Wildlife Accounts: A Multi-sectoral Analysis in Namibia

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Abstract The completion of a national wildlife inventory in 2004 enabled the development of a set of wildlife accounts for Namibia, comprising both physical and monetary asset accounts, as well as production or flow accounts. Some 2.04 million larger wild animals made up the physical wildlife asset base which produced gross output of some N$1.5 billion and directly contributed N$ 700 million to the gross national product (GNP). Non-consumptive wildlife-viewing tourism generated 62% of the total wildlife sector GNP contribution. Hunting tourism and live game production generated 19 and 10%, respectively. The wildlife use sector represented 2.1% of national GNP in 2004. Its contribution will likely triple in the next 30 years as the sector reaches potential. Namibia's standing wildlife assets in 2004 were estimated to have a value of N$10.5 billion, a value comparable with those estimated for fish and minerals. Findings suggest that development in the sector should emphasise both non-consumptive and consumptive tourism. Property rights should be secured, through the concessions policy and the community-based natural resource management (CBNRM) programme. Investments in building appropriate stocks of wildlife in both communal and private land should be facilitated.

Keywords Wildlife • Resource accounts • Namibia

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1 Introduction

This chapter describes the preliminary development of natural resource accounts for wildlife resources in Namibia. It forms part of the natural resource accounting (NRA) programme, established in the Ministry of Environment and Tourism. The NRA programme extends the conventional macroeconomic national accounts through the development of satellite asset accounts for natural resources such as fish, water, forests, minerals, livestock, energy and tourism. While the *use* of these natural resources is accounted for in the conventional national accounts, the resources are not been accounted for as capital *assets*. National accounts have historically only incorporated man-made or owned assets in their capital accounts. NRA aims to bring natural assets into national accounting and planning, in the interests of efficiency and sustainability.

In natural resource accounting, the natural assets are valued in two ways. First, the annual contribution of the resource to the national income is measured in a production, or *flow*, account. Second, the value of all existing stocks of the resource is estimated in an *asset* account. Here, the value of the stock, as a national capital asset, is measured in terms of its potential to generate resource rent (also known as economic rent or excess profit) in the future.

Wildlife as a resource is a complex entity, embracing all wild animal life, both vertebrates (mammals, birds, reptiles, amphibians, fish) and invertebrates. Wildlife, thus defined, has featured in resource accounts for fish (most wild aquatic organisms of economic value) and forests (non-timber forest products include some forest-dwelling invertebrates), and it forms part of the asset base for the tourism sector. To avoid double counting of assets, already recorded in other categories of accounts, *wildlife resources* are defined here as all wild animals other than fish and forest-dwelling invertebrates. For the purposes of the asset accounts, wildlife stocks are measured as estimated numbers of the large wildlife mammal species and ostrich.

Namibia embraces some 824,000 km^2 on the southwestern coast of Africa and has a human population of 1.8 million. The natural biomes range from extremely arid desert in the west, through arid semi-desert Karoo shrubland in the south, through semi-arid savanna in the north-centre, to semi arid and sub-humid woodland in the northeast. Wildlife in most of the country is dominated by southern African arid zone species, but in the northeast, wildlife typical of the central African plateau occurs.

The dry climate in Namibia means that very little of the land is converted for arable agriculture. Instead, natural vegetation is used as extensive grazing by livestock and wildlife. Land tenure can be divided into three broad types. In the centre and south most land is privately owned, and land use is large scale and commercially orientated. In the northwest, north and northeast, land tends to be communal, and land use is small scale and subsistence. In the dry west and parts of the north, north-east and south, state-owned land is maintained as protected parks and game reserves (Mendelsohn et al. 2002).

Natural resources have several types of economic value, and in resource economics, these values are commonly classified in the framework of ‘total economic value’. *Total economic value* embraces direct use values, indirect use values and non-use values.

Direct use values derive from the direct use of the resource, that is, in production of tangible goods, are usually with market value. Indirect use values derive from the resource's value in ensuring ecological function, such as watershed conservation. Non-use values derive from the value of preservation of the resource either for future use (*option value*), for its mere existence (*existence value*) or to bequeath to future generations (*bequest value*). The preliminary wildlife accounts deal exclusively with direct use values.

2 Methods

2.1 Approach

The asset and flow accounts were developed in accordance with the standardised methodology for natural resource accounting – the Integrated Environmental and Economic Accounting/IEEA Manual – developed by the United Nations (2000) and later refined (UN et al. 2003). The IEEA Manual was developed to complement the conventional, internationally adopted System of National Accounts (SNA) used to measure economic performance in most countries around the world (CEC et al. 1993). Conventional national accounting incorporates capital accounts but tends to restrict these to assets that are owned or man-made. IEEA, on the other hand, aims to include accounts for natural resources that are not man-made, such as natural forests, fish and wildlife, in the national economic data records and the planning process.

The physical wildlife *asset* account was based on the estimated numbers of larger wildlife species, mainly mammals but including ostrich, in the country. These data are based on aerial and ground surveys conducted throughout the country and compiled in the Directorate of Scientific Services of the Ministry of Environment and Tourism. We assembled the available data on estimated numbers of larger mammal species in the protected areas, the districts on private land and the conservancies on communal land. No data were available for communal land outside conservancies, but it is known that wildlife on this land is extremely scarce. The physical accounts were then valued in order to produce monetary asset accounts, so that in future, changes in the capital value of wildlife stocks can be measured.

The current annual use of the wildlife asset base is detailed in *flow* accounts; the latter present the volumes and monetary values (economic characteristics) of this use. Flow accounts measure use in terms of output, contribution to gross national product (GNP) and employment, in conformity with the SNA.

