok).
- There is only one abattoir facility accredited for exporting Springbok meat to the EU (the Farmers Meat Market Abattoir in Mariental in the south) so export of game meat to the EU does not meet demand. Game meat is often exported to South Africa, and then sometimes re-exported from there to the EU, resulting in loss of revenue for Namibia.

- Lack of awareness in target markets of the health advantages of game meat (as opposed to the hormone-manipulated venison production of some countries).

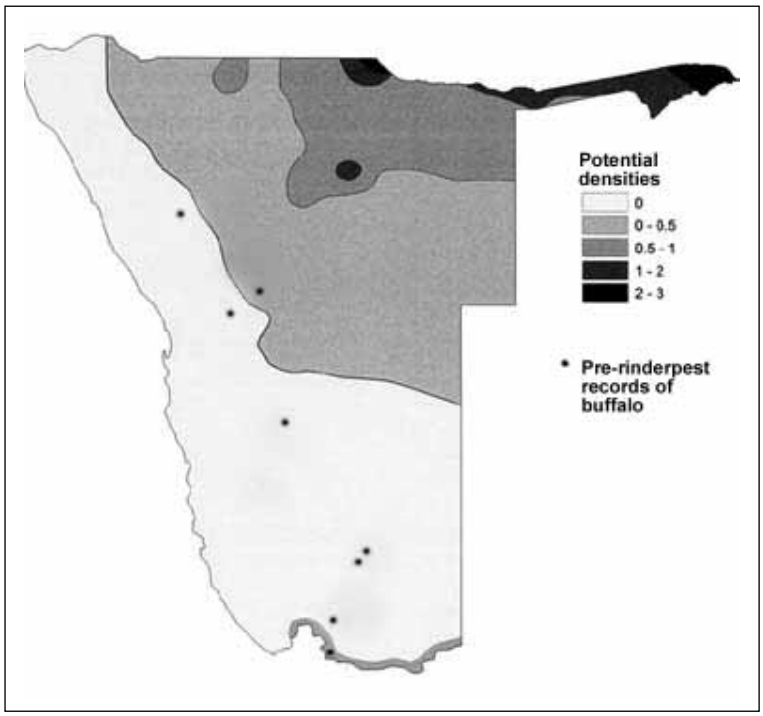
If these limitations were overcome, then a potential maximum of ~1400 t of Springbok meat and 4100 t of meat from Hartebeest, Oryx, Common Eland, impala and Greater Kudu could be exported annually. Given a value of NAD80/kg, this meat could generate theoretical gross earnings of NAD440 million/year [USD52 million], assuming that markets exist for such large quantities of meat.

2. Veterinary restrictions preventing the reintroduction of buffaloes Syncerus caffer

Considerable attention has been granted to the factors limiting game meat production and/or the potential for export of game meat from Namibia overseas (Gödde, 2008; Laubscher, 2007; MET, 2008). However, surprisingly little attention has been given to other (potentially more significant) factors currently limiting earnings from WBLU. One such factor is the veterinary restrictions which favour livestock production and preclude fully developed WBLU.

Figure 30

Pre-rinderpest range of buffalo in Namibia and potential densities, based on rainfall



Source: Martin, 2008.

Due to veterinary controls implemented to prevent the transfer of foot-and-mouth disease (FMD) from wildlife to livestock, farmers are not permitted to reintroduce buffaloes (including FMD-free individuals) south of the veterinary cordon (DVS, 2007; MAWF, 2007). Buffaloes are the single-most important species for generating revenues from safari hunting as they command high trophy fees and can also be used to sell hunting packages (Martin 2008). For example, in the Kwando region of Caprivi, 34% of safari hunting income is derived from buffaloes (Martin, 2006) and in Botswana, safari hunting revenues could be more than doubled if the quotas of buffaloes (and other dangerous game species) were expanded to fulfil the potential of available populations (Martin, 2008). Historically, buffaloes occurred widely in the northern and north-eastern sections of Namibia in areas with >250mm of rainfall, including large areas of what is now freehold farmland (**Figure 30**) (Martin, 2005).

