



TECHNICAL REPORT

ECONOMIC ANALYSIS OF LAND USE POLICIES FOR LIVESTOCK, WILDLIFE AND DISEASE MANAGEMENT IN CAPRIVI, NAMIBIA, WITH POTENTIAL WIDER IMPLICATIONS FOR REGIONAL TRANSFRONTIER CONSERVATION AREAS

Wildlife Conservation Society's Animal & Human Health for the Environment And Development (AHEAD) Program & World Wildlife Fund



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Economic analysis of land use policies for livestock, wildlife and disease management in Caprivi, Namibia, with potential wider implications for regional transfrontier conservation areas

Main Report

JI Barnes

**With Support from the Wildlife Conservation Society's Animal & Human Health for the Environment And Development (AHEAD) Program & World Wildlife Fund
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1.1 Abstract

Standard cost-benefit analysis was applied to several future policy options for land use and animal disease management in Caprivi, Namibia. Emphasis was placed on the livestock-wildlife interface and Caprivi's role as central to the Kavango Zambezi (KAZA) transfrontier conservation area (TFCA). Empirically-based enterprise models measuring private and economic values for livestock and wildlife sectors in Caprivi were used to measure returns to investment for policy options regarding animal disease management and land use allocation. Options included commodity-based trade (CBT) and veterinary control fencing approaches to animal disease management. CBT is a production and marketing approach, which assures product safety regardless of the disease status of the area of origin and therefore permits adaptation of conventional (geographically-based) animal disease control measures. The basic measure of economic efficiency was incremental change in net national income at opportunity cost. Local livelihood contributions were also measured.

The finding is that development in Caprivi along lines where CBT becomes central to disease management and formal meat production is highly likely to be economically efficient. The economic costs associated with a CBT approach would be outweighed by new economic gains in terms of wildlife use incomes, abattoir viability, and livestock farming incomes. Animal disease control is applied differently but remains important, income growth is more diverse and less risky, and ecological values are enhanced. On the other hand, the introduction of spatially segregated, fenced foot and mouth disease (FMD)-free compartments is technically impractical and would be very economically undesirable. Here, significant loss of growth in wildlife incomes, and significant costs for fencing would outweigh any new economic gains in abattoir viability, and livestock farming incomes.

The findings have importance for development policy in the KAZA TFCA, and possibly other TFCAs in southern Africa. They strongly suggest that initiatives aimed at introduction of CBT as part of a value chain approach to sanitary risk management offer significant economic potential. At the same time this approach can assist in meeting other TFCA objectives such as maintenance of diverse ecosystems with greater biodiversity across large landscapes, reducing risk to natural systems due to fencing regimes, and providing greater resilience in the face of natural catastrophes, disease outbreaks and climatic challenges.

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List of Acronyms

AHEAD – Animal & Human Health for the Environment And Development
ASF – Africa swine fever
CA – Codex Alimentarius
CBNRM – Community-based natural resource management
CBPP – Contagious bovine pleuropneumonia
CBT – Community-based trade
CCPP – Contagious caprine pleuropneumonia
DRC – Democratic Republic of Congo
DVS – Directorate of Veterinary Services
EU – European Union
FMD – Foot and mouth disease
GNI – Gross national income
GRN – Government of the Republic of Namibia
IFAD – International Fund for Agricultural Development
IRR – Internal rate of return
KAZA – Kavango Zambezi (TFCA)
LPF – Livestock producer forum
LSD – Lumpy skin disease
LSU – Large stock unit
MAWF – Ministry of Agriculture, Water and Forestry
MCA – Millennium Challenge Account
MCC – Millennium Challenge Corporation
MCDA – Multi-criteria decision analysis
MET – Ministry of Environment and Tourism
MLR – Ministry of Lands and Resettlement
NACSO – Namibian Association of CBNRM Support Organisations
NAD – Namibia dollar
NCA – Northern communal area
NDP – National development plan
NGO – Non-governmental organization
NNI – Net national income
NNF – Namibia Nature Foundation
NPC – National Planning Commission
NPV – Net present value
NTB – Namibia Tourism Board
OIE – World Organisation for Animal Health
PPR – *Peste des petits ruminants*
RVF – Rift Valley fever
SADC – Southern African Development Community
SAM – Social accounting matrix
SAT – South African Territories
TAHC – Terrestrial Animal Health Code
TEV – Total economic value
TFCA – Transfrontier conservation area
USD – United States dollar
WAHID – World Animal Health Information Database
WCS – Wildlife Conservation Society
WTTC – World Travel and Tourism Council
WWF – World Wildlife Fund

2 Introduction

2.1 Background

The Kavango Zambezi (KAZA) Transfrontier Conservation Area (TFCA) is the largest TFCA in southern Africa and it embraces contiguous parts of southeast Angola, northern Botswana, northeast Namibia, southwest Zambia, and western Zimbabwe. Figure 3.1 below shows the area, which is the subject of an agreement between these countries to coordinate and harmonise conservation and development efforts for the benefit of all. It contains a mosaic of protected areas, interspersed with extensive communal lands in which small-scale pastoral and agro-pastoral land use is practiced. The success of conservation in KAZA is heavily dependent on successful rural development and poverty alleviation in its communal lands.

Apart from localized areas of crop production, mainly for local markets, multi-species rangeland-based land use systems involving wildlife and livestock have comparative advantages in the KAZA TFCA. This has been shown from numerous research and analytical studies in KAZA and around it in similar semi-arid to sub-humid biomes. Work carried out in Botswana (Barnes et al. 2001) and Zimbabwe (Jansen et al. 1992) is relevant. Economically, socially, and environmentally sustainable development in KAZA depends largely on complementary use of rangeland for wildlife and livestock. However optimization of spatial allocation of land between different livestock and wildlife uses tends to be hampered by current, geographically-based (i.e., fencing-based) animal disease control strategies in southern Africa based on current standards advocated by the World Organization for Animal Health (OIE) and other international agencies.

The Caprivi in Namibia is in the core of KAZA, and here livestock and wildlife populations generally exist together and have done so for a long time. Caprivi region is classified as a foot and mouth disease (FMD) infected zone by the Directorate of Veterinary Services (DVS), which has the role of controlling and managing animal disease. This in turn reduces the potential for trade in commodities and products derived from animals, which in turn constrains commercialization of livestock production. Disease control strategies applied in Caprivi tend to reduce the potential for use of wildlife through tourism as attempts are made to keep wildlife, especially buffalo, away from areas occupied by livestock, limiting expansion of wildlife populations and tourism development.

There have been few other cost-benefit analyses on animal disease management in southern Africa. Perry et al. (2003) analyzed the costs and benefits of animal disease policy at national level in Zimbabwe. Naziri et al. (2012) are conducting a systems cost-benefit analysis on the merits of further developing commodity-based trade (CBT) practice in the slaughter of livestock and the marketing of meat from the northern communal areas (NCAs) of Namibia. CBT does not appear to have merit in this specific context. Neither of these studies incorporated the effects on other sectors such as wildlife.

WCS-AHEAD, WWF and partners in the present study ("this project") further this work by conducting a comprehensive financial and economic cost-benefit analysis of policy options for development of livestock and wildlife-based land uses in KAZA, with the analysis focused in Caprivi and described by this document. This project is being complemented by the development of a separate, Multi-Criteria Decision Analysis (MDCA) model, which is also able to examine qualitative, non-economic costs and benefits (Cassidy et al. 2013).

2.2 Goal and objectives

The overall goal of this project was to find ways to manage land-use choices in the KAZA region to optimize livelihood and economic welfare.

The objectives of the study were as follows:

- To value the current development path for livestock and wildlife multispecies systems on rangelands in Caprivi and examine policy options for development, in terms of the economic costs and benefits, with particular reference to animal disease management.
- To make clear the value of choices regarding sustainable land use, particularly as these choices affect the national economy and local livelihoods.
- To make recommendations as to technically, socially and economically beneficial strategies for land use, disease control, and overall development for the Caprivi as part of KAZA.
- To develop the cost/benefit analytical model as a tool for future analysis of livestock and wildlife development options in Caprivi and also the wider KAZA TFCA.

The project focused on Namibia's Caprivi, because it is in the core of KAZA, has a suitable range of ecosystems and land uses, has representative market development for multi-species systems, has a representative policy environment, has incidence of animal diseases including FMD, and has reasonably good data on these subjects. The administrative unit of Caprivi Region was specifically selected as the study area. Depending on the project findings, work may then be extended to other parts of KAZA and beyond.

The project sought to rationalize the development of livestock, wildlife, and other natural resources in Caprivi and KAZA to ensure economically efficient cooperation that meets development goals. As such it aimed to achieve cooperation between the stakeholder agencies including Ministry of Environment and Tourism (MET), Ministry of Lands and Resettlement (MLR), Ministry of Agriculture, Water and Forestry (MAWF) including DVS, and other actors engaged in study area development initiatives.

The process involved multidisciplinary data gathering from the literature, databases, and through field visits where needed. These data were used to develop/update new/existing financial and economic models of the land and natural resource use activities in Caprivi. They were also used to estimate macro-level economic development costs relevant to these sectors in Caprivi. A multidisciplinary project team examined current developments in Caprivi, and identified some alternative policy options. Particular attention was paid to contrasting options for animal disease management and the livestock-wildlife interface. Macro level cost-benefit analysis models were developed for the policy options.

The process and activities are described in detail in the project scope of work in Appendix 1 of this report. Data collection and analysis involved the services of a natural resources economist, who benefited from the active support of a multidisciplinary team, including two ecologists, two veterinarians with specialist knowledge of commodity-based trade (CBT), a community-based natural resource management (CBNRM) specialist, and two meat marketing and meat processing specialists.

3 The setting

3.1 Biophysical and socio-economic resources

Much work has been conducted on the natural resources, land and natural resource uses, social and economic values, and animal disease issues associated with the KAZA TFCA and Caprivi. Some has been described in atlas format for KAZA by Mendelsohn & Roberts (1998), Mendelsohn et al. (2002; 2010) and Mendelsohn & el Obeid (2003; 2004; 2005). Rodwell et al. (1995) and Chase (2007) studied the region's wildlife resources. Good databases have been developed by the WWF and MET using community-based assessment methods. Barnes et al. (2010), and Jones & Barnes (2009) valued forest resources and their use in Caprivi. A number of detailed social and economic valuations of natural resources, livestock and agricultural resource use activities have been done within the KAZA TFCA, including work in the Okavango basin by Barnes et al. (2001; 2008; 2009), Saraiva, et al. (2009), Turpie et al. (2006; 2011), Arntzen et al. (2010) and Chemonics International (2011). Similar studies, specifically in Caprivi, have included Ashley & LaFranchi (1997) and Turpie et al. (1999).

Caprivi region occupies 19,422 km² and makes up most of the narrow strip of Namibia extending east from northern Namibia to the western tip of Zimbabwe. It is the most humid part of Namibia climatically, but even so, is only semi-arid to sub-humid, receiving mean annual rainfall of between 550mm and 700mm per annum, in summer. Terrain is flat dominated by deep Kalahari sand-derived soils, with some seasonally flooded plains, adjacent to the perennial Kwando, Linyanti, Chobe and Zambezi rivers, and some heavier clay loam and clay soils on the edges of these plains. Conditions are marginal for rain-fed crop production, and plans for large-scale irrigated commercial production (MAWF 2008) suffer from economic viability problems due to remoteness. Most land produces income through livestock production, wildlife use, and forest use. This is the case, generally, throughout KAZA, except in the northern parts of the TFCA, where higher rainfall allows some successful crop production.

Figure 3.1 shows Caprivi as it fits in the center of the KAZA TFCA. The region contains some formal protected areas (the eastern half of the Bwabwata National Park, Mudumu National Park and Mamili National Park both on the Kwando River, and the Caprivi State Forest north of the main Kongola to Katima Mulilo road. These are shown in Figure 3.1. The remainder of the region is communal land, owned by the state, but held under usufruct by tribal authorities. Here households cultivate small-scale plots of millet and maize with limited success and graze small herds of livestock (mainly cattle) to provide milk, meat, draft power, manure, and store of wealth, under what is essentially open access. Individuals or groups of households also develop livestock water points in less settled areas and farm at a larger scale for meat and store of wealth. Households also make use of forest and other plant resources, fuel wood, poles, reeds, thatch grass, among numerous other less significant natural resources. More locally, small-scale and semi-commercial fishing is important. Much of the communal land is registered as community-based conservancies and community forests, within the national community-based natural resources management (CBNRM) programme. Protected forest areas in Caprivi are depicted in lighter green in Figure 3.1 while community-based conservancies in Caprivi are shown in brown. Communal lands not yet under CBNRM are light beige.