The valuation of renewable natural resource assets such as forests, fish and wildlife can be done in several ways (UN 2000; UN et al. 2003). The most appropriate of these is the *net present value method*, which estimates the present value of all future returns in resource rent from the use of the resources. For the wildlife asset accounts, we applied the net present value method, using streams of rents from expected growth in use over the next 30 years. As was the case with forests, reasonably good predictions of future growth in wildlife use can and have been made,

based on past records and future development plans (e.g. Erb 2003; Turpie et al. 2004; WTTC 2006; NTB 2008). With resources such as fish and minerals, future stock and use values are much less predictable, and to value these, it has been necessary to assume no growth in use (constant rent) into the long-term future (Lange 2004; Lange and Hassan 2003).

An important consideration in valuing natural asset stocks is that resources that are not exploitable, either for legal or economic reasons, have a zero value. Thus, only that portion of the natural stocks that can realistically be brought into viable production in the future was valued.

Wildlife use, current and future, conforms to national policy. Uses and the combinations of different types of use that can be practised differ depending on locality and land tenure. The approach adopted has been to divide the country into wildlife utilisation zones, reflecting differences in the possible uses and combinations of uses. The accounts are structured according to these zones.

2.2 Valuation of Flow and Asset Accounts

Monetary values in this chapter are given as Namibia Dollars (N$) at 2004 prices. In 2004, N$1.00 was equal to R1.00 (South African Rand) and approximately US$0.16 (United States Dollars).

The value of the current and potential output of wildlife resources is the product of the volumes produced and the market prices, as described above. A proportion of this output represents the direct contribution of the resource in terms of value added to the gross national product (GNP), as measured in the flow account. Another proportion of this output represents the resource rent that the resource use generates (the amount of economic rent or excess profit that the resource generates).

The approach to valuing wildlife use generally involved determining gross figures for output of particular uses derived from available data and literature and allocating these per utilisation zone. Thus, output data on wildlife-based tourism was calculated by taking the output for leisure tourism in the national tourism satellite accounts (WTTC 2006; NTB 2008) and multiplying that by the proportion of tourism value that is attributable to *wildlife* (as opposed to scenery, sense of space or other attributes). This proportion is very difficult to determine. We used data from a 2006 survey of protected area tourists in Namibia (SIAPAC 2007), where respondents were asked questions concerning which attribute(s) attracted them to make their trip in Namibia. Table 1 shows the results of this analysis. The average of three approaches was used to estimate that 51% of the tourists' expenditures were attributable to wildlife.

The gross output data for trophy hunting tourism were obtained from Humavindu and Barnes (2003), Novelli et al. (2006) and Erb (2003). Unpublished data on hunting concessions, from the Ministry of Environment and Tourism, were used to allocate hunting values geographically. Biltong hunting output values, a small portion of hunting tourism values, were obtained and synthesised from Erb (2003).

Table 1 Calculation of the value of wildlife as a component of total protected area tourism value in Namibia in 2006

	Results of different tourist preference ratings[a]						
Attribute	Frequency of mention		Frequency of first rating		Frequency of first ranking		Average
Wildlife	552,019	24%	152,438	29%	126,413	68%	51%
Landscape	298,409	13%	93,397	17%	28,292	15%	16%
Wide open spaces	268,848	12%	75,267	14%	12,370	7%	10%
Culture/people	248,709	11%	44,878	8%	8,416	5%	7%
Tranquillity	224,041	10%	49,738	9%	2,655	1%	5%
Sport	212,836	9%	25,523	5%	1,675	1%	3%
Freedom	183,216	8%	40,948	8%	3,754	2%	4%
Hospitality	158,974	7%	36,646	7%	852	0%	3%
History/archaeology	150,599	7%	15,294	3%	545	0%	2%
Total	2,297,651	100%	534,129	100%	184,972	100%	100%

[a]Relative values measured from different questions posed to protected area tourists by SIAPAC (2007)

Gross output values for live game capture for sale, small-scale meat production and commercial cropping for meat production were based on the results of analysis by Erb (2003) of licence records in the Ministry of Environment and Tourism and from past survey results of the Directorate of Scientific Services. Data on gross outputs for ostrich and crocodile production were obtained through synthesis of the unpublished stock census records of Directorate of Veterinary Services in Ministry of Agriculture Water and Forestry and empirical enterprise data from Botswana (FGU-Kronberg 1988a, b; Barnes 1998). Crafts outputs were partly derived from Terry et al. (1994) and Terry (1999).

The Environmental Economics Unit uses a system of empirically based enterprise models, originally developed by Barnes (1998), and subject to ongoing development, to measure the financial and economic values associated with natural resource use. These are detailed budget and cost-benefit analyses that measure returns to investors as well as the national economy. Such models have been developed for wildlife use activities such as non-consumptive wildlife viewing through lodges and campsites on private and public land, trophy hunting on private and public land, intensive ostrich breeding and rearing, intensive crocodile breeding and rearing, taxidermy and craft production.

For the monetary flow account, such enterprise models were used to calculate the direct contributions of wildlife uses in terms of *value added* to the GNP. *Value added* is defined as the return to the internal factors of production in the activity, namely, capital, labour and entrepreneurship. The value added is calculated in the models as a residual by subtracting intermediate expenditures from the gross output or total revenue. Value added/output ratios were then applied in the flow account to determine the *direct economic contribution* of wildlife use activities. Where specific representative models were not available, for example, for commercial, small-scale meat production and live game production, then ratios from other related enterprises were used. Ratios for some wildlife uses such as small-scale hunting for meat production, crafts production, ostrich production and crocodile production were also gleaned from models developed in Botswana (FGU-Kronberg 1988a, b; Barnes 1998; Terry 1999). Table 2 shows the ratios applied.