Given that the economic output of wildlife on freehold land is likely already to exceed that of livestock and given the potentially major increases in revenues if the reintroduction of buffaloes were permitted, the wisdom of promoting the livestock industry at the expense of the wildlife industry through stringent veterinary controls is questionable. That WBLU creates more employment than livestock production emphasizes this point. A change in veterinary restrictions should be considered to permit the reintroduction of buffaloes on freehold land. The need for strict veterinary control measures is deeply entrenched in various government ministries in Namibia, as it is in other Southern African nations. Consequently, before any changes in veterinary control strategies would be considered, an assessment of the potential economic impacts of alternative approaches would be required. A study is required in which the potential earnings from livestock and WBLU on freehold land in Namibia are compared under the following scenarios:

a) The status quo whereby buffalo reintroductions on freehold land are prohibited.
b) The scenario whereby the reintroduction of FMD-free buffaloes is permitted.
c) The scenario where FMD-endemic zones are created in areas where WBLU has a clear comparative advantage over livestock production on freehold land, where the reintroduction of FMD-infected buffaloes (which are much cheaper to purchase) is permitted.
d) The scenario where FMD-exclusion zones are abandoned except for islands set aside for livestock production.
e) The scenario whereby the strategy of FMD-exclusion zones is abandoned completely in favour of a commodity-based trading approach (i.e. where meat processed in a manner proven to provide minimal risk of transmitting FMD (e.g. through removal of bones and lymph nodes)) is considered acceptable for export (Thomson *et al.*, 2004). Under such a scenario, restrictions on the reintroduction of buffaloes on freehold land would be greatly reduced or even removed completely.

3. Failure to reintroduce other large high-value species

In addition to buffaloes, other large (and high-value) wildlife species are rare on freehold land in Namibia, severely limiting potential earnings from ecotourism and safari hunting. Most farmers are able to offer similar, low-value hunting or wildlife-viewing experiences involving antelopes. Elephants, rhinoceros species, and Lions occur on a small fraction of freehold farms. In South Africa, game ranchers able to advertise the "big five" (Lions, African Elephants, Leopards, Hippopotamuses and rhinoceros species) are able to charge more than double the amount for ecotourism experiences than those lacking such species (Lindsey *et al.*, 2009). The profitability of Namibia's safari hunting industry is similarly compromised by the lack of high-value dangerous game species on freehold land. Namibia and Botswana generate similar revenues from safari hunting even though Namibia attracts >15 times more visiting hunters than Botswana (5363 c.f. 350 in 2004, Debbie Peak, Botswana Wildlife Management Association, pers. comm., 2010; Damm, 2005). Most hunts in Namibia are low-value hunts involving primarily antelope species, whereas a significant proportion of those in Botswana involve high-value dangerous game (Humavindu and Barnes, 2003).

4. Failure to develop fully-integrated conservancies

A key reason for the rarity of reintroductions of large (and high-value) wildlife species on Namibian freehold farms is the failure of fully integrated conservancies of sufficient size to develop. In several areas of Zimbabwe and South Africa, several large (up to 1000 km^2 in South Africa, and 3500 km^2 in Zimbabwe) conservancies have developed where all livestock and internal fencing has been removed, and all indigenous mammal species reintroduced, within an all-encompassing perimeter wildlife-proof fence. Fully integrated conservancies confer a number of clear economic, ecological and social benefits (see **Box 1** for a summary, below). In such conservancies, land values and earnings are markedly higher than when livestock farming was the primary land use (Lindsey *et al.*, 2009). In South Africa, for example, land values of properties with the "big five" are up to six times greater than equivalent land lacking those species (Falkena, 2003).

Namibian conservancies are considerably less well developed and are not cohesive units because not all farms within their boundaries are members. Furthermore, livestock fencing and some wildlife-proof fencing exists within conservancies and livestock farming remains the primary land use. The only meaningful difference between land within and outside Namibian conservancies is that wildlife counts and safari hunting off-takes by neighbouring farmers are co-ordinated. Though wildlife biomass and diversity is somewhat higher within conservancies, key species required to fulfil the potential of WBLU are missing from most of them. Furthermore, there is increasing disillusionment among farmers in conservancies in Namibia owing to the lack of legal recognition of conservancies by the government, due to concerns over the systems in place for sharing of pooled wildlife populations, and due to the fact that their primary function appears to be promoting safari hunting rather than conservation. Without an overhaul of the structure of conservancies and lobbying for legal recognition, there is a danger that the process of their development will stall or even reverse.