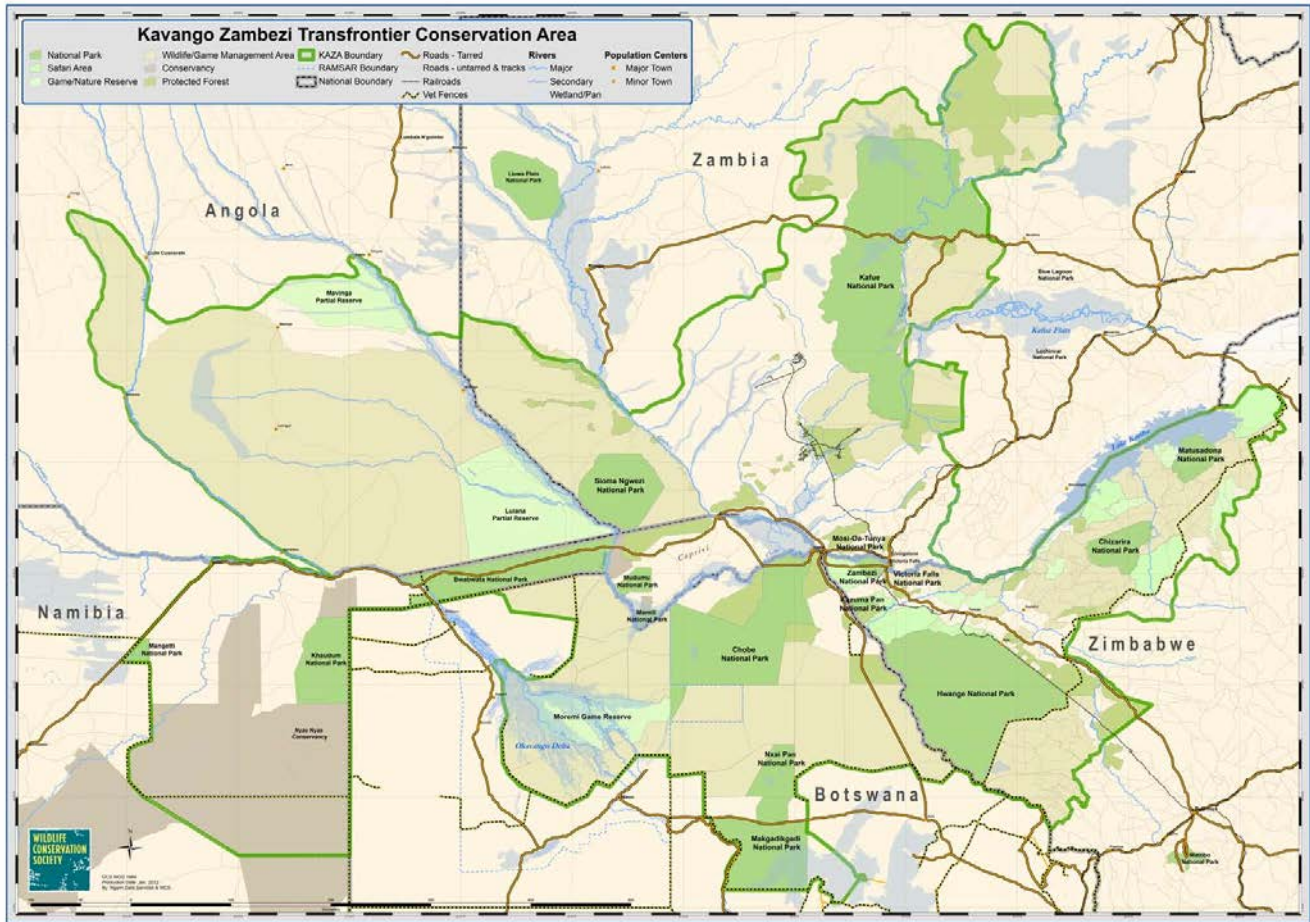


Figure 3.1: The Kavango Zambezi (KAZA) Transfrontier Conservation Area (TFCA) showing the Caprivi region extending into the center

In much of the west and north, Kalahari woodlands occupy seep sands and are dominated by tree species with some value for timber, such as *Burkea africana*, *Baikiaea plurijuga*, *Guibourtia coleosperma* and *Pterocarpus angolensis*. Mopane woodlands occupy limited heavier soils in central east Caprivi and tend to be dominated by the tree, *Colophospermum mopane*. Floodplains, mostly in the east and south, tend to be open and are variable spatially in terms of soil type, wetness and vegetation. Human settlement tends to be clustered along the main roads and particularly in and around the main town, Katima Mulilo. The total human population in Caprivi numbers some 90,000, and most live in rural villages and settlements in the communal land (NPC 2012).

The livestock population is made up of some 143,000 cattle, along with 10,000 goats, some 38,000 head of poultry, and very small numbers of pigs, donkeys and sheep. Livestock is also clustered around the zones of human settlement, and mostly absent from the formal protected areas. Cattle are kept by 58% of households, with only 16% of households keeping goats and 53% of households keeping some poultry (Mendelsohn et al. 2006). Cattle are kept to provide traction, milk, manure, and are sold mainly to provide a source of income in times of need. Cattle are also necessary for ceremonies such as weddings and funerals. Sale of cattle is regarded as an important coping measure in times of food shortage caused by drought or floods. Herd size disparity is wide, with households with the highest number of livestock, in particular cattle, being considered to be wealthiest with the best access to food

and the highest capacity to cope with disasters. Herd sizes are also skewed with only 15% of households in Caprivi having more than 30 cattle. Deaths of cattle impact on draught power capability and decrease household asset ownership.

Wildlife resources are concentrated in and around the national parks in Caprivi. They also occur along the southern and northern borders with Botswana, Angola and Zambia where, especially in the south, extensive protected areas sustain viable stocks. Wildlife populations contain an array of high value key species including elephant (*Loxodonta africana*), buffalo (*Syncerus caffer*), lion (*Panthera leo*), leopard (*Panthera pardus*), sable antelope (*Hippotragus niger*), roan antelope (*Hippotragus equinus*) and others. Localized areas in riparian settings with high wildlife densities have high potential for wildlife viewing tourism, primarily through medium scale lodges, while surrounding woodland areas have potential for the generation of significant income from safari hunting. Tourism development along these lines has been valued, planned and developed for the national parks, as well as for neighboring conservancies where they are developed as joint ventures between local communities and private sector operators. Ashley & Garland (1994), Massyn et al. (2009) Barnes et al. (2010), Turpie et al. (2010) and PMTC (Zambia) Limited (2010), have estimated and demonstrated the financial and economic importance of and potential for non-consumptive tourism in the protected areas of KAZA, as well as in the adjacent conservancies. ULG Northumbrian (2001), Booth (2010) and Barnes et al. (2012) have measured and demonstrated the financial and economic value and potential for hunting tourism (safari hunting) in KAZA and settings similar to Caprivi. Namibia Nature Foundation (2010) has estimated the financial and economic value of recreational angling tourism in Caprivi.

CBNRM has been a successful programme in Namibia, in as much as it imparts property rights to communities over their wildlife resources, generates significant income for these communities, and fosters conservation of the wildlife base. It has involved significant subsidies, mainly from international donors, aimed at institutional development. Work of Barnes et al. (2002), NACSO (2008), Barnes (2008) and Massyn et al. (2008) has shown the significant current and potential economic merits of CBNRM and its development at the community and national programme levels. Less well established is how positive the impact of CBNRM is at the household level. Research by Suich (2010), Collomb et al (2010), Indongo et al. (2010), Bandyopadhyay et al. (2008; 2009), Bandyopadhyay & Tembo (2010), has been focused on this. The findings are generally positive.

CBNRM in Namibia and KAZA has been focused on wildlife and tourism and to a lesser extent forestry, as areas where improvements in income can be significant. More recently in Namibia a programme to develop community-based rangeland management (CBRM) in the northern communal areas has been underway. GOPA Consultants (2010) and Nott & Goldberg (2010) describe this initiative, which aims to enable communities to apply sound rangeland management principles, as espoused by MAWF (2012), through common property rights over their rangelands. As determined by Barnes et al. (2008), this holds significant potential to increase the economic efficiency of small-scale livestock systems in KAZA and Caprivi.

A fundamental problem at the wildlife-livestock-human interface in Caprivi is human-wildlife conflict. O'Connell-Rodwell et al. (2000) and Evans (2004) examined the dimensions of human-wildlife conflict in Caprivi. Brown (2011), Jones & Barnes (2006) and Natural Resources & People (2007) have measured how the costs of human-wildlife conflict (through crop damage, and livestock predation) affecting households relate to the benefits that communities receive and can receive from wildlife use in the same areas. Benefits tend to exceed costs at community level, but distribution of benefits to affected households is often lacking.

The benefits of CBNRM go further than in livelihoods and economic contribution in that it has devolved management responsibility, accountability and beneficiation at community level that underpins good natural resource stewardship and governance. It has led to the adoption of collaborative co-management principles and practice amongst the different management regimes in Caprivi, i.e. National Parks, Communal Conservancies, State and Communal Forest Areas.

However, greater integration with other communal land is still needed, and inter-sectoral policy constraints limit the potential of integrated management, and at different scales. Geographic-based disease control measures at the wildlife-livestock interface present serious challenges to greater wildlife connectivity across boundaries within and between countries - as they rely on extensive veterinary cordon fencing. Geographic-based disease control measures also tend to limit the opportunity for communal livestock producers to access meat markets more efficiently and effectively, using for example, CBT approaches.

The work that has been done on the economics of wildlife and livestock land uses in KAZA indicates clearly that policy within and between KAZA countries needs to recognize the comparative economic advantage of wildlife, as well as that for livestock and the way these fit together spatially, and work towards maximizing the development of both.

Hamilton, et al. (2007) and Suich et al. (2005) estimated the economic value of tourism in KAZA or parts thereof. It has significant comparative advantage, value, and potential to contribute further to development in much of KAZA, along with livestock. Caprivi is pivotal to the promise of KAZA in terms of ecological and functional connectivity and ecosystem services to sustain livelihoods. Spatial integration of land units at different scales and with linked institutional arrangements provide exciting opportunities for wildlife-based land use and multispecies animal production systems.

3.2 Animal disease

Of critical importance in the development of the rangeland uses by livestock and wildlife in KAZA and Caprivi is the management of animal disease. Osofsky et al. (2005), Cumming (2011), Cumming & Atkinson (2012), Thomson & Penrith (2011) and Penrith & Thomson (2012) have pointed out how disease control policies have constrained either livestock or wildlife, and the economic imperative for improvements.

Within Namibia, Caprivi falls outside the national FMD free and FMD protection zones from which meat exports to the EU, and other markets, is possible. It is in the northern communal areas, north of the main veterinary cordon fence, "the red line." Current policy (Directorate of Veterinary Services 2010) aims to eradicate transboundary animal diseases in the northern communal areas, but Caprivi is unusual in its setting and is classified as an FMD endemic or red zone. It does not have veterinary fences, except for part of its southwestern border with Botswana. An abattoir, owned by government and managed by the semi-private company, MeatCo, operates intermittently and has in the past been able to apply basic commodity-based trade (CBT) principles in the export of beef to South Africa.

FMD outbreaks have occurred with increasing frequency in recent decades in Caprivi. According to OIE records (Handistatus II & WAHID)¹ the Caprivi has suffered five primary outbreaks of FMD since 1996, i.e. over a period of nearly 17 years (an average of one outbreak every 3.4 years). However, in the

¹ Accessible through the OIE website: <http://www.oie.int/>

12-year period 1996–2006, there was only one outbreak (in 2000); the other four all occurred between 2007 and 2011/2012. Together, the four outbreaks that occurred in the Caprivi since 2007 reportedly spawned 43 secondary outbreaks. According to WAHID, in the 68 months since the beginning of 2007, FMD has been present in the Caprivi for approximately 30 months (based on the dates of notification and resolution reported to WAHID, i.e. FMD restrictions were in place for about 44% of these 68 months).

There are other non-FMD factors that influence cattle trade in the Caprivi, e.g. the poor quality and quantity of grazing in the dry months of the year (the abattoir is usually closed between August and November each year – due to poor condition of animals in the absence of supplementary feeding). Furthermore, there is a well-established tendency for owners to market C-grade² cattle predominantly (>80% on a long-term basis).