The direct economic contribution creates further demand in the broader economy through indirect multiplier and linkage effects. This represents the *total economic contribution* or impact of wildlife use in the economy. For example, the use of transport services in commercial game cropping would indirectly involve further value added being generated in the transport sector, or the purchase of food for a tourism lodge would indirectly involve further value added being generated in the food sector. The flow account included a measure of this total impact. To measure the total economic contribution, an income or value-added multiplier was used, derived from the national social accounting matrix (SAM) model of the Namibian economy (Lange et al. 2004). An overall income multiplier of 1.86 for the wildlife sector, following that derived by Turpie et al. (2004), was used. This means that for every N$1.00 contributed directly to the GNP through wildlife use, a further N$0.86 is contributed indirectly as a result.

Table 2 Ratios used to calculate the value added directly to gross national product and the generated resource rent in the wildlife accounts of Namibia in 2004

	Percentage of gross output	
Wildlife use	Gross national product (%)	Resource rent (%)
Wildlife viewing	47	28
Hunting tourism	47	27
Live game	47	27
Commercial meat	47	27
Small-scale meat	47	27
Ostrich farming	50	11
Crocodile farming	51	25
Guano harvesting	45	27
Meat processing	48	21
Taxidermy	48	33
Crafts production	67	16

For the monetary asset account, the financial and economic models were used to calculate the *resource rents* generated in wildlife use activities. These economic rents are calculated as a residual – by subtracting costs of production, including the compensation of employees, the consumption of fixed capital and normal profit from the gross output. Normal profit was assumed to be a 15% return on initial fixed capital. The rent calculations were used in valuing the assets, using the net present value method, described above. The portion of natural wildlife assets that was not likely to be used economically in the next 30 years was given a zero value in the monetary asset account.

One exception to the use of the net present value method was in the case of semi-domesticated ostrich, which are recorded in the Ministry of Agriculture, Water and Forestry's annual livestock census and are effectively owned. They were valued by multiplying number by price – the conventional way that livestock assets are valued.

After determination of the asset values of wildlife in the five utilisation zones, an attempt was made to allocate these values according to the species in the asset account. To do this, a relative, blend price per head for each species was calculated by averaging the per head live game auction value, a basic meat value and a hunting trophy value. The auction prices were obtained from published local and South African auction prices adjusted to 2004 values. The basic meat price was obtained using species body mass and a 2004 Meat Board low-grade livestock meat price. Hunting trophy prices for 2004 were obtained from hunting outfitter brochures and the Namibian Professional Hunters Association (NAPHA).

The blend price for each species was multiplied by the numbers of animals of each species in each use zone, to get relative values, which were then used to proportionally allocate the asset values by species and by zone.

3 Wildlife Utilisation in Namibia

3.1 Current Use of Wildlife Resources

The direct use values derived from the use of Namibia's wildlife resources come from diverse activities embracing several sectors of the economy. Wildlife viewing is one of the major products of leisure tourism activities on protected, private and communal land. It involves the broad spectrum of wildlife in its ecological setting but is driven by keystone large mammals. Consumptive use of wildlife takes place through trophy hunting tourism on private land, mainly involving plains game, and on communal and protected land, mainly involving high-value key species. Fee hunting, or biltong hunting tourism, of plains game takes place on private land. Wildlife, involving mainly large mammals, is captured live and dispersed via sale, mainly from private land and protected areas. Commercial cropping of more common plains game species, mainly springbok, is practised under permit on certain private properties for venison production. On most private land and some communal land, more common plains game species are hunted, at small-scale for own consumption and sale (known as the 'shoot-and-sell' system). Commercial cropping of Cape fur seals takes place under permit at selected coastal rookeries (Barnes and Alberts 2007). Intensive production systems involving breeding and rearing have been developed for ostrich and to a lesser extent crocodile. On the coast, guano, deposited by piscivorous sea birds, is harvested from islands and artificial platforms (Barnes and Alberts 2007).

Some processing of wildlife products takes place including taxidermy for hunted trophies, biltong manufacture, meat processing for export and crafts manufacture using wildlife products such as ostrich eggs and skins. These are considered as part of the marketing process, contributing to the economic rent generated by wildlife use, so they are included in the wildlife accounts. Further forward linkages, such as leather goods manufacture and retail of game meat products, are conserved separate from the use activities and excluded. Also excluded from the wildlife resource accounts are marine and freshwater fisheries, treated separately in the fish resource accounts (Lange 2004), and the use of invertebrates such as mopane worms and termites, treated as part of non-timber forest products in the forest resource accounts (Barnes et al. 2005).

3.2 Wildlife Utilisation Zones

In protected areas, policy dictates that use is dominated by non-consumptive tourism. Consumptive use through trophy hunting is limited to parts of a few protected areas. Live game capture and sale tend to be limited to protected areas south of the redline veterinary cordon fence, except in the case of certain species which are not vectors

of foot-and-mouth disease. In communal land conservancies, policy allows the full range of wildlife uses, but in practice, the potential, lack of appropriate infrastructure, distances from markets and disease constraints (behind the veterinary redline) dictate that use is dominated by non-consumptive tourism, some trophy hunting and some small-scale hunting. In private land, which is south of the veterinary redline, better furnished with infrastructure, skills and capital; generally closer to markets; and the beneficiary of considerable private investment in wildlife stocks, all the wildlife uses described above are possible.