Two aspects of the Namibian legislative framework are largely responsible for the fact that WBLU has not developed to the same extent as in Zimbabwe and South Africa, and for the failure of fully integrated conservancies to develop (http://www.nnf.org.na/RARESPECIES/InfoSys/wildlife Landuse/devolveFarms.htm). Firstly, user-rights over wildlife have not been devolved to landowners to the extent that they have been in Zimbabwe and South Africa. Landowners are still required to apply for permits to use wildlife on their land, reducing the freedom with which the resource can be exploited. Secondly, landowners with properties surrounded by game fencing are given more complete user-rights over "huntable-game" than those whose land is not fenced. Such legislation is likely to promote the break-up of freehold land into fenced pockets and mitigate against the development of large, co-managed, fully integrated and more profitable conservancies.

There is a need for adjustment of the legislation in Namibia to provide incentives for the formation of fully integrated conservancies and to discourage the break-up of land into fenced pockets, to avoid the ecological problems associated with such trends in South Africa (Lindsey *et al.*, 2009). A key incentive for the formation of fully integrated conservancies would be provided if user-rights were granted to landowners within conservancies following submission of an acceptable management plan, while retaining current restrictions on user-rights for farms not part of conservancies.

Box 1: Advantages of fully-integrated private conservancies

Defined as multi-owner blocks of land with all internal fences removed, with an all-encompassing perimeter boundary fence (extracted from Lindsey *et al.,* 2009, and with input from C. Brown, Namibia Nature Foundation, pers. comm., 2010)

Economic advantages

- Larger areas permit the reintroduction of the full range of indigenous mammal species, including high-value "big-game" species
- When "big-game" species are reintroduced, land use tends to shift from the high-off-take, low-value forms of wildlife use typical of isolated ranches (and commercial conservancies in Namibia at present), to low off-take, high-value safari hunting, and ecotourism
- Income from low-off-take safari hunting and ecotourism is much less dependent on rainfall than that from livestock or high off-take consumptive use of wildlife, reducing risk
- Large areas are less susceptible to drought as wildlife can move to exploit patchy primary productivity resulting from spatially variable rainfall
- With the shift in land use, a higher proportion of income comes in the form of foreign exchange
- The value of land in fully integrated conservancies with the full range of mammal species present typically increases markedly
- Large co-managed areas will benefit from economies of scale whereby less infrastructure and management effort per km^2 is required
- Co-managed areas may provide a critical mass of capital to permit significant investments in tourism infrastructure, or wildlife for reintroduction
- Co-managed areas (particularly ones demonstrating clear ecological and social benefits) are likely to attract donor funds to assist with start-up costs

Ecological advantages

- Professionally developed management plans (coupled with group accountability) are likely to reduce arbitrary and environmentally damaging management decisions which are sometimes observed on ranchlands (e.g. persecution of predators, reintroduction of exotic or extra-limital species, genetic manipulation of wildlife, over-stocking, over-harvesting, etc)
- Larger areas permit the re-establishment of intact guilds of indigenous species, and improve prospects for conserving threatened and endangered species
- As land use shifts to low-off-take safari hunting and ecotourism, predators become valuable to landowners and are more tolerated
- The presence of predators reduces stocking densities and the prevalence of ecological degradation associated with over-stocking of wildlife (which is a widespread problem on Namibian freehold land at present)
- Large areas increase ecological resilience and reduce the risk of catastrophic die-offs during droughts