In 2007-2009 the abattoir was closed for a continuous period of 22 months; however, this was not entirely due to FMD because it also included the period for abattoir maintenance and in August-November the abattoir is in any case closed as mentioned above. FMD also affects the marketing of cattle into the informal sector – estimated by the Directorate of Veterinary Services to be about 50% of cattle marketed – because even at municipal and local abattoirs/slaughter-slabs, animals without movement permits may not be slaughtered. Movement permits are not issued during FMD outbreaks. FMD outbreaks therefore affect both formal and informal marketing of cattle.

The trend of increasing incidence of FMD outbreaks is not unique to the Caprivi because other countries in the SADC Region with good reporting records such as Botswana and South Africa have experienced similar situations (UP/ARC 2011). A further general phenomenon is that outbreaks in southern African countries have recently lasted longer than was the case in the past. The 2007 outbreak in eastern Caprivi took about 12.5 months to resolve and the 2008 outbreak in western Caprivi about 9 months. An outbreak in Botswana that began in October 2007 took more than 2 years to resolve (WAHID).

Obvious questions are why FMD outbreaks have recently become (1) more frequent and (2) of longer duration than formerly? These questions are not possible to answer definitively at present but at least three factors are likely to contribute.

- In some locations near conservation areas, cattle and buffalo numbers are increasing which probably intensifies the buffalo/cattle interface (this applies in Caprivi and in Ngamiland, Botswana).
- There is good evidence that prophylactic vaccination programmes in recent years have been less effective than formerly; likely due to both reduced vaccine efficacy (including poor antigenic matching with field Southern African Territories (SAT) viruses) and inadequate coverage of the target populations.
- Livestock owners appear to be less observant of animal health regulations than was formerly the case.

² The grade is a composite between age of the animal and body condition, including fat cover. Grades A and AB have higher demand and prices than grade C, which is of low value.

In Caprivi specifically and the KAZA TFCA more generally, borders (even those with fences) are unguarded and therefore movement of livestock across country borders cannot be effectively prevented. There is molecular epidemiological evidence (based on genome sequencing of representative viral isolates) that the SAT 2 virus involved in the 2007 Caprivi outbreak was derived from unreported FMD occurrence in Zambian cattle that preceded the Caprivi outbreak (Knowles & Wadsworth 2008a, 2008b). Thus, occurrence of FMD in the Caprivi likely arises from both buffalo/cattle contact locally and transboundary movement of infected livestock from neighbouring countries.

Information on animal diseases of importance in the Caprivi Region other than foot and mouth disease (FMD) is scanty. The only diseases for which Namibia reports the area of occurrence to the World Organisation for Animal Health (OIE), apart from FMD, are Rift Valley fever (RVF) and African swine fever (ASF). The others are all simply reported for 'the whole country' although it is well known that contagious bovine pleuropneumonia (CBPP), for example, is restricted to the Northern Communal Areas (NCAs). Some information has been sourced from press releases, reports and published articles, as well as from farmers during meetings held in three districts (Kabbe, Kongola and Linyanti) in April 2011, and a meeting for farmers participating in the Livestock Producer Forum (LPF) mentorship programme in Katima Mulilo in May 2011.

In a hazard mapping draft report, lumpy skin disease (LSD), CBPP, anthrax, rabies and FMD were indicated as the most important diseases in the Caprivi (Kachale 2009). In an assessment of the IFAD-funded Northern Regions Livestock Development Project, FMD and CBPP were regarded as having the greatest economic impact (Anon 2002). FMD is obviously the most serious barrier to trade in livestock and livestock commodities from the NCAs (Mendelsohn et al. 2006). Not only are the farmers excluded from higher priced markets, but the restrictions on the movement and sale of animals and lengthy closure of the abattoir in Katima Mulilo place additional pressure on grazing. Animals lose condition and become more prone to diseases.

A number of diseases of potential importance in the KAZA TFCA have been selected for consideration on the basis that they are known or likely to occur in the Caprivi, are likely to have an impact on livelihoods and/or biodiversity conservation, or would pose a serious threat to livestock keepers and/or biodiversity conservation if introduced into the Caprivi. The diseases have been allocated to four groups according to their known or probable status in Caprivi.

Diseases that have a high probability of occurrence and a known impact on producers are FMD, LSD and tick infestation. LSD and tick infestation are widespread in sub-Saharan Africa and likely to present no more threat to livestock in Caprivi than elsewhere. This is not the case with FMD. The probability of the majority of other diseases considered occurring is thought to be moderate, and their potential impacts vary from livestock losses due to mortality and low production and/or reproduction, to human infection and sometimes serious human disease (as can occur with RVF). The epidemic diseases of goats, *peste des petits ruminants* (PPR) and contagious caprine pleuropneumonia (CCPP), currently not present in Namibia, are considered unlikely to occur (probability of occurrence low). However, the southward progress of PPR has been inexorable, with Tanzania and DRC endemically infected, and the entire SADC region is believed to be at risk; Angola reported PPR for the first time in 2012, apparently due to an introduction from DRC (WAHID 2012, database accessible through <http://www.oie.int/>). Introduction of either of these diseases is likely to have dire consequences for Namibia as a whole due to disruption of the trade in live goats to South Africa from the FMD-free zone in the south.

Although the causative agents of Rift Valley fever (RVF) and corridor disease may exist endemically in Caprivi, outbreaks are considered unlikely based on probably stable endemic situations and the absence of known events to date involving these diseases. It is noteworthy however, that lineage H of RVF, which caused widespread disease in South Africa, Botswana and Namibia in 2010-11, was first identified in Caprivi (Grobbelar et al. 2011). Since susceptible livestock host species (horses, pigs and sheep) are not present in the Caprivi, the risk of clinical manifestations of African horse sickness (AHS), African swine fever (ASF) or bluetongue is considered negligible although the agents are likely to be present.

FMD has the highest economic impact on both livestock producers and the state, followed by CBPP and anthrax. PPR and CCPP currently have no economic impact but further southward advance of these diseases, which is particularly likely in the case of PPR, would require investment in surveillance, and an incursion would have a high cost to both producers and the state. LSD causes losses to producers mainly due to damage to hides, is a common and recurring problem, and vaccination would be advisable and probably cost-effective. No current economic implications of RVF, theileriosis and trypanosomiasis were identified, but an outbreak of any of them would have a relatively high economic impact both in terms of livestock losses and the need to implement control measures. The economic impact of the remaining diseases appears to be relatively low to zero.

3.3 Fencing

As noted above, the countries, involved in KAZA are Angola, Botswana, Namibia, Zambia and Zimbabwe. All but Angola have employed geographical-based measures and in particular fencing to control animal disease spread. Over 40 years ago, European Union (EU) treaties provided preferred market trade agreements to southern African countries, aimed at promoting economic development. The commercial livestock sector, in particular, was a major benefactor of these agreements with participating countries receiving lucrative returns for exported livestock products to the recipient EU markets. Many traditional agro-pastoral livestock producers, however, being located outside veterinary cordon fenced zones in FMD-endemic areas, were not beneficiaries of these agreements.

Engagement of these trade agreements required participating countries to comply with stringent animal health standards, and this resulted in significant negative consequences for wildlife populations and their associated dispersal or movement routes. The eradication of targeted wildlife species in some areas was followed by the establishment of disease-free livestock export zones and adjacent disease surveillance areas through the construction of thousands of kilometers of wildlife-proof fencing aimed at separating wildlife from livestock. In some places, fences were established initially to control tsetse fly, the vector of trypanosomiasis (sleeping sickness), and thereafter, FMD. Some 15,000 km of fences have been erected over the years for control purposes, separating cattle and wildlife. Veterinary fences have constrained movements of wildlife on the southern edges of KAZA. Raborokgwe (1998) in Botswana and Lindeque (1998) in Namibia have explained the function and justification of these fences.

Some uncertainty in regard to long-term continuation of the agreements enabling preferential market access has arisen. Long-term trends in the EU away from agricultural subsidies, and recent difficulties in finalizing economic partnership agreements between the EU and some southern African countries, along with the emergence of alternative world markets, suggest possible discontinuation in the future.

At the time of the initial trade agreements, livestock production, promoted by EU agricultural subsidies, was seen as the viable land use option for future development in semi-arid southern Africa.

Since the late 1980s, however, a significant amount of research and practical evidence has shown that wildlife production systems have economic comparative advantage in many parts of southern Africa (Cumming 1991, 1994; Jansen et al. 1992; Barnes et al. 2001). The current paradigm is that livestock and wildlife both have economically efficient multispecies roles to play in semi-arid southern Africa, and this has specifically been shown within KAZA (Barnes et al. 2001; Chemonics International 2011).

Cumming (2011), in an analysis of the constraints to development of multispecies systems in southern African TFCAs, found that development planning, conservation planning, and disease management policies tend to be suboptimal. Wildlife has been unable to achieve its full potential due to policy and legislative constraints. Evidence shows that efficient accommodation of competing interests at the wildlife-livestock-human interface in TFCAs, including KAZA, requires a multispecies animal production systems approach to land use.

One approach to improving the production potential of the livestock sector, while simultaneously removing constraints to wildlife sector development, could be commodity-based trade (CBT). The OIE recommendations contained in article 8.5.25 (TAHC, 2010) are partially based on CBT and have been endorsed by SADC:

Article 8.5.25 of the OIE Terrestrial Animal Health Code

Recommendations for importation from FMD infected countries or zones, where an official control program exists, involving compulsory systematic vaccination of cattle for fresh meat of cattle and buffaloes (*Bubalus bubalis**) (excluding feet, head and viscera). *Veterinary Authorities* should require the presentation of an *international veterinary certificate* attesting that the entire consignment of *meat*:

1. Comes from *animals* which:

- a) have remained in the *exporting country* for at least 3 months prior to *slaughter*;
- b) have remained, during this period, in a part of the country where cattle are regularly vaccinated against FMD and where official controls are in operation;
- c) have been vaccinated at least twice with the last vaccination not more than 12 months and not less than one month prior to *slaughter*;
- d) were kept for the past 30 days in an establishment, and that FMD has not occurred within a ten-kilometer radius of the establishment during that period;
- e) have been transported, in a vehicle which was cleansed and disinfected before the cattle were loaded, directly from the establishment of origin to the approved abattoir without coming into contact with other animals which do not fulfill the required conditions for export;
- f) have been slaughtered in an approved abattoir:
 - (i) which is officially designated for export;
 - (ii) in which no FMD has been detected during the period between the last *disinfection* carried out before *slaughter* and the shipment for export has been dispatched;
- g) have been subjected to ante-mortem and post-mortem inspections for FMD with favorable results within 24 hours before and after *slaughter*;

2. Comes from deboned carcasses:

- a) from which the major lymphatic nodes have been removed;
- b) which, prior to deboning, have been submitted to maturation at a temperature above + 2°C for a minimum period of 24 hours following *slaughter* and in which the pH value was below 6.0 when tested in the middle of both the *longissimus dorsi*.

*Asian water buffalo

Animal diseases need to be managed whether the approach is geographic or non-geographic, but non-geographic approaches can be less expensive and can have reduced impact on parallel land uses involving domestic animals and wildlife in particular. Taylor (2010) documented the considerable costs incurred in Zimbabwe, Namibia and Botswana in pursuing geographic approaches.

CBT is amenable to incorporation into value chain risk management systems appropriate for the control of food safety-related pathogens and animal diseases. Furthermore, this is the trend in risk management for all food industries worldwide. In effect, therefore, adoption of value chain-based systems would remove an anomaly in food risk management standards that has existed since the inception of the World Trade Organization (WTO)³.

It is possible to imbed “CBT value chain-based risk management” within other broader FMD control strategies. CBT appears to be non-prejudicial to livestock owners living adjacent to wildlife areas, enabling greater land use harmonisation, and enabling risk diversification in the face of climate change, intimate wildlife-livestock interactions and other challenges.

3.4 Meat processing and marketing

Currently in Caprivi, the livestock production systems practiced mean that off-take from the regional cattle herd of some 143,000 cattle amounts to only some 10% per year (Indongo et al. 2010). About half of these has been for the local informal market, and the other half has gone to the formal market – the abattoir in Katima Mulilo. Live animal sales are limited to the Caprivi Region. Some 25% of sales go via livestock traders, and the rest directly from producers. Current annual abattoir throughput is some 7,000 to 8,000 cattle per annum for which there tends to be a peak following the months with better grazing. 80% of production is of poor quality (C grade), due to the fact that finishing is minimal and most animals are sold beyond optimal selling age. In the informal market there is no grading and most cattle are sold privately and there are few auctions.