The wildlife stocks were divided according to their distribution in five wildlife utilisation zones, based on the current and likely future combinations of uses possible. The zones are the following:

Zone 1: Protected areas north of the veterinary redline, where wildlife use is limited to non-consumptive tourism, very limited trophy hunting tourism and limited live game.
Zone 2: Protected areas south of the veterinary redline, where, except for seal culling on the coast, wildlife use is limited to non-consumptive tourism and live game.
Zone 3: Communal land north of the veterinary redline, where wildlife use involves non-consumptive tourism, trophy hunting tourism and small-scale meat hunting.
Zone 4: Communal land south of the veterinary redline, where wildlife use involves non-consumptive tourism, trophy hunting tourism, live game and small-scale meat hunting.
Zone 5: Private land, wildlife use involves non-consumptive tourism, trophy hunting tourism, live game, commercial cropping and small-scale meat hunting.

The parts of the country in each zone are described in Table 3. Values for current and future wildlife use and asset value were estimated for each zone separately. The wildlife use zones do not coincide with regional boundaries.

Consolidated data on stock numbers for the whole country are only available for 2004, and the wildlife resource accounts are those of 2004. Asset accounts should normally include consideration of depletion, degradation, conversion and accumulation of stocks during the accounting year, so that changes in volume and value of stocks can then be accounted for over time. Closing stock or any additional numbers are not available at this time. Generally, while wildlife stocks are tending to increase in the country, their use is also increasing (Barnes and Jones 2009). Compared to sectors such as fisheries and forestry, the wildlife sector has relatively well-developed property rights through rights of management and use furnished on private land (Barnes and Jones 2009), communal conservancies (NACSO 2008) and in concessions (MET 2007). As a result, little current wildlife use is considered to be unsustainable, and potential is greater than current use levels. Changes in wildlife stocks appear to be the result of wet and dry climatic cycles, droughts and investment resulting from the above-mentioned property rights.

Table 3 Descriptive components of Namibian wildlife use zones

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5[a]
Bwabwata national park	Ai-Ais hot springs	Anabeb conservancy	!Khob !Naub conservancy	Bethanie district
Etendeka concession	Cape cross seal reserve	Ehirovapuka conservancy	≠Gaingu conservancy	Gobabis district
Etosha national park	Daan Viljoen game park	Joseph Mbambangandu conservancy	//Huab conservancy	Grootfontein district
Hobatere concession	Gross Barmen hot springs	kwandu conservancy	Doro !Nawas conservancy	Karasburg district
Khaudum game park	Hardap recreation resort	Marienfluss conservancy	Gamaseb conservancy	Karibib district
Mamili national park	Hobotere concession	Mashi conservancy	≠Khoadi-//Hoas conservancy	Keetmanshoop district
Mangetti game reserve	Namib-Naukluft park	Mayuni conservancy	Oskop conservancy	Lüderitz district
Mudumu national park	National west coast recreation area	N#a-Jaqna conservancy	otjimboyo conservancy	Maltahöhe district
Palmwag concession	Naute recreation resort	Nyae Nyae conservancy	Sorri-Sorris conservancy	Mariental district
Skeleton Coast Park	Von bach recreation resort	Okangundumba conservancy	Torra conservancy	Okahandja district
	Sperrgebiet National Park	Omatendeka Conservancy	Tsiseb Conservancy	Omaruru District
	Waterberg plateau park	Orupembe conservancy	Uibasen conservancy	Otjiwarongo district
		Ozondundu conservancy		Outjo district
		Puros conservancy		Rehoboth district
		Salambala conservancy		Tsumeb district
		Sanitatas conservancy		Windhoek district
		Sesfontein conservancy		
		Uukwaluudhi conservancy		

[a]Embraces only private land within the districts listed

3.3 Potential Use of Wildlife Resources

Valuation of the wildlife assets requires estimation of the expected flows of resource rent from the resource in the future. Predictions of the future growth in all forms of wildlife use need to be made. Clearly, this growth cannot take place beyond the ultimate potential of the resource to sustain utilisation into the future.

Depending on the wildlife product itself, only part of the total stock can be used at any one time. This is for several reasons. First, some uses, such as game meat production in protected areas, are prohibited through policy. Second, for most uses, only some animals are suitable for harvest, for example, those animals in the population of trophy quality or those adult animals in the population of suitable size for slaughter. Third, annual harvest of the products in question must be limited to the annual sustainable yield or less for those products. Fourth, some stocks cannot be viably exploited from an economic point of view, as they are too remote from human settlement and appropriate infrastructure, or have restricted markets for their products.

Current combinations of use are likely to change in future depending on relative returns to investment. The assumption is that combinations will emerge that maximise returns for land holders while spreading risk within the constraints of resources and markets. We used the relative return to investment as a guide but also drew from a study in Botswana, where the most rewarding combinations of wildlife uses were determined using linear programming (Barnes 1998, 2001).

Sustainable (maximum permissible) general off-take rates for each species were calculated as half of the inherent rate of increase for each species, the inherent rate being a function of the average weight of animals of the species population. The trophy off-takes are estimated at around 5% of the general off-take rates for each species. This follows the approach of Caughley (1983), Craig and Lawson (1990) and FGU-Kronberg (1987).