Social benefits

- As land uses shift to high-end safari hunting and ecotourism, and away from livestock and low-value consumptive wildlife use, the quality and quantity of employment opportunities will increase
- Conservancies are potentially important vehicles for land reform:
    - Conservancies provide the appropriate institutional scale to interact effectively with government and communities
    - Due to centralized management, and economies of scale, conservancies remove two key barriers to the entry of emerging farmers into WBLU—namely, lack of expertise related to wildlife management, and lack of start up capital
    - Conservancies provide an opportunity to create a shareholding structure based on wildlife (or land) resources which indigenous entrepreneurs (or government or NGOs on behalf of emerging farmers) can be encouraged to invest in
    - Conservancies can be easily expanded to incorporate communal land or land belonging to emerging commercial farmers
- Conservancies provide a critical mass of capacity, and are likely to attract a convergence of expertise from the private sector, NGOs and government

There is a need for research into alternative structures for freehold conservancies in Namibia, including investigation into the profitability of fully integrated wildlife-only designs. Presently there is reluctance among Namibian farmers to venture into wildlife only land uses or fully integrated conservancies because of a belief that a dual land use system is more profitable, and less risky. Such a concern is logical: there probably is increased risk associated with shifting from a mixed system to a pure-wildlife system based on antelope production which relies on high-off-takes for biltong hunting, meat production and low-value safari hunting. However, where high-value wildlife species are reintroduced, land use tends to shift from high off-take and low-value safari and biltong hunting to low off-take (high-value) safari hunting and ecotourism (Lindsey *et al.*, 2009). Under such land uses, potential earnings are markedly higher, and income is de-coupled from rainfall to some extent, reducing risk (Price-Waterhouse, 1994). Furthermore, if intact predator guilds are restored, the stocking rates of wild ungulates would likely be reduced, reducing the risk of catastrophic die-offs in the event of drought (Lindsey *et al.*, 2009).

A detailed assessment of the potential profitability of various potential conservancy structures is required, taking into account risk factors such as rainfall, variable tourist arrivals, exchange rate fluctuations and variable prices for livestock products. Possible scenarios that should be compared include, *inter alia*:

a) Fully integrated conservancy structures where all livestock and all internal fencing are removed, a single perimeter fence is constructed, and the full complement of mammal fauna is reintroduced (including the scenarios where buffalo reintroductions are and are not permitted).
b) The retention of livestock, but the development of a perimeter game fence and re-stocking with the full diversity of herbivore species (including scenarios with and without African Elephants, and with and without predators—looking at the potential costs of livestock losses and increased husbandry).
c) The status quo – typical conservancy structures in place at present on Namibian farmland.

Research is also required to document successful collaborative management agreements developed by private conservancies elsewhere in Southern Africa, to identify means of:

a) Ensuring equitable access among members to pooled wildlife resources.
b) Accounting for differential investments in wildlife among members prior to conservancy formation.

Efforts should then be made to raise awareness among farmers of the potential economic and ecological benefits associated with fully integrated conservancies and of models for effective management of pooled wildlife resources.

5. The risk of WBLU declining in prevalence with land reform

There is currently inadequate participation of black farmers in WBLU, despite a recent initiative by the MET to provide breeding stock of wildlife on loan to emerging farmers (http://www.namibian.com.na/index.php?id=28&tx_ttnews%5Btt_news%5D=8285&no_cache=1). Lack of engagement in WBLU by black farmers may be due to lack of awareness of the potential benefits from the industry, lack of the necessary capital or expertise, and possibly the failure of the Ministry of Lands and Resettlement to create opportunities for them to engage in wildlife-ranching. During this survey, black farmers demonstrated a clear interest in engaging in WBLU, but without active efforts to facilitate their integration into the industry, a passive drift from WBLU to livestock-based land uses is likely as land reform proceeds. Greater integration of black farmers into WBLU would increase the political sustainability of and social benefits arising from the wildlife industry on freehold land. Such integration could be promoted during the farm acquisition and re-allocation process if the Ministry of Lands and Resettlement identified farms with significant wildlife populations as "game ranches" and allocated such properties to emerging farmers with a particular interest in WBLU.