The fixed assets of the Katima Mulilo abattoir are government-owned and the facility and operations are leased to MeatCo, the dominant national semi-private meat market company. The facility consists of holding pens, a slaughter unit, a chiller unit, a deboning unit, a freezer, and a packaging/holding unit. Overall capacity is currently constrained by chiller capacity, but there are plans to increase the latter.

In the past, application of an approach with features of CBT, where there was quarantine of the animals for three weeks before slaughter and a three-week holding period for the beef at the abattoir, allowed MeatCo to sell industrial grade deboned beef from the Caprivi abattoir to the South African market. In the face of recent FMD outbreaks, this market was closed to the Caprivi in 2007. In recent years the abattoir has, on average, been operating less than 50% of the time, restricted primarily by FMD-induced

³ International standards and guidelines for managing food safety and spread of animal diseases through trade are provided by international standard-setting bodies (ISSBs) mandated by the WTO’s Committee on Sanitary and Phyto-sanitary Measures (SPS Committee). The Codex Alimentarius (CA) Committee provides standards and guidelines for food safety in the Codex Alimentarius (CA; <http://www.codexalimentarius.org>), while the OIE provides standards and guidelines for trade in animal commodities in respect of animal diseases (the OIE does not provide specific standards for products, other than recommendations for procedures required to inactivate infectious agents in products). OIE standards differentiate between terrestrial animals (TAHC) and aquatic animals (Aquatic Animal Health Code). This is because the OIE’s standards are based on identification and management of risks associated with specific infections/diseases whereas CA standards are designed to manage all physical, chemical and biological risks posed by individual food products (i.e. disease-based approach *versus* product-based approach). Although the nature of the risks of dissemination of infectious disease agents important for food safety and animal diseases posed by commodities and products intended for human food are generic, the methodologies these two ISSBs recommend for effecting risk mitigation are different.

closure, but also the need for abattoir maintenance, limited quarantine space, and seasonal variation of animal condition.

The local market is small, already mostly served by the informal sector, and MeatCo has been unable to exploit it. Nevertheless, it has been possible for MeatCo to export partially processed products (deboned, frozen cuts and offal) from Caprivi to the Democratic Republic of Congo, Angola and Zimbabwe. Some 170 tons of basically processed products were thus sold in 2010. The technical and financial feasibility of extended processing is being investigated.

4 Approach and methods of this study

4.1 Approach

Economic values can be expressed in a variety of ways, and to enable meaningful comparison it is important that those used are defined and explained. The approach to valuation adopted for this project fits within the resource economic concept of **total economic value** (TEV). The total economic value of an ecosystem comprises direct use, indirect, option and non-use values.

- **Direct use values** may be generated through the consumptive use of resources (e.g. hunting, gathering) or non-consumptive use (e.g. photographic tourism, bird watching).
- **Indirect use values** are values generated by outputs from ecosystems that form inputs into production by other sectors of the economy, or that contribute to net economic outputs elsewhere in the economy by saving on costs. These outputs are derived from ecosystem functioning such as carbon sequestration, water flow regulation and provision of wildlife refugia.
- **Non-use values** include the value of having the option to use the resources (e.g. genetic) of ecosystems in the future, and the value of knowing that their biodiversity is protected. Although far less tangible than the above values, non-use values are reflected in society's willingness to pay to conserve these resources, sometimes expressed in the form of donations.

The values used in this study were all direct use values. They were measured as net private value (financial profit), local livelihood value (contribution to local livelihoods), and economic value (contribution to net national income or NNI). **All values were presented in Namibia dollars (N\$ or NAD) at 2012 prices⁴**

Net private value is the net financial value (= profit), measured as cash plus in-kind benefits to specified economic players (e.g. households, communities, entrepreneurs or firms). The difference between total annual revenues (also termed turnover or gross output) and their annual expenditures is their net profit or net private value. Private values were measured using simple financial or in-kind transactions.

⁴ Where NAD (N\$) 1.00 = ZAR (R) 1.00 = USD (US\$) 0.12 at the time of the study

Local livelihood value is the contribution accruing to local households and communities, defined as their share of the net private value, plus income derived from wages and salaries, rentals and royalties.

Economic value is defined as the total value added to national income, which reflects all income generated as a result of an activity, and not just the net profit for the investor or community. Put another way, it represents the returns to the internal factors of production (land, capital, labour and entrepreneurship) employed in the activity. It includes payments to government and other economic actors, such as remuneration to employees, taxes, interest and capital repayments, and rental payments. All these things together represent the annual contribution made by the activity to the national income. This measure allows the value to be assessed in terms of statistics that are generated for a country's whole economy on a regular basis. These statistics include *gross national income* (GNI) and *net national income* (NNI), which are the returns in gross and net value added to factors of production owned by a country's citizens (Gittinger 1982). NNI is GNI minus annual capital asset depreciation.

Value added to national income comprises **direct value added** and **indirect value added**. Direct value added is the income generated directly in the operations of the enterprise or activity - in the first round of expenditure. Operations result in expenditure on inputs from other sectors, for example, raw materials or fuels, and induced activity in the enterprises supplying these inputs generates another round of value added, and further rounds may follow. These 'backward linkages' create a multiplier effect, so that the overall impact is larger than the direct value added alone. The magnitude of the multiplier effect is calculated in input-output models such as social accounting matrices (SAMs). The SAM model for the Namibian economy was described by Lange et al. (2004) and Lange & Schade (2008). In this project only direct value added was used in the cost-benefit analysis. Inclusion of indirect value added in the cost-benefit analysis would be unlikely to affect results, and was thus not been deemed necessary. Nevertheless, the multiplier may have a role in future use of the model in the KAZA context.

Figure 4.1 attempts to illustrate the relationship between first round turnover (say of an enterprise), financial value private net income, local livelihood benefits, and all the economic income generated or the direct value added to the national income. It also illustrates how the enterprise also spends on inputs from other sectors/enterprises, which in turn generates indirect value added (the indirect value added in the backward linkages).

In measuring economic value, prices were adjusted to correct for distortions, wherever market prices did not reflect true value (e.g. if a commodity such as labour has price fixed by government rather than established in a free market). This true value was taken to be its opportunity cost (the value of its best alternative use). Where actual prices differed significantly from opportunity cost, then '**shadow pricing**' was applied. Shadow pricing ensured that values applied to inputs and outputs reflected their opportunity cost or real scarcity in society (rather than simply market prices). Standard criteria for shadow pricing developed in the past for Namibia (Barnes 1994; Humavindu 2008) were used to make these adjustments. The main adjustments were for unskilled and semi-skilled labour to reflect unemployment and wage price distortions, a foreign exchange premium on tradable items, to reflect excess demand for foreign exchange, and the elimination of transfers (taxes, subsidies) as costs and benefits. Namibia's economy has been relatively open in recent years with few price distortions, and many market prices fairly reflect opportunity cost. To account for the time value of money the streams of values in constant 2012 prices in the models were discounted at real base case rate of 8%.

4.2 Enterprise and macro-level models

The project made use of detailed spreadsheet budget cost-benefit models, at constant 2012 prices, of individual enterprises of the kind developed and used for some time in Namibia, Botswana and elsewhere. Here the aim is to generate typical examples of relatively homogeneous enterprises, using empirical data on the physical and financial characteristics of the enterprise. The values in the models are estimated to represent long-term average conditions, after consideration of the (often) wide variations that take place around these averages.

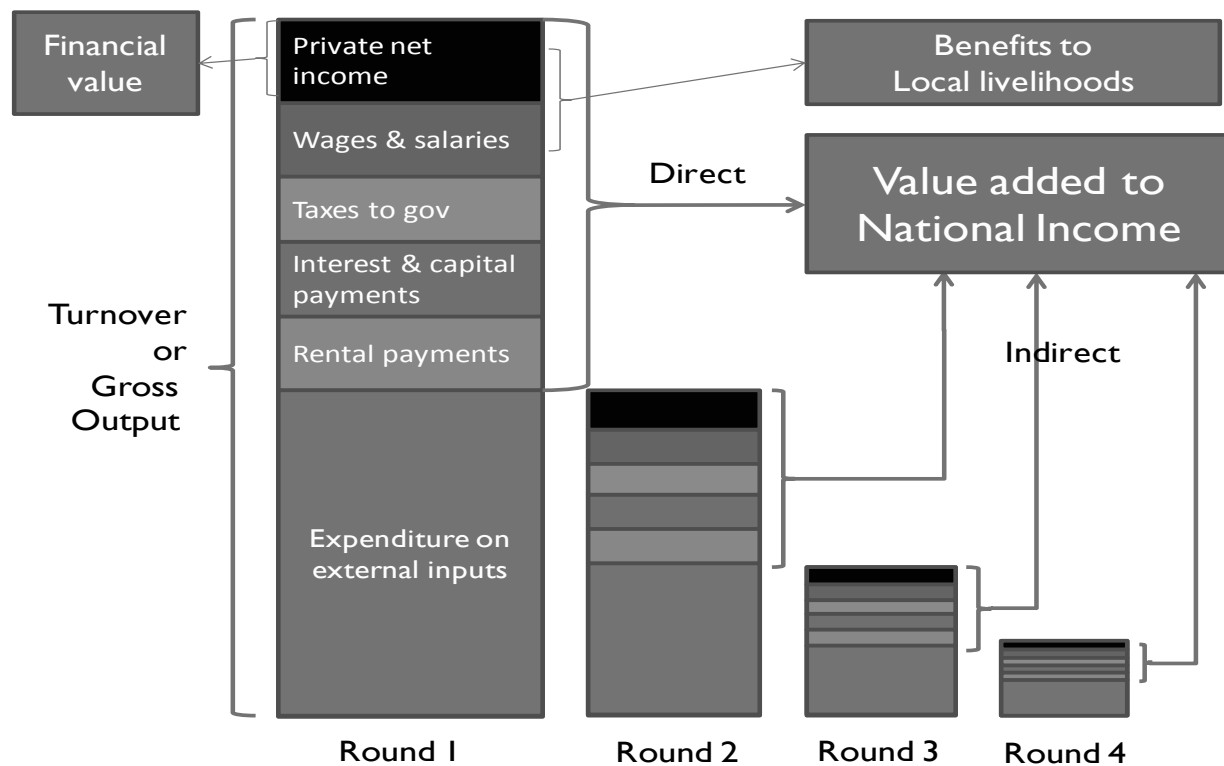


Figure 4.1: Illustration of the relationships between private and economic values described in the text

In this project enterprise models were developed for typical examples of wildlife use in Caprivi, including medium-scale wildlife viewing tourism lodges, medium-scale tented camps, small-scale community-owned campsites, and medium-scale safari hunting concessions. In all but the campsites, these enterprises are joint ventures between private sector investors and government or community conservancies. Community campsites are ventures initiated by community conservancies themselves. Enterprise models were developed for typical community conservancies. These are investments from communities, donors and government, which derive rents from joint ventures as per above, but also generate additional value added in their own profits, wages, etc.

Enterprise models were developed for typical livestock farming activities in Caprivi, including small-scale traditional cattle keeping on open access grazing around villages and homesteads, and more

remote medium-scale cattle post enterprises with their own water provision and more exclusive grazing. The small-scale enterprises are typically households owning an average of 35 cattle. Cattle post investments belong to either groups or individuals representing richer cattle owners.

A basic enterprise model was made for the large-scale abattoir facility in Katima Mulilo. This was also based on empirical data where available, and represented the status quo. Using this as a base, assumptions were changed where applicable to reflect alternative scenarios described below, and a preliminary model for a processing plant involving canning. Due to lack of detailed feasibility data the processing model was conceptual, based on experience elsewhere (Cassidy D., 2013, pers. comm.). Models have been developed for other land and natural resource use activities such as small-scale rain-fed crop production, fishing, fuel-wood pole, reeds, grass and other non-timber forest products harvesting. Where these activities were deemed to not be substantially affected by policy options they were not included in the cost-benefit models.

Basically, enterprise models included details of all initial capital required for start-up in an enterprise, the annual variable and fixed operating costs at full production, and the annual sales at full production. These generated annual private net incomes after costs associated with capital and annual contribution to local livelihoods. They also generated, after shadow pricing, economic value in incremental annual change to gross and net national income. Of these values, the annual contribution to local livelihood and the incremental annual contribution to national incomes were important for use in the macro-level cost-benefit models. Then the models also generated internal rates of return and net present values, over five, and ten years for both private and economic values.

Results from enterprise models were used in macro-level cost-benefit models, which entailed accounting for the **incremental investment costs** associated with different policy options, and comparing these with the resulting **incremental net national incomes** generated during the analytical period, obtained through aggregating enterprise values. The primary measures of economic merit were the economic internal rate of return and the economic net present value. These were measured over ten, 20 and 30 years at constant 2012 prices, and were compatible with the key measures used by the Millennium Challenge Corporation in conducting project appraisals (MCC 2009). Also derived from the macro-level models was the incremental contribution to local livelihoods on an annual basis.