Maximum limits to use of wildlife populations in wildlife utilisation zones were assumed to be as follows:

Zone 1: Tourism, making use of 89.84% of the wildlife population; trophy hunting, making use of a maximum of 1.05% of the population; and quarantined live game production, making use of 4.55% of the population
Zone 2: Tourism, making use of 89.84% of the wildlife population; trophy hunting, making use of a maximum of 1.05% of the population; and live game production, making use of 9.11% of the population
Zone 3: Tourism, making use of 89.84% of the wildlife population; trophy hunting, making use of 1.05% of the population; quarantined live game production, making use of 4.55% of the population; and small-scale meat production, making use of 4.55% of the population
Zone 4: Tourism, making use of 89.84% of the wildlife population; trophy hunting, making use of 1.05% of the population; live game production, making use of 4.55% of the population; and small-scale meat production, making use of 4.55% of the population

Zone 5: Tourism, making use of 89.84% of the wildlife population; trophy hunting, making use of 1.05% of the population; quarantined live game production, making use of 4.55% of the population; and small-scale and commercial meat production and biltong hunting tourism, together making use of up to 4.55% of the population. Additional intensive ostrich production, unlimited except by feed constraints

Predicted expansion of wildlife use over the next 30 years was within these maximum limits. Non-consumptive wildlife-viewing tourism was assumed to continue growing at 6.9% per annum following WTTC (2006) and NTB (2008). An analysis of concession policy implementation in the context of protected area plans was made, which suggested that after 20 years, the wildlife tourism sector will stop growing as spatial and tourism carrying capacity limits are reached inside and outside of parks. The trophy hunting tourism sector was assumed to grow at a slower rate, 5% per annum, also until year 20 when it would stop growing. Growth rates in the live game, small-scale meat and commercial meat production uses were assumed to be 2.8%, through to year 30, based on analysis of past growth (Unpublished permit records from the MET; Erb 2003). Intensive ostrich production, crocodile production, seal cropping and guano production were assumed to have no further growth, as all these are considered to feed or market constraints.

4 Wildlife Accounts, 2004

4.1 Physical Wildlife Asset Account

The wildlife communities in the drier parts of the country, the desert, shrublands and savannas, are dominated by desert-adapted species such as springbok (*Antidorcas marsupialis*), gemsbok (*Oryx gazella*), kudu (*Tragelaphus strepsiceros*), warthog (*Phacochoerus aethiopicus*), red hartebeest (*Alcelaphus buselaphus*), ostrich (*Struthio camelus*), steenbok (*Raphicerus campestris*) and duiker (*Sylvicapra grimmia*), with less widespread mountain zebra (*Equus zebra hartmannae*), eland (*Taurotragus oryx*), plains zebra (*Equus burchelli*), blue wildebeest (*Connochaetes taurinus*), giraffe (*Giraffa camelopardalis*), elephant (*Loxodonta africana*), black-faced impala (*Aepyceros melampus petersi*), black rhino (*Diceros bicornis*), klipspringer (*Oreotragus oreotragus*) and dik-dik (*Madoqua kirkii*) also occurring. Introduced to some savanna localities are species not characteristic of arid areas, such as common impala (*Aepyceros melampus*), waterbuck (*Kobus ellipsiprymnus*), sable (*Hippotragus niger*), roan (*Hippotragus equinus*), lechwe (*Kobus leche*), tsessebe (*Damaliscus lunatus*) and white rhino (*Ceratotherium simum*). Some introduced species alien to Namibia, such as blesbok (*Damaliscus dorcas*), black wildebeest (*Connochaetes gnou*) and others, also occur. Semi-domesticated ostrich flocks are also maintained on private land.

In the better watered parts of the country, the woodlands and associated riparian environments of the northeast, wildlife species representative of the central African plateau occur, including buffalo (*Syncerus caffer*), elephant, hippo

Table 4 Physical wildlife asset account, 2004: estimated wildlife stock numbers in Namibia[a]

	Wildlife utilisation zone					
Species	1	2	3	4	5	Total
Buffalo	1,025	250	90	0	0	1,365
Cheetah	706	149	405	270	2,970	4,500
Eland	1,704	524	245	0	34,743	37,216
Elephant	9,043	24	735	155	0	9,957
Gemsbok	11,450	3,115	18,670	5,084	350,092	388,411
Giraffe	3,683	229	666	68	5,769	10,415
Hartebeest, red	1,468	115	700	0	122,805	125,088
Hippopotamus	1,262	0	300	0	0	1,562
Impala, black-faced	1,500	0	0	0	1,870	3,370
Impala, common	77	0	385	0	14,980	15,442
Kudu	2,063	1,484	1,545	1,000	345,801	351,893
Lechwe	0	0	250	0	284	534
Leopard	1,970	430	960	640	4,000	8,000
Lion	574	23	109	22	0	728
Ostrich	3,947	530	2,840	2,020	36,336	45,673
Rhino, black	816	43	45	75	134	1,113
Rhino, white	54	62	0	0	75	191
Roan	440	120	95	0	435	1,090
Sable	256	60	15	0	902	1,233
Springbok	33,811	1,771	37,150	37,270	621,561	731,563
Tsessebe	0	15	0	0	162	177
Warthog	148	61	40	0	173,866	174,115
Waterbuck	0	0	0	0	4,475	4,475
Wildebeest, blue	4,975	224	470	0	16,623	22,292
Zebra, plains	18,098	0	20	0	7,303	25,421
Zebra, mountain	8,564	4,347	2,130	2,175	55,520	72,736
Total	107,634	13,576	67,865	48,779	1,800,706	2,038,560

[a] Excludes an additional 22,000 semi-domesticated ostrich, used in intensive production in zone 5, and some 800,000 Cape fur seals used for skins and other products mostly in zone 2.

(*Hippopotamus amphibius*), kudu, common impala, sable, roan, lechwe, tsessebe, reedbuck (*Redunca arundinum*), duiker, bushbuck (*Tragelaphus scriptus*) and sitatunga (*Tragelaphus spekei*).