There is a particularly pronounced under-representation of black farmers in commercial conservancies. The failure of commercial conservancies to integrate effectively with emerging farmers has created a perception among some sectors of government that conservancies represent a barrier to land reform. Such a perception is likely to ensure that changes in the legislation favouring the development of conservancies are not forthcoming. Conservancies could play an important role in the integration of emerging farmers in WBLU and in doing so could increase the likelihood of receiving government recognition and support. Due to the centralization of management in conservancies and economies of scale associated with infrastructure, lack of expertise and funding would be reduced as barriers to the entry of black farmers into WBLU in conservancies. In addition, in areas where commercial conservancies occur adjacent to communal land or re-settlement farms, they could provide opportunities for such communities to engage in WBLU by extending the conservancy boundaries to encompass community land (as is currently being attempted at Savé Valley Conservancy in Zimbabwe, for example) (Lindsey *et al.*, 2008). Active efforts are required on the part of commercial conservancies to demonstrate to government a commitment to integrating with emerging farmers and facilitating their entry into WBLU. Such efforts would significantly improve the prospects of being granted a legislative environment favourable to the development and profitability of conservancies, and of WBLU in general.

Conclusions

WBLU is increasing in prevalence on freehold land in Namibia. As a result, increasing quantities of game meat are being produced, partly as a by-product of hunting tourism and partly through purposeful harvesting of wildlife specifically for meat. Consequently there is potential for game meat from freehold land to make a significant contribution to rural food-security. However, this potential is limited by the distance between the source of game meat on freehold land and most of the high

population density communal lands (situated in the far north) and also due to the high and increasing price of game meat. Game meat contributes most directly to food security by acting as the primary source of meat that is provided to farm workers as rations. Furthermore, WBLU can however contribute significantly to food security on a national level through the provision of employment and the generation of foreign currency. WBLU creates more employment opportunities per unit area than livestock-based land use, and foreign currency revenues from WBLU on freehold land are increasing rapidly due to increased tourist and tourist hunter visits. Presently though, the earnings from WBLU in Namibia are stifled by veterinary restrictions which prevent the reintroduction of buffaloes, by failure of farming communities to form fully integrated conservancies or to reintroduce the high-value species necessary for the most profitable forms of hunting and photographic tourism. Furthermore, future growth in WBLU on freehold land is threatened by failure to integrate emerging farmers in the wildlife industry.

Research is urgently required to assess the economic and financial efficiency of current veterinary control strategies, to develop templates for the formation of fully integrated conservancies, and to develop means for integrating emerging farmers in the development of WBLU.

RECOMMENDATIONS

Steps required to increase the economic and social contributions of WBLU

- The reintroduction of the full range of indigenous mammal fauna should be promoted where possible on freehold land, including large, high-value species (which are currently largely absent). Government could assist this process by providing conducive legislation (i.e. encouraging the formation of fully integrated conservancies, revising veterinary control strategies) and providing founder animals sourced from protected areas.
- Alternative veterinary control strategies should be explored that would permit the reintroduction of buffaloes to some areas under certain conditions.
- The reintroduction of FMD-free buffaloes on freehold should be permitted, and consideration should be given to creating wildlife-production (and regulated FMD-endemic) zones in areas where WBLU has clear comparative economic/financial advantages over livestock production, to permit the reintroduction of FMD-buffaloes (which are much cheaper and more affordable than FMD-free individuals).
- The EU and World Organisation for Animal Health should be lobbied to accept commodity-based trading, to remove or reduce the need for costly veterinary restrictions based on the maintenance of disease-free zones, which restrict the development of WBLU.
- Changes in legislation should be made to promote the development of fully-integrated conservancies (i.e. with all internal fencing removed) in which the full complement of indigenous mammals is reintroduced (e.g. by devolving full user-rights over wildlife to conservancies following the submission of an acceptable management plan, while retaining current permit requirements for farms not part of conservancies).