No field data gathering was undertaken after it was determined that acceptably up-to-date empirical data on key issues were available from literature and unpublished databases. Parameters for tourism models were updated and improved with empirical data from Massyn et al. (2008), Barnes & Humavindu (2003), Massyn et al. (2009) and Turpie et al. (2006). Parameters for livestock models were updated and improved with data from Indongo et al. (2010), GOPA Consultants (2010), Katjiua, et al. (2010), Innovations for Poverty Action (2012), Shuh et al. (2006) and Murray (2005). For the abattoir models, unpublished data provided by MeatCo were used as the main source.

4.3 Scenario development

A dedicated multidisciplinary workshop to select appropriate policy options based on scenarios for development first examined the development goals and objectives for KAZA and Namibia as a whole. KAZA objectives are to foster cooperation in ecosystem and cultural resource management, promote alliances in biological, cultural, social, and economic areas, enhance ecosystem integrity through harmonizing NRM and tourism development, develop CBNRM, and promote cross-border tourism.

GRN (2001; 2004) describe the primary goals for Namibia's national development in the national development plans and the vision 2030 document. These are high and sustained economic growth, increased income equality, and employment creation. The priority areas for National Development Plan 4 (NDP4) are logistics, tourism, manufacturing and agriculture. Schuler et al. (2012a, 2012b, 2012c) conducted policy reviews of the livestock, logistics and tourism sectors, which are of direct relevance to this project.

A list of policy options was created and these were screened against the team members' visions for the ideal future and the ability of options to contrast situations for analysis. Then a short list was selected. The selection was aimed at options that involved policy alternatives to the status quo, which made up the first scenario. Three other scenarios were examined by comparing changes in economic costs, benefits and net returns which would likely result from adoption of the policy option. Two alternative scenarios, based on adoption of variations on the CBT approach of OIE Article 8.5.25, were selected. These were considered to be technically practicable. Another scenario, essentially a hypothetical one involving the introduction to East Caprivi of three fenced FMD-free compartments, was selected for examination. This scenario was determined to be technically impractical and very difficult to apply, but was included in the cost-benefit analysis to assess the economic value of a fenced compartment approach.

Appendix 3 to this report presents a description of the essential features, requirements for optimal function, and the implications for the status quo scenario and the two practicable CBT scenarios. These two alternative options are considered to have potential for addressing the sanitary constraints to export of deboned beef from Caprivi to regional and international markets. Basic characteristics of all four final policy alternatives with associated scenarios subjected to cost-benefit analysis are described here:

Scenario 1: Status quo

- Animal disease (FMD) management based on geographic approach
- Current policies with ongoing growth trajectories, and currently planned investments
- FMD outbreak management with ongoing extended abattoir closures
- Continued low slaughter throughput, continued exports to northern SADC markets
- Continued CBNRM development and tourism expansion around protected areas and within conservancies
- Livestock vaccination and surveillance, quarantine, continued as currently conducted
- Livestock-wildlife contact avoided as far as possible as is currently practiced

In the cost-benefit analysis, Scenario 1 capital costs involved new initial capital of N\$40 million for improvement/extension of quarantine station and chiller capacity. They involved ongoing annual expenditure on capital (new and replacement) by DVS amounting to N\$4.4 million over the analytical period. They also involved ongoing annual expenditure on capital (new and replacement) by MET, donors and NGOs, amounting to N\$7.9 million over the analytical period. They also involved ongoing annual expenditure on capital (new and replacement) by other supporting agencies, including MLR and MAWD, amounting to N\$2.6 million over the analytical period.

Scenario 1 involved new annual recurrent variable and fixed costs rising from N\$13.2 million in year one to N\$25.5 million in year 10 and to N\$31.2 million by year 17 after which these costs stabilized. These costs were made up of general DVS expenditures, vaccination and surveillance, expenditure by

MET, NGOs and donors on wildlife conservation and CBNRM, FMD control and quarantine management.

Scenario 1 involved new benefits in terms of annual net national income contribution rising from N\$25.3 million in year one to N\$46.5 million in year 10, and to N\$56.8 million by year 17 after which income growth stabilized. This income was generated through non-consumptive tourism, small-scale traditional livestock and cattle post livestock, safari hunting tourism, community conservancies and the abattoir.

Scenario 2: CBT article 8.2.25 with modification

- Application of CBT OIE Article 8.2.25, but with modifications as applicable to the ongoing MCA initiative in Caprivi⁵
- Continued FMD vaccination, and enhanced FMD surveillance
- Motor transport to abattoir
- Three-week quarantine retained as for scenario 1, as preferred by DVS
- Improved income for livestock enterprises serving MeatCo market, but no finishing of stock prior to slaughter
- Reduction of abattoir down time, some improvement in abattoir management, minor upgrading of abattoir, with expansion of chiller capacity as planned
- Access to regional markets for deboned beef as at present (Angola-Zambia-Zimbabwe, possibly South Africa)
- Less restrictions on wildlife movement, corridors opened between national parks and state forest and north to Zambia, and from Botswana border to conservancies in East Caprivi
- Expanded CBNRM development with improved growth in wildlife income

In the cost-benefit analysis, Scenario 2 capital costs involved new initial capital of N\$49 million for improvement/extension of quarantine station and abattoir upgrade. They involved ongoing annual expenditure on capital (new and replacement) by DVS amounting to N\$4.4 million over the analytical period. They also involved ongoing annual expenditure on capital (new and replacement) by MET, donors and NGOs, amounting to N\$7.9 million over the analytical period. They further included ongoing annual expenditure on capital (new and replacement) by other supporting agencies, including MLR and MAWD, amounting to N\$3.1 million over the analytical period.

Scenario 2 involved new annual recurrent variable and fixed costs rising from N\$16.1 million in year one to N\$31.4 million in year eight after which these costs stabilized. These costs were made up of the same items as Scenario 1, except that FMD control costs were 20% less, and CBNRM costs were 10% higher.

Scenario 2 involved new benefits in terms of annual net national income contribution rising from N\$42 million in year one to N\$81.9 million in year 11, after which income growth stabilized. This income was generated through the same activities as for Scenario 1, except that livestock producer incomes were 20% higher, non-consumptive tourism incomes were 35% higher, and safari hunting incomes were 25% higher. Net value added in CBNRM and the abattoir increased 2.5 fold.

⁵ TAHC Article 8.5.25 “1.d. were kept for the past 30 days in an *establishment*, and that FMD has not occurred within a ten-kilometre radius of the *establishment* during that period” likely cannot be adhered to as written if it is meant to imply that all animals in the prescribed area, including buffalo, must be demonstrated to be free of FMD.

Scenario 3: CBT processing

- Variant of Scenario 2 with the addition of a processing plant
- Same basic requirements as for Scenario 2, processing renders compliance with sanitary standards (this scenario involves product heating)
- Abattoir extended with processing plant, ongoing feasibility study
- Along lines of what has been done in Kenya (Farmer's Choice Kenya)
- Improved livestock enterprise income but no finishing prior to slaughter
- Access to a wider range of markets in SADC, including South African markets, ongoing feasibility study
- Quarantine requirement retained as for Scenarios 1 and 2
- Less restrictions on wildlife movement, corridors opened between national parks and state forest and north to Zambia, and from Botswana border to conservancies in East Caprivi
- Expanded CBNRM development with improved growth in wildlife income

In the cost-benefit analysis, Scenario 3 capital costs involved new initial capital of N\$125 million for improvement/extension of quarantine station and abattoir upgrade, as for Scenario 2, as well as a processing plant. They involved ongoing annual expenditure on capital (new and replacement) by DVS amounting to N\$4.4 million over the analytical period. They also included ongoing annual expenditure on capital (new and replacement) by MET, donors and NGOs, amounting to N\$7.9 million over the analytical period. They further included ongoing annual expenditure on capital (new and replacement) by other supporting agencies, including MLR and WAWD, amounting to N\$6 million over the analytical period.

Scenario 3 involved new annual recurrent variable and fixed costs rising from N\$16.5 million in year one to N\$31.4 million in year 11, after which the costs stabilized. These costs were made up of the same items as Scenario 1, except that FMD control costs were 20% less, and CBNRM costs were 10% higher.

Scenario 3 involved new benefits in terms of annual net national income contribution rising from N\$58.3 million in year one to N\$111.2 million in year 11, after which income growth stabilized. This income was generated through the same activities as for Scenario 1, except that livestock producer incomes were 20% higher, non-consumptive tourism incomes were 35% higher, and safari hunting incomes were 25% higher. Net value added in CBNRM increased 2.5 fold. That for the abattoir and processing increased 8.3 fold.

The processing model used was conceptual and involved canning. It was essentially additional and could enhance incomes (as in this case) or reduce them, depending on the feasibility of processing.

Scenario 4: FMD-free compartments

- Introduction of three 200,000 hectare fenced FMD-free compartments in those parts of East Caprivi, where livestock numbers are high and wildlife numbers are minimal
- Separation of wildlife from livestock with game proof electrified or I-beam fencing
- Community-based compartment development integrated with conservancy development among communities living in and on edges of compartments
- Compartments with adequate controlled access/exit points for people, animals and material that is strictly controlled (including log books)

- Sound biosecurity plan, including identification of critical control points and associated limits, for prevention of FMD entry into the area, including standard operating procedures and emergency response plans
- Loading and off-loading facilities for animals and isolation unit for new animal introductions
- Vehicle disinfection facilities for trucks wherever they may enter compartments
- A surveillance system adequate to detect FMD occurrence but also subclinical infection of animals (certified for the preceding 12 months); more rigorous surveillance than currently conducted
- Re-examination (based on risk assessment) of the rule that no vaccination against FMD may take place and no animal vaccinated within the last 12 months may be present within the compartment
- Improved animal ID and traceability system to meet the standard
- Improved livestock enterprise income but no finishing prior to slaughter
- Access to a wider range of markets for beef in SADC, including South African markets
- Wildlife corridors cut off in East Caprivi and development of new ones precluded
- Development of wildlife based tourism and CBNRM restricted with no growth beyond current levels

In the cost-benefit analysis model for Scenario 4 capital costs involved new initial capital of N\$46 million for compartment fencing (30% electrified), N\$17 million for improvement/extension of quarantine station and abattoir upgrade as for Scenario 2. They involved ongoing annual expenditure on capital (new and replacement) by DVS amounting to N\$4.4 million over the analytical period. It also involved ongoing annual expenditure on capital (new and replacement) by MET, donors and NGOs, amounting to N\$7.9 million over the analytical period. It further involved ongoing annual expenditure on capital (new and replacement) by other supporting agencies, including MLR and MAWD, amounting to N\$3.8 million over the analytical period.

Scenario 4 involved new annual recurrent variable and fixed costs rising from N\$23.2 million in year one to N\$49.9 million in year 10 after which the costs stabilized. These costs were made up of the same items as Scenario 1, except that surveillance costs were 50% higher, FMD control costs were 80% less, the DVS costs were 50% higher, and CBNRM costs were 100% higher.

Scenario 4 involved new benefits in terms of annual net national income contribution rising from N\$35.7 million in year one to N\$76.8 million in year 10, after which income growth stabilized. This income was generated through the same activities as for Scenario 1, except that livestock producer incomes were 20% higher, and the income contribution from the abattoir increased 2.5 fold. Incomes for wildlife use and CBNRM were unchanged from those in Scenario 1.

The implementation of Scenario 4 is considered difficult, given the requirements for maintaining biosecurity described above. These would be disruptive to the lives of the people living in the area and to visitors, especially those who do not own or have an interest in cattle. The capital costs (notably the fencing costs) assumed for Scenario 4 are conservative and may in reality be much higher.

Attention was given to correctly defining the project boundaries for the cost-benefit analysis models, including **only** scenario-specific investments, and the incremental benefits attributable to those. Thus, the models contained the incremental capital costs and annual recurrent costs as described above for each scenario. The benefits embraced the resultant net national income contributions, as described for

the scenarios. Sensitivity analysis, with varying assumptions regarding wildlife and livestock sector growth, and processing viability, were conducted to see how robust the basic findings were.

Benefits growth was planned for each scenario within the constraints of the scenario, the particular sector, and physical and social carrying capacity limits. Data from Barnes et al. (2012) Kruger, et al. (2012), Humavindu et al. (2011), Jordaan (2012), NACSO (2008), MET (2007, 2008), Ministry of Finance (2010), WTTC (2006), NTB (2008) and Naziri (2012) were used to assist in ensuring that scenarios were realistic.