Larger predators occurring widely in the country are leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), brown hyaena (*Hyaena brunnea*) and spotted hyaena (*Crocuta crocuta*), while more localised populations of lion (*Panthera leo*) and wild dog (*Lycaon pictus*) also occur. In perennial rivers of the northeast and northwest, crocodile (*Crocodylus niloticus*) are present. On the coast, a large population of the piscivorous marine mammal, the Cape fur seal *(Arctocephalus pusillus*), occurs.

Table 4 shows the physical wildlife assets for 2004. Not all the species listed above are recorded in the table, due to their being too inconspicuous, too localised or too uncommon and thus overlooked in surveys. It is noteworthy that the list of species, including as it does only the more economically important larger mammals and ostrich, is representative of a broader wildlife resource.

It is clear that by far, the majority of the wildlife numbers (88%) is present on private land, zone 5. This is the result of the private incentives, capital and skills long prevalent in the zone which permitted significant investment in the wildlife resource.

4.2 Wildlife Flow Account

Table 5 shows the estimated value of Namibia's use of wildlife resources in 2004. This is given as the gross output (the aggregate turnover of all wildlife use activities), the direct contribution of wildlife use to GN, and the total of the direct and indirect contributions that the use of wildlife made to GNP. The indirect contribution incorporated the backward linkage (multiplier) effects in the broader economy. Total output in the wildlife use sector was N$1.5 billion. This sector contributed N$700 million of direct value added to the GNP, and the total direct and indirect impact on the GNP amounted to N$1.3 billion.

The most significant component of wildlife use was non-consumptive wildlife-viewing tourism, which generated some 62% of the total direct sector GNP contribution. Hunting tourism contributed 19% of the total direct sector GNP contribution. Of this hunting tourism contribution, trophy hunting made up 97% and biltong hunting made up only 3%. Live game production contributed 10% of the total sector GNP. Other use activities which were somewhat important were meat production (mostly small scale, under the 'shoot-and-sell' system on private land), intensive ostrich production and taxidermy (which adds value in particular to the hunting tourism activities). None of these other uses contributed more than 3% of the total direst sector contribution.

The total direct value-added contribution of the wildlife use sector of N$700 million represented approximately 2.1% of GNP. This proportion can be compared with the estimated direct contributions made by other sectors (CBS/Central Bureau of Statistics 2004): 4.6% for agriculture, 5% for fishing (which includes some on-board fish processing), 6.8% for mining and 3.4% for tourism (WTTC 2006). Much of the contribution of the wildlife use sector is part of the tourism sector contribution, and some of it is part of the agriculture contribution.

4.3 Monetary Wildlife Asset Account

The net present value method of valuing natural assets requires estimates of current and future resource rents generated by use of the resource. Table 6 shows the estimated rents generated by wildlife use and by zone. The rent generated in the sector amounts to an estimated N$403 million.

Table 5 Wildlife flow account, 2004: estimated gross output and direct and total contributions to gross national product made by wildlife utilisation in Namibia

	Wildlife utilisation zone					
Wildlife use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total
Gross output in wildlife use sector (N$'000, 2004)						
Gross output	268,473	76,929	80,093	29,877	1,019,517	1,474,889
Direct contribution to gross national product (GNP)[a] by utilisation zone (N$'000, 2004)						
Wildlife viewing	107,497	12,366	7,361	4,089	302,976	434,289
Hunting tourism	1,754	0	26,312	7,017	99,368	134,451
Live game	17,511	17,511	0	0	35,023	70,045
Commercial meat[b]	0	2,836	0	0	1,529	4,365
Small-scale meat	0	0	484	0	15,641	16,125
Ostrich farming	0	0	0	31	11,186	11,217
Crocodile farming	0	0	0	0	1,955	1,955
Guano harvesting	0	3,400	0	0	0	3,400
Meat processing	0	0	48	3	3,031	3,083
Taxidermy	133	0	2,024	532	9,445	12,133
Crafts production	0	0	2,148	3,436	3,007	8,591
Total	126,895	36,113	38,377	15,108	483,159	699,653
Total (both direct and indirect) contribution to GNP[c] (N$'000, 2004)						
Total impact	236,025	67,170	71,382	28,101	898,676	1,301,354

[a] Direct contribution of the wildlife use industry to the economy, in terms of value added to GNP

[b] Includes seal culling on coast (zone 2) and game culling on private land (zone 5)

[c] Total direct contribution to, and indirect impact on, the economy, in terms of value added to GNP, measured using a social accounting matrix of the Namibian economy (Lange et al. 2004)

Table 6 Estimated resource rent[a] generated in wildlife use activities in Namibia in 2004 (N$'000)

	Wildlife utilisation zone					
Wildlife use	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total
Wildlife viewing	63,580	7,314	4,354	2,419	179,198	256,865
Hunting tourism	1,008	0	15,116	4,031	57,084	77,238
Live game	10,060	10,060	0	0	20,119	40,239
Commercial meat	0	1,629	0	0	878	2,507
Small-scale meat	0	0	278	0	8,985	9,263
Ostrich farming	0	0	0	6	2,358	2,365
Crocodile farming	0	0	0	0	970	970
Guano harvesting	0	2,025	0	0	0	2,025
Meat processing	0	0	28	1	1,319	1,348
Taxidermy	90	0	1,374	361	6,410	8,234
Crafts production	0	0	513	821	718	2,052
Total resource rent	74,738	21,028	21,662	7,638	278,041	403,106

[a] Resource rent or economic rent or excess profit = gross output less costs of production, including a reasonable return on capital

The ratios, determined from wildlife use enterprise models and used to calculate rent as a proportion of gross output (shown in Table 2), are between 11% and 33%. These are significantly lower than the ratios, determined by Barnes et al. (2005), from models of forest use enterprises, which were between 40% and 84%. This is surprising at first glance, as forest use tends to take place on public land under open access, where rents should get dissipated, and wildlife use is characterised by better property rights, where rents should be maintained. However, forest use is commonly small scale with no resource investments, and use levels remain generally very low, compared with potential. In such circumstances, rents might remain high until the resource starts to be fully utilised. Wildlife users, on the other hand, are generally required to invest significantly in the resource and may face product markets that are more mature and competitive. Here, rents should tend to be smaller.