- Legislation should be changed to discourage the break-up of freehold land through the construction of high game fencing around individual farms.
- Steps should be taken to organize formal representation for the wildlife industry to protect the interests of wildlife ranchers and to lobby for policies conducive to profitable WBLU and against policies that are prejudicial toward the industry.
- The development of WBLU should be integrated with the process of land reform: emerging farmers should be encouraged and assisted to become involved in wildlife-ranching (e.g. through the provision of extension services and founder populations of wildlife for reintroduction) and some areas should be earmarked and reserved for WBLU following the transfer of land to emerging farmers.
- Commercial conservancies should be seen as a vehicle for the integration of emerging farmers into WBLU (by using the economies of scale and centralized management to make it easier for new entrants to break into the industry). Active efforts are required from conservancies to assist emerging farmers to join and to participate in WBLU.
- Conservancies should consider forming corporate structures whereby wildlife and tourism assets are converted to shares which are available for purchase by investors. The purchase of such shares for/by emerging farmers/investors should form an alternative strategy for achieving land reform, in addition to the acquisition of land.
- Efforts should be made to increase income generated from game meat production through the development of export markets, the development of infrastructure necessary to process high quality game meat, and measures to improve the consistency of supply of game meat to abattoirs.

The following research is required to promote increased understanding of the role of WBLU and to promote elevated productivity

- An assessment of the scale and food-security contribution of game meat production in communal areas.
- An in-depth financial and economic analysis of the pros and cons of various potential alternative veterinary control strategies and scenarios to explore the advisability or otherwise of various possible options for buffalo reintroductions on freehold land.
- A financial and economic analysis of the comparative profitability of various land use options in various scenarios in Namibia, including mixed livestock/wildlife production systems, pure wildlife systems, current conservancy models and more integrated conservancy systems (i.e. those lacking internal fencing and where the full range of indigenous species have been reintroduced).
- A review of co-management systems, conservancy constitutions and systems in place in Namibia, South Africa, Zimbabwe and Kenya to identify those that are most effective, profitable and which yield the greatest gains for conservation and social development.
- An assessment of wildlife movement and migration patterns on freehold land to prevent disruption through inappropriately placed fence lines.

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APPENDIX 1: Namibia Game Meat Questionnaire

Interviewer.....Date.....

Background

1. Region.....GPS/Map point.....
2. District.....

3. How much land do you own?

Number of farms.....Size.....
Farm name.....Farm number.....
Farm name.....Farm number.....
Farm name.....Farm number.....
Farm name.....Farm number.....
Farm name.....Farm number.....

4. How much land do you lease?

Number of farms.....Size.....
Farm name.....Farm number.....
Farm name.....Farm number.....
Farm name.....Farm number.....
Farm name.....Farm number.....
Farm name.....Farm number.....

5. Is (are) the farms part of a conservancy?

□ Yes, conservancy name.....conservancy size.....
□ No
.....

6. Why did you become part of the conservancy?

.....

7. Why are you not part of a conservancy?

.....

8. Do you have fencing around your property(ies)?

□ No □ Yes, what type.....

Land uses

9. Do you live on the farm? □ Yes □ No

10. Are you a full time farmer, or do you have another job or income generating activity?

□ Full-time farmer
□ Part-time farmer, also work as.....

11. What land uses do you practice on your properties, and what proportion of the ranch income do they generate in an average year? (Is this for OWNED □ or LEASED land. □ or all land owned or leased □)

Land use	**Tick if yes**	**Proportion of ranch income**
Agriculture	□	
Livestock production	□	
Photographic ecotourism	□	
Trophy hunting	□	
Biltong hunting	□	
Shoot-and-sell	□	
Cropping / harvesting of game for meat (with culling team)	□	
Management hunts (non trophy tourist hunts)	□	
Own use	□	
Live game sales	□	
Other, please specify....		

12. If any of the following forms of wildlife use are not conducted, please explain why you do not practice them?

Land use	
Livestock	
Photographic ecotourism	
Trophy hunting	
Biltong hunting	
Shoot-and-sell (sale of meat)	
Cropping / harvesting of game for meat (with culling team)	
Management hunts (non trophy tourist hunts)	
Live game sales	

13. How many employees do you have on the land that you own and/or lease?
(Is this for OWNED □ or LEASED land. □ or all land owned or leased □)

.....

14. How many people live on the properties that you own and/or lease (employees and families, and dependents) (**not including the farmers own family**)
(Is this for OWNED □ or LEASED land. □ or all land owned or leased □)

.....