5 Results and interpretation

5.1 Enterprise analysis

Tables 5.1 and 5.2 show some key parameters for the more significant enterprise models used in the analysis. The main differences between the two livestock models reflect scale, herd productivity (related to stocking rate), and products. The wildlife viewing lodge investment is typical for the conditions prevalent in the KAZA TFCA where tourism is developed. Table 5.3 shows some of the values associated with typical financial (private) and economic models for livestock and tourism used in the analysis. In Appendix 2 of this report, details are shown for two examples of these models. Table 5.4 shows some basic values for the abattoir and processing models. Confidentiality considerations preclude more detail being included on these individual models. The processing model is conceptual and only provides an indication of how processing may improve the value of MeatCo operations in Caprivi.

Table 5.1: Basic parameters applied in the primary livestock land use enterprise models in Caprivi, 2012

Parameters	Livestock enterprise	
	Traditional small scale	Cattle post
Land used (hectares)	180	6,400
Number of cattle (head)	35	760
Number of goats (head)	3	59
“Economic” carrying capacity (ha/LSU*)	13	13
Stocking rate (ha/LSU*)	6.5	8.3
Calving rate (% cows)	60%	63%
Calving rate (% heifers)	60%	63%
Mortality rate (% calves)	18%	9%
Mortality rate (% others)	11%	5%
Bull rate (% herd)	5%	5%
Goat reproductive rate	20%	25%
Average total herd growth rate (%/annum)	0.70%	8%
Cattle off-take rate (% herd)	9%	12%
Goat off-take rate (% flock)	20%	25%
Milk yield (litres/lactating cow/annum)	158	n/a
Transport draft (days/span of 4/annum)	55	n/a

* Large stock unit - metabolic equivalent of one 450 kg ox

Generally, wildlife-based enterprises have high economic rates of return relative to their financial rates of return, while with livestock this is not the case. It demonstrates economic comparative advantage for wildlife use in Caprivi. Small-scale livestock generates relatively high private values compared to its economic values per hectare. This demonstrates the effect of subsidies and suggests that these are economically inefficient. Hunting economic values per hectare tend to be low compared to those for wildlife viewing. This is due to the large areas taken up by hunting concessions, compared with wildlife viewing ones.

Table 5.2: Basic parameters applied in the wildlife viewing tourism enterprise models in Caprivi, 2012

Parameters	Woodland/floodplain setting
Land used (hectares)	14,400
Game density (ha/LSU equivalent*)	16
“Economic” carrying capacity (ha/LSU*)	13
Hectares per tourist bed	800
Number of lodges	1
Number of tourist beds	18
Occupancy rate at stability (per annum)	54%
Average length of stay (days)	3
Daily tariffs - Up-market Lodge (N\$)	3,580
Daily tariffs - Roadside Lodge (N\$)	1300
Daily tariffs - Mid-market Lodge (N\$)	1300
Daily tariffs - Camping (N\$)	172

* Large stock unit - metabolic equivalent of one 450 kg bovine ox

Table 5.3: Values for typical primary livestock and wildlife land use enterprises in Caprivi (N\$, 2012)

	Livestock		Wildlife	
	Small scale	Cattle post	Hunting	Viewing
Financial data				
Initial capital	134,160	1,437,450	4,790,230	15,965,020
<i>At stability</i>				
Gross turnover	47,550	513,190	6,581,810	20,352,670
Financial costs variable	10,860	325,750	2,424,350	10,397,180
Financial costs fixed	14,410	110,310	3,085,480	4,171,290
Entrepreneur net cash income	22,270	77,120	1,071,970	5,784,190
Local livelihood private income	31,740	36,450	560,270	845,640
<i>Overall return</i>				
Financial IRR* (10 years)	20%	8%	12%	35%
Financial NPV** (8%, 10 years)	65,860	-25,980	297,000	23,637,560
Wage bill	9,470	36,450	1,193,440	1,545,480
Economic data				
Initial capital	117,120	1,294,110	4,536,230	14,599,850
<i>At stability</i>				
Gross output	39,650	583,360	6,209,280	22,052,420
Economic costs	26,390	356,220	1,493,310	12,647,770
Incremental contribution to GNI***	13,260	227,140	2,165,400	9,404,650
Incremental contribution to NNI****	10,750	196,160	1,817,270	8,495,150
<i>Overall return</i>				
Economic IRR* (10 years)	24%	12%	35%	70%
Economic NPV** (8%, 10 years)	75,840	133,650	7,707,700	46,428,430
Number of jobs	1.3	4	12	28
<i>Measures per hectare</i>				
Incremental contribution to GNI***/ha	74	35	27	650
Incremental contribution to NNI****/ha	60	31	23	590
Community income/ha	180	6	7	59
Entrepreneur net cash income/ha	120	12	13	400
Initial economic capital/ha	650	200	57	1,010
Economic gross output/ha	220	91	78	1,530

* Internal rate of return

** Net present value

*** Gross national income

**** Net national income

Table 5.4: Enterprise values for beef slaughter and processing in Caprivi (N\$, 2012)

Beef slaughter and processing facility	Abattoir base*	Abattoir upgraded**	Processing plant***
<i>Financial values</i>			
Financial rate of return (10 years)	-22%	6.2%	9.4%
Annual local livelihood contribution	1,390,000	1,390,000	3,626,500
<i>Economic values</i>			
Initial capital	26,610,300	26,828,800	68,593,000
Annual gross output	38,409,800	45,027,900	120,133,400
Annual economic costs	32,086,300	32,103,800	85,156,000
Annual gross national income contribution	6,323,400	12,924,100	34,977,300
Annual net national income contribution	4,898,500	11,499,100	31,414,900
Economic rate of return (10 years)	25%	49%	51%
Economic net present value (8%, 10 years)	22,278,500	60,034,600	163,383,500

* Current situation with closure for 50% of time or more

** Closure for only 3 months per annum, improved chiller and quarantine capacity

*** Concept model based on cannery

5.2 Cost-benefit analysis

Table 5.5 shows the most important findings for this project. It shows the economic rate of return and economic net present value for each scenario, measured over periods of ten, 20 and 30 years. Figure 5.1 shows the economic net present value findings. Returns to the nation in terms of economic growth (inclusive of job creation) are high with scenario 3 and with scenario 2, and low with the current scenario 1, and with scenario 4. Scenarios 1 and 4 are essentially non-viable economically.

Scenarios 2 and 3 exhibit very high economic efficiency relative to the status quo (Scenario 1), and it appears that adoption of policy along these lines is highly desirable. It appears that processing can add value significantly, but this will depend on the finding of definitive feasibility studies on processing, which are underway. Scenario 4 is economically undesirable, and this compounds the huge technical problems associated with it.

Tables 5.6, 5.7, 5.8 and 5.9 show the results of the main sensitivity analyses conducted for each scenario. The more optimistic projections for Scenarios 1 and 4 raise these to being marginally economically viable. The cost assumptions applied in the basic model for Scenario 4 were conservative, and higher costs should arguably be applied. With the application of higher capital costs the economic returns for the scenario become entirely and significantly negative.

Table 5.5: Basic cost-benefit analysis results - returns to policy options in direct net national income (N\$, 2012)

Economic measure and scenario	Period of analysis		
	10 years	20 years	30 years
<i>Economic rate of return (%)</i>			
Scenario 1: Status quo	-8.5%	6.7%	9.1%
Scenario 2: CBT article 8.2.25	51.0%	52.1%	52.2%
Scenario 3: CBT processing	53.3%	54.2%	54.2%
Scenario 4: FMD-free compartments	-2.9%	7.3%	9.1%
<i>Economic NPV (@8%, N\$, 2012)</i>			
Scenario 1: Status quo	-33,366,100	-6,678,800	7,500,900
Scenario 2: CBT article 8.2.25	127,816,100	228,978,600	275,836,400
Scenario 3: CBT processing	251,645,900	428,547,100	510,486,600
Scenario 4: FMD-free compartments	-35,654,800	-4,652,400	9,707,600

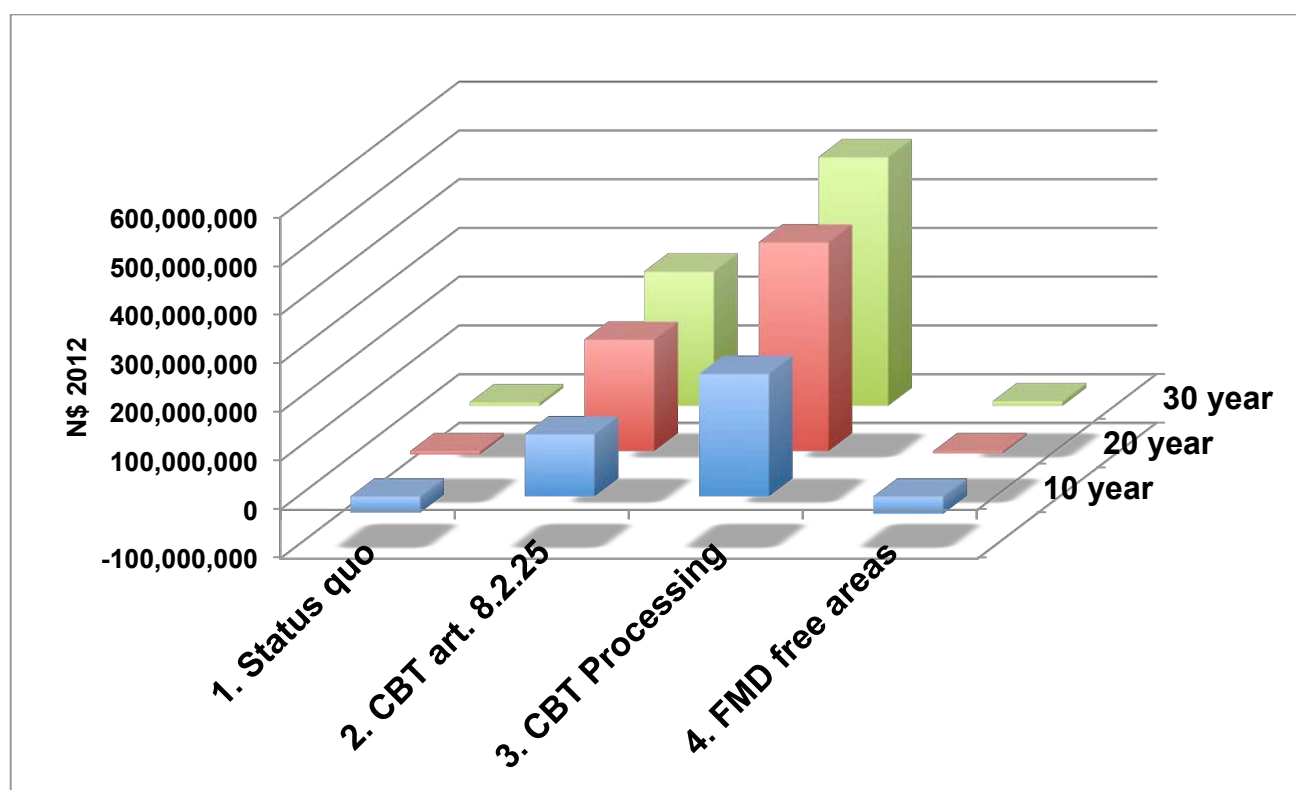


Figure 5.1: Basic results for cost-benefit analysis showing economic net present values (ENPVs) measured over 10, 20, and 30 years for each policy option (N\$, 2012)

Table 5.6: Sensitivity analysis on the cost-benefit analysis results for Scenario 1 - returns to investment in direct net national income (N\$, 2012)

Scenario and variation from base case	Period of analysis		
	10 years	20 years	30 years
Scenario 1: Status quo			
<i>Economic rate of return (%)</i>			
Base case	-8.5%	6.7%	9.1%
Wildlife land use NNI 20% higher	3.0%	14%	15%
Livestock land use NNI 10% higher	-1.7%	11%	12%
<i>Economic net present value (@ 8%, N\$, 2012)</i>			
Base case	-33,366,100	-6,678,800	7,500,900
Wildlife land use NNI 20% higher	-11,275,300	29,335,300	50,327,500
Livestock land use NNI 10% higher	-21,093,400	13,328,900	31,293,400

Table 5.7: Sensitivity analysis on the cost-benefit analysis results for Scenario 2 - returns to investment in direct net national income (N\$, 2012)