Natural resource accounts provide the opportunity to measure the extent to which resource rents are captured for redistribution and investment in the economy. As shown above, rents in the wildlife sector are not particularly high, but enterprise models to hand indicate that rent capture is fairly efficient. Well-developed property rights on communal and private land, the concessions policy in protected areas and appropriate tender process appear to be ensuring that landholders (government communities and farmers) capture available resource rent.

Table 7 shows the resource rent generated in 2004 as well as that that can be expected to be generated after 30 years, in 2034. The predicted growth in wildlife use and the changes in combinations of uses, according to the criteria and assumptions made above, will result in approximately three times more use by 2034. At this stage, much of the physical potential for expansion, mainly for tourism, will be used, and further increases in value will tend to be as a result of intensification.

Table 7 shows the value of Namibia's wildlife assets in 2004, estimated in terms of the resource rent that could be generated from them during the next 30 years,

Table 7 Monetary wildlife asset account, Namibia, 2004: estimated rent generated, asset value[a] and the effect on asset value of different discount rates

	Wildlife utilisation zone					
Value	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Total
Current and anticipated resource rent generated in the wildlife sector (N$'000, 2004)						
Rent in year 2004	74,738	21,028	21,662	7,638	278,041	403,106
Rent in year 2034	251,135	52,110	59,641	22,614	872,908	1,258,409
Wildlife asset value @ 6% discount (N$'000, 2004)						
Asset value @ 6%	2,034,485	448,913	525,427	194,136	7,249,271	10,452,232
Sensitivity to discount rate						
Asset value @ 2%	3,762,557	803,778	952,839	354,695	13,319,180	19,193,050
Asset value @ 4%	2,724,232	591,140	696,622	258,367	9,674,644	13,945,004
Asset value @ 6%	2,034,485	448,913	525,427	194,136	7,249,271	10,452,232
Asset value @ 8%	1,564,705	351,246	408,090	150,211	5,594,091	8,068,343
Asset value @ 10%	1,236,748	282,418	325,622	119,415	4,436,107	6,400,310

[a] Net present value of future rents generated in expected growth over the next 30 years

Table 8 Monetary wildlife asset account, 2004: estimated asset values for wildlife in Namibia by species

Species	Wildlife utilisation zone					Total
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	
Asset value by species @ 6% discount (N$'000, 2004)						
Buffalo	61,604	29,839	3,192	0	0	94,634
Cheetah	15,658	6,548	5,298	1,921	21,320	50,744
Eland	28,780	17,576	2,442	0	190,008	238,806
Elephant	462,409	2,437	22,178	2,543	0	489,568
Gemsbok	143,634	77,601	138,203	20,466	1,422,036	1,801,940
Giraffe	70,542	8,710	7,527	418	35,779	122,977
Hartebeest, red	18,460	2,872	5,194	0	500,026	526,552
Hippo	33,803	0	4,742	0	0	38,544
Impala, black-faced	26,995	0	0	0	10,897	37,892
Impala, common	919	0	2,712	0	57,893	61,523
Kudu	26,775	38,249	11,833	4,165	1,453,220	1,534,242
Lechwe	0	0	2,821	0	1,759	4,580
Leopard	48,004	20,808	13,804	5,005	31,561	119,182
Lion	18,685	1,482	2,098	228	0	22,493
Ostrich	45,582	12,155	19,354	7,486	135,877	220,454
Rhino, black	144,913	15,165	4,716	4,274	7,705	176,774
Rhino, white	3,992	9,103	0	0	1,795	14,891
Roan	34,265	18,558	4,366	0	10,969	68,158
Sable	13,805	6,426	477	0	15,750	36,458
Springbok	386,924	40,248	250,870	136,870	2,303,185	3,118,097
Tsessebe	0	605	0	0	1,065	1,670
Warthog	1,682	1,376	268	0	639,645	642,971
Waterbuck	0	0	0	0	25,694	25,694
Wildebeest, blue	68,151	6,094	3,799	0	73,734	151,777
Zebra, plains	246,904	0	161	0	32,261	279,326
Zebra, mountain	132,000	133,060	19,373	10,758	277,093	572,285
Total value @ 6%	2,034,485	448,913	525,427	194,136	7,249,271	10,452,232

using the net present value method. The wildlife assets in Namibia in 2004 were estimated to be worth N$10.5 billion. The basic model used for net present values necessarily contains a prediction on the future discount rate, about which there is some uncertainty. To test the sensitivity of values to the future discount rate, several options for the rate were tested. If discount rates between 2 and 10% are used, the total wildlife asset value varies between N$19 and N$6 billion. We consider a future real discount rate of 6% as the most likely, and so the total value of the wildlife asset base is taken as N$10.5 billion.

Table 8 shows the asset values, calculated at 6% discount, for the wildlife resource in 2004, allocated by species and by use zone. As described above, the allocation is based on the relative value of each species as measured by a live animal, meat and trophy blend price. It is interesting to note that zone 5, which contained 88% of the total wildlife stock numbers in Table 4, only contained 69% of the total wildlife asset

Table 9 Comparative estimates of asset value for some Namibian natural resources and the manufactured capital stock in 2004

Resource	Asset value (N$ million)
Wildlife	10,500
Fish[a]	12,000
Minerals[b]	14,300
Forests[c]	18,700
Manufactured capital[d]	82,000
Total national wealth[e]	137,500

[a] Derived from Lange (2004)
[b] Derived from Lange and Hassan (2003)
[c] Derived from Barnes et al. (2005)
[d] Fixed capital stock; derived from the national accounts (CBS 2004); includes tangible, produced assets
[e] Partial estimate only; excludes, for example, some asset values for land, water and tourism

value. The asset value per head in zone 5 on private land was N$4.03, while in the other four zones on protected and communal land, the asset value per head was N$13.47.