15. If the farmer has livestock: Would you consider removing all livestock and farming with just game in future?

□ Yes, because.....
□ No, because.....

For farmers in conservancies:

16. If the conservancy proposed that all farmers switch to purely game farming, remove all internal fences, and that the conservancy constructed a single fence around the perimeter and reintroduced all indigenous animals that the law permitted to the area, would you be supportive of such a move and be willing to include your land?

□ Yes, because.....□ No, because.....

17. Do you have guest accommodation on the farm? □ Yes □ No

18. If so, how many **beds** (NOT ROOMS) do you have?

.....

19. If you do have guest accommodation, what type of client is it used for?
    □ Tourists □ Hunters □ Conferences □ Business meetings □ Other

20. If you are involved in ecotourism, approximately how many tourists visit your property per annum on average?

.....

21. How many ecotourism bed nights to you have on average?

Wildlife

22. Please estimate the approximate population sizes of each of the following species on your property (PREDATORS JUST ASK PRESENCE ABSENCE)
    (Is this for OWNED □ or LEASED land. □ or all land owned or leased □)
    Specify number of farms and land area.....

Species	**Population size on your property**
Blesbok	
African Elephant	
Common Eland	
Common Duiker	
Giraffe	
Hartebeest	
Impala (Common)	
Impala (Black-faced)	
Greater Kudu	
Oryx	
Ostrich	
Roan Antelope	
Sable Antelope	
Springbok	
Steenbok	
Tsessebe	
Common Warthog	
Waterbuck	
Wildebeest, Black	
Wildebeest, Blue	
Zebra, Hartmann's	
Zebra, Plains	
Other (specify)	
Cheetahs	
Hyaena, Brown	
Hyaena, Spotted	
Leopards	
Lions	
Wild dogs	
Cattle	
Sheep	
Goats	
Horses	
Donkeys	

23. What is your basis for the above population estimations?

.....

24. Do you think that wildlife populations in your area have been increasing, staying stable or decreasing during the last five years?
□ Increasing □ Staying stable □ Declining. Why?.....

25. Approximately how many animals of the following species are killed / extracted per year from your property through the means listed below?

(Is this for OWNED □ or LEASED land. □ or all land owned or leased □)
Specify number of farms and land area.....

Species	Trophy hunting		Biltong hunting		Game harvesting		Shoot-and-sell		Management hunts		Own use		Live sale	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Blesbok														
Common Duiker														
African Elephant														
Common Eland														
Giraffe														
Hartebeest														
Impala (Common)														
Impala (Black-faced)														
Greater Kudu														
Oryx														
Ostrich														
Springbok														
Steenbok														
Common Warthog														
Waterbuck														
Wildebeest, Black														
Wildebeest, Blue														
Zebra, Hartmann's														
Zebra, Plains														
Other (specify)														

26. For any of the above forms of wildlife use do you kill animals that are not adults? If so, please specify the proportion of the total killed that are not adult for each use type .....

Meat Production

27. What do you do with meat from the following sources (provide %s)

Species	Trophy hunting	Game harvesting	Biltong	Shoot-and-sell	Management hunts	Own use
Use at own guest accommodation						
Personal consumption (you or family)						
Give as farm worker rations						
Sell as farm worker rations						
Give to local communities						
Sell to local communities						
Sell processed meat through your own butchery						
Sell unprocessed meat through your own butchery						
Sell to other butchery						
Sell to culling team						
Other, please specify...						

28. How much GAME meat do you give to workers per week on average during the year?

.....

29. How much meat from DOMESTIC animals do you give to workers per week on average during the year?

.....

30. What proportion of your meat is sold/disposed of in the following formats, and what price do you get for each category?

	%	**Price**
Carcasses		
Unselected cuts (wet/frozen)		
Selected cuts (e.g. rump, sirloin, etc)		
Processed (biltong / *droëwors*)		
Other		

31. Is there a price difference between meat sold from different sources (e.g. trophy hunting, shoot-and-sell, culling, management hunts)?