Scenario and variation from base case	Period of analysis		
	10 years	20 years	30 years
Scenario 2: CBT article 8.2.25			
<i>Economic rate of return (%)</i>			
Base case	51%	52%	52%
Wildlife land use NNI 20% higher	66%	67%	67%
Livestock land use NNI 10% higher	59%	60%	60%
<i>Economic net present value (@ 8%, N\$, 2012)</i>			
Base case	127,816,100	228,978,600	275,836,400
Wildlife land use NNI 20% higher	165,920,800	286,654,000	342,576,900
Livestock land use NNI 10% higher	148,016,200	259,553,500	311,216,900

Table 5.8: Sensitivity analysis on the cost-benefit analysis results for Scenario 3 - returns to investment in direct net national income (N\$, 2012)

Scenario and variation from base case	Period of analysis		
	10 years	20 years	30 years
Scenario 3: CBT processing			
<i>Economic rate of return (%)</i>			
Base case	53%	54%	54%
Wildlife land use NNI 20% higher	62%	62%	62%
Livestock land use NNI 10% higher	58%	58%	58%
Beef processing NNI 50% lower	31%	33%	33%
<i>Economic net present value (@ 8%, N\$, 2012)</i>			
Base case	251,645,900	428,547,100	510,486,600
Wildlife land use NNI 20% higher	292,571,700	488,985,400	579,962,900
Livestock land use NNI 10% higher	273,115,200	460,252,500	546,933,200
Beef processing NNI 50% lower	126,855,800	244,260,000	298,640,900

Table 5.9: Sensitivity analysis on the cost-benefit analysis results for Scenario 4 - returns to investment in direct net national income (N\$, 2012)

Scenario and variation from base case	Period of analysis		
	10 years	20 years	30 years
Scenario 4: FMD-free compartments			
<i>Economic rate of return (%)</i>			
Base case	-2.9%	7.3%	9.1%
Capital costs 50% higher	Negative	-9.5%	-4.2%
Livestock land use NNI 10% higher	3.5%	12%	13%
<i>Economic net present value (@ 8%, N\$, 2012)</i>			
Base case	-35,654,800	-4,652,400	9,707,600
Capital costs 50% higher	-122,425,400	-114,589,400	-110,959,900
Livestock land use NNI 10% higher	-15,563,700	26,707,100	46,286,600

The analysis model allowed for the assessment of the contribution to private incomes of local residents within Caprivi resulting from the policy option in question. Table 5.10 and Figure 5.2 show the aggregate annual gross private values in salaries, wages, and enterprise net incomes accruing to local households in Caprivi for the different basic policy scenarios. The values are attributable to year 30 of the basic development scenarios. They are compared with the national income contributions, also attributable to year 30, for the scenarios. *It must be noted that the values do not take account of the capital and recurrent development costs associated with each option, and thus, they cannot be used to gauge the economic viability or desirability of scenarios.*

Table 5.10: Livelihood values associated with policy options - relative annual contributions in year 30 in terms of national income and aggregate private incomes for Caprivi residents (N\$, 2012)

Year 30 annual values for scenario	Net national income	Local private incomes
Scenario 1: Status quo	56,784,900	22,269,500
Scenario 2: CBT article 8.2.25	81,933,600	28,421,200
Scenario 3: CBT processing	111,151,500	31,953,000
Scenario 4: FMD-free compartments	76,776,100	28,689,700

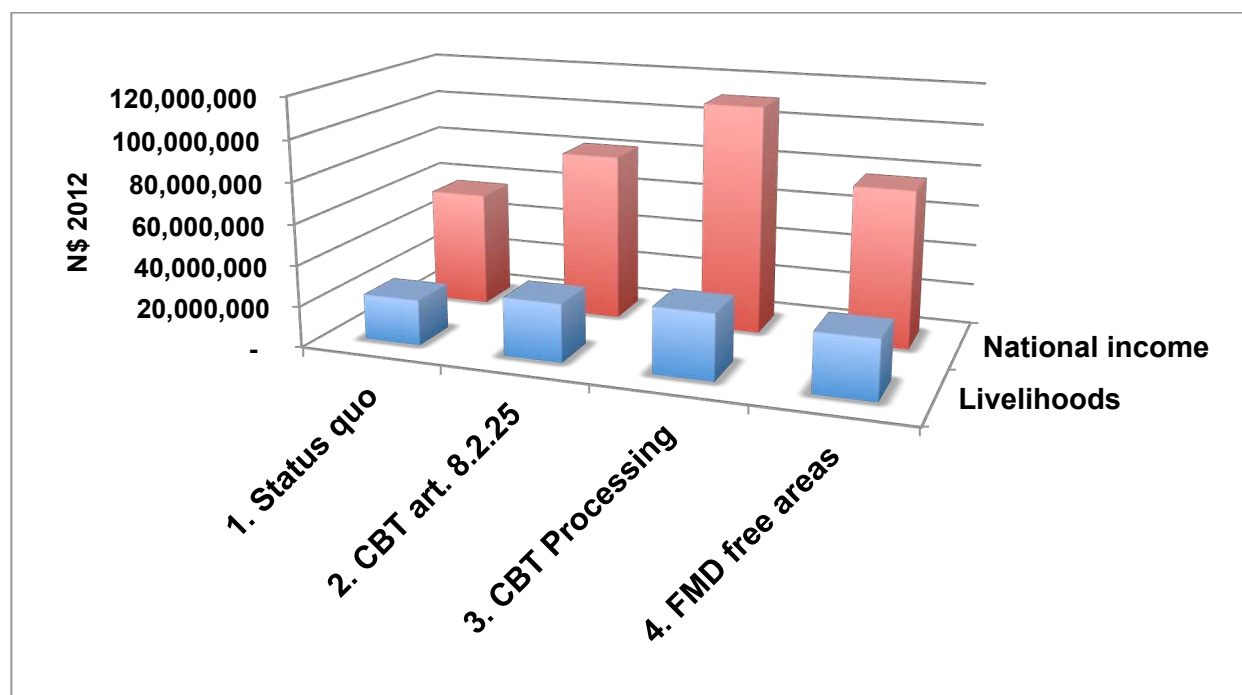


Figure 5.2: Annual contributions to local livelihoods, and the national economy for the different policy options, before consideration of policy option development costs (N\$, 2010)

What the results in Figure 5.2 do show is the degree to which gross benefits generated in the different scenarios accrue to households within Caprivi. Subsidies at the household enterprise level improve the

livelihoods value for Scenario 4, although this is an economically non-viable option. Of the considerable incomes generated through wildlife-based tourism with comparative advantage in Scenarios 2 and 3, a lesser proportion tends to accrue to local households. The findings point to the need for examination of policy on subsidies to ensure that they are economically efficient.

6 Conclusion

The finding of this project is essentially that a scenario of development in Caprivi along lines where value chain risk management incorporating CBT principles (accompanied by appropriate animal disease management activities) becomes central to formal beef production and trade is highly likely to be economically efficient. The economic costs associated with this would be outweighed by new economic gains in terms of wildlife use incomes, abattoir viability, and livestock farming incomes. Animal disease control is applied differently but remains important, income growth is more diverse and less risky, and ecological values are enhanced. The introduction of spatially segregated, fenced FMD-free compartments would be very economically inefficient. Here, significant loss of growth in wildlife incomes, and significant costs for fencing would outweigh any new economic gains in abattoir viability, and livestock farming incomes.

The findings have importance for development policy in the KAZA TFCA, and possibly other TFCAs in southern Africa. They strongly suggest that initiatives aimed at introduction of CBT as part of a value chain approach to sanitary risk management offers significant economic potential. At the same time, this approach can assist in meeting other TFCA objectives such as maintenance of diverse ecosystems with greater biodiversity across large, connected landscapes - reducing risk to natural systems and providing greater resilience in the face of, for example, natural catastrophes, disease outbreaks and climatic challenges.

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Economic analysis of land use policies for livestock, wildlife and disease management in Caprivi, Namibia, with potential wider implications for regional transfrontier conservation areas

Appendices

JI Barnes

**With Support from the Wildlife Conservation Society's Animal & Human Health for the Environment And Development (AHEAD) Program & World Wildlife Fund
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Appendix 1: Scope of work for economic analysis for the WCS-AHEAD, WWF Animal Disease Management Project in Caprivi, Namibia - FINAL August 01, 2012

Background

The KAZA TFCA contains a mosaic of protected areas, interspersed with extensive communal lands in which small-scale pastoral and agro-pastoral land use is practiced. The success of conservation in KAZA is heavily dependent on successful rural development and sustainable poverty alleviation in its communal lands.

Apart from localized areas of crop production, mainly for local markets, multi-species rangeland-based land use systems involving wildlife and livestock have economic comparative advantages in the KAZA TFCA. This has been shown from numerous research and analytical studies in KAZA and around it in similar semi-arid to sub-humid biomes. Work carried out in Zimbabwe and in Botswana (Barnes et al. 2001) and Zimbabwe (Jansen et al. 1992) is relevant. Economically, socially, and environmentally sustainable development in KAZA depends on complementary use of rangeland for wildlife and livestock. However optimization of spatial allocation of land between different livestock and wildlife uses is hampered by current geographically-based animal disease management strategies prevalent in southern Africa.

The Caprivi in Namibia is in the core of KAZA, and here livestock and wildlife populations generally exist together. Caprivi region is classified as a Foot and Mouth Disease (FMD) infected zone, and this in turn reduces the potential for commercial production of meat from livestock. Disease control strategies applied in Caprivi tend to reduce the potential for use of wildlife through tourism as attempts are made to keep wildlife, especially buffalo, away from areas occupied by livestock limiting expansion of tourism development.

Several initiatives are examining alternative approaches to animal disease management in the KAZA TFCA, with the aim of ensuring more economically efficient development, and full exploitation of the area's comparative advantages. More specifically, projects in the Caprivi are examining the technical, economic, and social merits of introducing the commodity-based trading (CBT) approach to livestock disease management.

WCS-AHEAD, WWF and partners intend to further this work by conducting a comprehensive financial and economic cost-benefit analysis of policy options related to the possible introduction of CBT in Caprivi. The objectives of the project will be as follows:

1. Policy options for choices on sustainable land use, particularly as these choices affect local level livelihoods and the national economy, will be examined in term of their costs and benefits.
2. Recommendations will be made as to the most technically, socially and economically beneficial strategies for disease control, land use allocation, and overall development for the Caprivi as part of KAZA.
3. The cost/benefit model will be developed as a tool for future analysis of livestock and wildlife development options in Caprivi and also the wider KAZA TFCA.

The objectives aim to meet the overall goal, which is to find ways to influence market access and manage land-use choices in the KAZA region to optimize livelihood and economic welfare.

The study will focus on Namibia's Caprivi, because it is in the core of KAZA, has a suitable range of ecosystems and land uses, has representative market development for multi-species systems, has a representative policy environment, has incidence of animal disease including FMD, and has reasonably good data. Depending on the outcome, work may then be extended to other parts of KAZA. This document is for a scope of work (SoW) for the financial and economic cost-benefit analysis of CBT in Caprivi ("the project").

The study will seek the approval, guidance, and cooperation of the stakeholder agencies including MET, MLR, MAWF, and other actors engaged in study area development initiatives.

Cost-benefit Analysis (CBA) of land use and policy options

The project will apply standard cost-benefit investment models with discounted cost and benefit flows to measure the values for livestock and wildlife land uses, as well as values for different livestock-wildlife development scenarios.

The key value to be sought in these analyses will be the contribution to Namibia's **national income**. This will be specifically measured as the annual incremental change in gross and net national income resulting from the investment in question. This will be the **economic** value or value to society. Associated with that, and measured in tandem, will be the measure of annual changes in livelihood value, which is reflected in net financial and in-kind benefits accruing to investors in the activities and options. This will be the **private** value which indicates financial incentive for investment. Positive net economic values reflect economic efficiency, and desirability for development. Given economic efficiency, the private incentives for use/ investment can be ensured through appropriate policy measures.

To this end existing private and economic budget/cost-benefit models for current specific income-earning enterprises will be updated and modified to determine the livelihood and economic values for:

- Livestock enterprises: small scale village, cattle post, and fenced commercial breeding and rearing as well as finishing systems. Household/farmer level investment models, involving open access, individual, and community-based, range management, as well as associated small scale crop production.
- Wildlife enterprises: medium, large, and small scale use of wildlife for non-consumptive and hunting tourism, wildlife harvest, as well as associated use of forest products and fish. Private, state, and community-based investment models, set in protected areas and communal land conservancies.
- Multi-system enterprises: community level investments in natural resource use management (CBNRM). Community-based management and use of wildlife rangelands typified by conservancies. Where possible and relevant, associated large scale commercial crop production and other land uses will be modelled.