This can be explained by the fact that the wildlife stocks in zone 5 are largely made up of plains game with only moderate value. Key high-value key species such as elephant, buffalo, lion and rhino are few on private land and more concentrated in the protected areas and communal conservancies. Novelli et al. (2006) illustrated this point when comparing hunting values for Namibia (mostly in zone 5) and Botswana. Private land in Namibia, being drier, tended to lack key species in any case, but it was also developed primarily for livestock, making introduction or reintroduction of key species very difficult.

Table 9 shows a comparison between our 2004 wildlife asset values and the estimates made for some other Namibian natural resources. Asset accounts for Namibia's marine fish stocks (Lange 2004) show an estimated value of N$12 billion in 2001 (converted to 2004 prices). The value of mineral assets in Namibia has also been estimated (Lange and Hassan 2003), namely, N$14 billion in 2001 (also converted to 2004 prices). The value of Namibia's forest assets, as estimated for 2004 by Barnes et al. (2005), was N$19 billion. Our estimate of the value of wildlife assets, at N$10.5 billion, is lower than any of these but comparable and significant. The fact that resource rent as proportion of output appears to be relatively low for wildlife uses may account for the lower asset values involved.

5 Conclusion

The completion of a national wildlife inventory in 2004 enabled the development of a set of wildlife accounts for Namibia. For the purposes of the accounts, wildlife was defined as all wild animals except fish and forest-dwelling invertebrates.

The physical accounts included the larger mammals and ostrich. Five wildlife use zones were identified, corresponding to conditions of differing land tenure and veterinary status. Each wildlife use zone was characterised by having different combinations of use and possible use.

The wildlife accounts conform to the internationally recognised IEEA methodology and include flow accounts detailing the contribution made by the use of the resource to the national economy and asset accounts detailing the capital asset value of the resource stocks.

Some 2.04 million larger wild animals made up the physical wildlife asset account, and 88% of these were on private land. This likely reflects the fact that property rights for use and management of wildlife were bestowed on private landholders some 40 years ago. Skills, appropriate infrastructure and proximity to markets resulted in significant investment in wildlife resource on private land. Another contributing reason is that a very large part of the protected area system is desert with little potential for wildlife.

The wildlife assets are responsible for gross output of some N$1.5 billion. All wildlife uses contribute N$ 700 million directly to the gross national product (GNP). The most significant component of wildlife use was non-consumptive wildlife-viewing tourism which generated some 62% of the total wildlife sector GNP contribution. Hunting tourism contributed some 19%, and live game production contributed some 10%. Other wildlife use activities contributing between 2 and 3% of the total sector GNP were meat production, intensive ostrich farming and taxidermy.

The total direct value-added contribution of the wildlife use sector of N$700 million represented approximately 2.1% of GNP. This proportion can be compared with 4.6% for agriculture, 5% for fishing (which includes some on-board fish processing), 6.8% for mining and 3.4% for the whole tourism sector. Much of the GNP contribution of wildlife is part of this tourism sector contribution, and some of it is part of the agriculture contribution. The *total* impact of wildlife use on the broader economy is greater than the direct contribution. Inclusion of the indirect impacts resulting from the income multiplier (a further N$600 million) makes the total impact some N$1.3 billion.

Resource rents generated in the wildlife sector are fairly low, possibly due to the fact that wildlife users commonly have to pay for much of the investment in the resource. Capture of wildlife resource rents by landholders appears to be relatively efficient, due to tenure conditions and appropriate tender process.

Barnes and Jones (2009) showed that, on private land between 1970 and 2000, the main game species numbers increased by some 100%, while livestock numbers decreased by some 45%. Mendelsohn et al. (2006) confirmed that wildlife use is increasing relative to livestock production. Our predicted growth in wildlife use values over the next 30 years will likely triple the economic contribution of the sector and bring it close to its full spatial potential. Further increases in direct use value from wildlife will likely occur through intensification.

Namibia's standing wildlife assets (the natural capital stock) were estimated to have a value of N$10.5 billion in 2004. Wildlife stocks represent a significant national asset, comparable with those for fish, minerals and forests. Wildlife, fish, mineral and forest stocks – as well as several other natural resources – are not included in

the national account for manufactured capital stock, which was valued at some N$86 billion in 2004, and incorporated only owned or produced assets.

Asset values were calculated for all the species in the physical asset account. Private land, which contained 88% of the total wildlife stock numbers, only contained 69% of the total wildlife asset value. The asset value per head of wildlife on protected and communal land was three times higher than that on private land. Although there has been a lot of investment in wildlife on private land, this has mostly involved plains game and not high-value key species.

Some policy implications have arisen from the findings in this study:

The development of the wildlife sector should continue to place emphasis on tourism activities, both consumptive and non-consumptive.
Appropriate property rights, notably through the concessions policy and the community-based natural resource management (CBNRM) programme, should continue to be an important element of policy.
Investments in building up stocks of wildlife in the communal lands, particularly as driven through the CBNRM programme, should continue to be encouraged and facilitated.
As wildlife use through tourism becomes more established on private land, introductions of high-value key wildlife species should be permitted and facilitated.

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