	Price
Trophy hunting /management hunts	
Shoot-and-sell	
Culling	

32. Does the price of meat vary by season? If so please provide examples and make sure they specify the source of the meat – e.g. if it is from trophy hunted animals, or shoot-and-sell, or culled animals (WRITE in NAD values)

□ No □ Yes Examples.....

33. If the price varies by season, what proportions do you sell at the different prices?

.....

34. Does the price of meat vary by species? If so, please provide examples (and make sure they specify the source of the meat – e.g. if it is from trophy hunted animals, or from shoot-and-sell, or culled animals (WRITE NAD values)

□ No □ Yes Examples.....

35. What factors presently limit your ability to generate income from selling game meat from the various forms of meat utilization?

.....

36. Are there any government regulations that affect the profitability of game meat production?

□ No □ Yes, if so, which ones and how.....

37. Do you have any suggestions on what could be done to enhance the profitability of selling game meat? .....

38. Would you be willing to participate in commercial game cropping enterprises if better systems were developed to export game meat to EU markets?

□ No, why not.....

□ Yes, if so, how.....

39. Do you think that game meat currently contributes significantly to food security in Namibia?
□ No, why not.....
□ Yes, if so, how.....

Poaching

40. How serious is poaching as a threat to the financial viability of wildlife-based land uses on your property?

□ Not serious at all □ Moderately serious □ Very serious

41. How many separate poaching incidents have you recorded on your property during the last 12 months? .....

42. How many incidents of domestic stock rustling have you recorded on your property during the last 12 months? .....

43. How many animals do you know of that were lost from your property to poaching / rustling during the last 12 months?

Species	**Lost to poaching**
Blesbok	
African Elephant	
Common Eland	
Giraffe	
Hartebeest	
Impala	
Greater Kudu	
Oryx	
Ostrich	
Springbok	
Common Warthog	
Waterbuck	
Wildebeest, Black	
Wildebeest, Blue	
Zebra, Hartmann's	
Zebra, Plains	
Other (specify)	
Cattle	
Sheep	
Horses	
Donkeys	

44. What proportion of poaching on your property is conducted with the following methods?

Method	**% of poaching incidents**
Snaring	
Hunting with dogs	
Shooting on farm	
Shooting from road passing the farm	
Other, please specify	

45. Where do you think most GAME poachers who hunt on your property come from?.....
46. What do you think GAME poachers who hunt on your property do with the meat they obtain?
.....

47. How do you think the incidence of GAME poaching on your property could be reduced?
.....

48. Do you consider the legal / penal structures governing GAME poaching in Namibia to be sufficient and appropriate?

□ Yes, because.....; □ No, because.....

49. Do you consider the legal / penal structures governing STOCK rustling in Namibia to be sufficient and appropriate?

□ Yes, because.....
□ No, because.....

50. If you have caught GAME poachers before, what kind of punishments have they received for the offence? .....

51. If you have caught STOCK rustlers before, what kind of punishments have they received for the offence? .....

Predators

52. Given the choice, which of the following predator species would you choose to have occurring on your property?

Species	**Prefer to have or not**	**Reason**
Jackals *Canis mesomelas*	□ Yes □ No	
Caracals *Caracal caracal*	□ Yes □ No	
Cheetahs	□ Yes □ No	
Leopards	□ Yes □ No	
Brown Hyaenas	□ Yes □ No	
Spotted Hyaenas	□ Yes □ No	
Wild dogs	□ Yes □ No	
Lions	□ Yes □ No	

53. What do you estimate the annual financial impact of each predator species to be on livestock production and game on your property? (for livestock: give dollar figure; for impact on game: give rank, i.e. 'worst', 'second', 'third' etc.

Species	**Livestock impact (dollar figure)**	**Game impact (RANK)**
Jackals		
Caracals		
Cheetahs		
Leopards		
Brown Hyaenas		
Spotted Hyaenas		
Wild dogs		
Lions		

Background information

54. Age (estimate).....

55. Highest level of education.....

56. Mother tongue language.....

TRAFFIC, the wildlife trade monitoring network, works to ensure that trade in wild plants and animals is not a threat to the conservation of nature.

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JULY 2011