Similarly, private and economic budget/cost-benefit models will be developed for:

- The existing Katima Mulilo abattoir, and any new or upgraded abattoir which might be required for the introduction of CBT.

Analysis will be made of the investments by government, donors, and NGOs, in the livestock and tourism, sectors in Caprivi. This will include costs of provision of services in animal disease control (stock vaccination, fencing, ear-tagging, as appropriate), net subsidies to livestock, wildlife and CBNRM land uses, net subsidies to the Katima Mulilo abattoir, net subsidies in meat market chains, and net subsidies to the tourism sector.

Market assessment will be conducted to determine the product values and market characteristics to be expected in different markets and market segments for livestock meat and wildlife-related tourism products.

Results of all these analyses will be used as building blocks for the broader analysis of the costs and benefits of policy change in the management of animal disease. Several distinct scenarios will be developed and analyzed to ensure that policy options are fully covered, and their selection will be based on current findings, as well as other analytical work conducted to date. Scenarios will incorporate changes to land uses and spatial land use allocation, animal disease management, animal finishing, product processing, market access, product pricing, input pricing, and different levels of risk, which may result from implementation of CBT policy. Scenarios will be developed and selected with the essential multidisciplinary contributions of all team members, coordinated either in physical meeting or virtually.

The direct use values for livestock and wildlife will be examined in a spatial context, along with backward and forward linked values, other associated direct use values (such as for crops and forests), and the indirect use values of associated ecosystem services (such as for carbon, wildlife refuges and corridors, and water recharge and purification).

Values determined above would be applied in cost-benefit analysis models of the economic impacts of different scenarios in the Caprivi context. Depending on feasibility, the cost-benefit models may be further developed using Bayesian Network modeling, which could enable inclusion of a wider range of values.

As stated, the key values to be derived from cost-benefit models will be gross and net incomes accruing to Caprivi and Namibian households (livelihood value), and the incremental changes to Namibia's national income (economic value). In this context the effect of animal disease management strategies on these values and their contribution to economically desirable, environmentally sustainable development will be appraised.

Data needs

A moderately well-developed empirical data-base is in place for Caprivi which can be drawn on for these analyses. Further data needs are likely to be:

- Existing empirical data on the land and natural resource use enterprises involved is several years old. These data will need, where possible to be checked and updated. This should be

possible with results from animal population baseline data gathering, selected focus group meetings, key informant interviews, and household survey, to be conducted as part of the project by WWF and IRDNC. Ecological, institutional and land use specialists will assist the economist.

- In addition data on the broader economy will need to be sought. Such data would include, for example those on the backward, forward, and lateral linkages of enterprises, government investments and subsidies in the multispecies systems, market/alternative market characteristics and trends, policy environment and change. All these data will be acquired from diverse sources, including government agencies, government companies, the private sector, NGOs, donors, researchers, and international sources. Here, the economist will be supported by the Vet/CBT specialist, the ecologist, a meat processing specialist, and a meat marketing specialist.
- Data on the ecological processes and economic features associated with ecosystem services (indirect use values) in Caprivi will need to be gathered and updated where available. Here the economist will be supported primarily by the team ecologist(s).
- Data and information on the technical, environmental, and political, feasibility of alternative animal disease control policies, the design of such policies with details of expected necessary investments will be needed. This information will be obtained primarily through the disease control experts in the project, and will require a multidisciplinary collaboration of all team members. Decisions on assumptions to be used will be decided by the Economist, with the Vet/CBT specialist, the ecologist(s) a CBNRM specialist(s), a meat marketing specialist and a meat processing specialist.

Expertise and activities

The data collection and analysis will require the services of an **economist** with a sound knowledge of the natural resource values involved in the study, and the Namibian economy. Some data collection might be carried out by an economics assistant.

The project will require the active support and involvement of one or more **ecologists**, one or more **Vet/CBT specialists**, a **CBNRM specialist**, a **meat marketing specialist**, and a **meat processing specialist**. Where possible and depending on individual's skills, individual team members may be able to supply more than one set of skills.

A core team consisting of an economist with some economics assistance, one (or more) vet/CBT specialist(s), and one (or more) ecologist(s), will be supported with *ad hoc* inputs from by the additional skills mentioned. These specialists will likely also have roles in other technical analyses related to but not directly applicable to the cost-benefit analysis. Thus their inputs might be shared with other aspects of work being undertaken by WCS-AHEAD, WWF and partners in the Caprivi. Table 1 presents a description of anticipated activities for team members.

Table 1: Envisaged activities to be undertaken by team members

<p>1. <u>Data - livestock & wildlife land uses</u> Ecologist and CBNRM specialist: Desk study & situational analysis; land allocation; human, <u>cattle</u> & wildlife demographics; numbers & distribution spatially and temporally; land use conflict issues. Economist: Desk study & situational analysis: ecotourism & livestock economics; household benefits from different land uses.</p> <p>2. <u>Data - abattoir, processing</u> Meat processing specialist: Technical aspects of processing; capital & recurrent expenditure, meat volumes In relation to disease constraints and seasonality of production; employment; fluctuation in numbers of personnel due to disease outbreak and abattoir closure; and subsequent start up issues. Vet/CBT specialist: Disease constraints and management; role of quarantine camp; livestock movements and controls. Economist: Transaction costs of moving from traditional agro-pastoralist production system to commercial production system; Present C/B versus future C/B.</p> <p>3. <u>Data - government expenditures</u> Vet/CBT specialist: Disease control and management of quarantine camp; livestock movements and controls; fences-game &/or cattle-capital and maintenance costs-redline and international fences; FMD specific control measures and costs, e.g. vaccination. Ecologist: Economic and financial Implications for land use options. Economist: Financial and economic investments/expenditures - analysis of livestock, wildlife and tourism components - by Government, donors (KfW, BMZ) NGOs (IRDNC, WCS, WWF) and private sector.</p> <p>4. <u>Market analysis - meat & tourism</u> Meat market specialist: Market analysis for communally produced beef-local, regional and international by type of product, i.e. cuts; characterise market demand and its seasonality; identify market resistance and why; identify informal markets. Vet/CBT specialist: Identify market fears, resistance and why; identify producer risk-averse strategies in the context of TADs to accommodate market fears; which markets are least risk averse? Where are these markets? Ecologist: Identify and understand market requirements for environmentally friendly “green” produce; no additives; no hormone supplementation; free-range; organic, etc. Economist: Economic and financial analysis of formal and informal meat markets; economic and financial analysis of tourism markets; market niche and preferences, e.g. communal conservancies.</p> <p>5. <u>Models - livestock & wildlife land use</u> Ecologist: Assist with biophysical components of models. Economist: Lead modelling with input as needed from ecologist and others; undertake sensitivity analyses.</p> <p>6. <u>Models – abattoir</u> Economist: Lead modelling with input as needed from others, especially Meat Board.</p> <p>7. <u>Scenario development workshop</u> Vet/CBT specialist, Ecologist, CBNRM specialist, Meat processing specialist, Meat market specialist, Economist: conduct workshop to develop the most appropriate scenarios for analysis.</p> <p>8. <u>Cost-benefit analysis</u> Economist: On basis of workshop develop best approach to C/B analysis; incorporate other approaches, conduct analyses of scenarios.</p> <p>9. <u>Report</u> Vet/CBT specialist, Ecologist, CBNRM specialist, Meat processing specialist, Meat market specialist, Economist: Prepare technical report.</p>

Table 2 below provides an illustrative breakdown of the project activities and levels of effort for each team member within these activities. As described here, the project may require up to five team months, and some 171 person-days, with up to 72 days being required for the specific economics inputs, up to 29 being required for the ecologist, up to 11 for the CBNRM specialist, up to 26 for the Vet/CBT specialist up to 23 for the meat processing specialist, and 10 for the meat market specialist. Some 30 % of these days would be likely to be spent in the field.

Conclusion

It is considered that with a cost-benefit analysis study formulated as described in the scope of work above, WCS-AHEAD, WWF and partners in the Caprivi will be able to complement as well as contribute positively to the technical and economics work which has been, or is currently being, carried out in the Caprivi and KAZA in relation to CBT and animal disease management. The project will enumerate sound economic, social and environmental parameters to help guide decisions on different potential livestock / wildlife / multispecies rangeland use options for the study area. It will also result in the development of a tool for ongoing use in planning of sound development the broader KAZA TFCA.

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Table 2: Envisaged level of effort (days) for economist and support team

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Days	
Month	1				2				3				4				5				Team	
Data - livestock & wildlife land uses																						
Ecologist	3	4																				7
CBNRM specialist		2																				2
Economist		2	6																			8
Meat processing/market specialist		1																				1
Data - abattoir, processing																						
Meat processing/market specialist			3	4																		7
Vet/CBT specialist				3																		3
Economist				2	2																	4
Data - government expenditures																						
Vet/CBT specialist						4																4
Ecologist					3																	3
Economist						6	3															9
Meat processing/market specialist						2																2
Market analysis - meat & tourism																						
Meat processing/market specialist							6	6														12
Vet/CBT specialist							3	3														6
Ecologist								2														2
Economist								4														4
Models - livestock & wildlife land use																						
Ecologist									4													4
Economist									3	4	3											10
Models – abattoir																						
Economist												3	3									6
Scenario development workshop																						
Vet/CBT																3						3
Ecologist																3						3
CBNRM specialist																3						3
Meat processing/market specialist																3						3
Economist																3	3					6
Cost-benefit analysis																						
Economist																6	4					10
Report																						
Vet/CBT specialist																		4	4	2		10
Ecologist																		4	4	2		10
CBNRM specialist																		6				6
Meat processing/market specialist																		4	4			8
Economist																		6	6	3		15
TOTAL Days	3	9	9	9	5	12	12	15	7	4	3	3	3	3	15	6	4	24	18	7		171

Appendix 2: Examples of financial and economic natural resource use enterprise models

Appendix 2.a: Example of medium scale wildlife viewing enterprise

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

ASSUMPTIONS*

Production System:	18	bed, up-market lodge offering all inclusive, guided, wildlife viewing.						
Site:	High quality, unfenced area with river/floodplain frontage and mixed forest of riparian thicket and north eastern woodland and floodplain plant and wildlife, including key wildlife species, in Caprivi region							
Game Density:	100%	6.23	LSU Equivalents/Sq. Km. or,		16	Hectares Per LSU Equivalent		
Carrying Capacity:	100%	0.125	Tourist Beds/Sq. Km. or,		800	Ha. Per Tourist Bed		
Concession Size:	14400	Hectares or,		144	Square Kilometres			
Tourist Category:	Overseas Adults	55% 90%	Regional Children	20% 10%	Resident	5%	Citizen	20%
Occupancy Rate:	100%	57.5%	Average Length of Stay:		3 Days			
Daily Tariffs (NAD):	135%	Overseas Children	4833 75%	Regional of Adult Price	4833	Resident	4833	Citizen 4833
Capital Item Prices:	135%	(Variation from Normal for Sensitivity Analysis)						
Capital Sources:	100%	Loan =	25%	Equity =	75%	and:	100%	Foreign ^r 25% Domestic 75%
Interest Rates:	50%	Rate for Capital Loans:		9%	Rate for Working Capital Loans:		14%	
Working Capital as Proportion of Annual Operating Costs:	20%							
Park Entry Fees:	100%	Fee Per Tourist Night/Day:			0.00			
Land Rental and Resource Royalty (NAD):	100%	Rental:	0.00	Per Ha.	100%	Royalty:	0.00%	of Turnover
ManPower Needs:	100%	Managers Management:	6	Skilled Labour Foreign	7 0%	Unskilled Labour Citizen	15 100%	
Shadow Wage Adjustment:	100%	Managers	1.00	Skilled Labour	1.00	100%	Unskilled Labour	0.30
Foreign Exchange Premium:	100%	10%	Adjustment Factor =		1.10			
Tax Adjustments:	100%	General Sales Tax:	15%	Import Taxes: from SACU:	0%	to SACU:	n/a	
Discount Rates:	100%	Financial Discount Rate:		10%	Economic Discount Rate:		10%	
Opportunity Cost of Capital:	100%	10%						

Static models depict enterprise at full Production. Static financial model includes interest, amortisation government fees, royalties and land rentals. Static economic model takes foreign inflows and outflows into account, excludes other interest and transfers and values enterprise in economic prices before land and government costs

Dynamic models Presented over 5 and 10 years, to measure IRR and NPV. Financial dynamic model, at constant Prices, excludes interest and dePreCiation, and includes asset residual values. Economic model includes foreign inflows and outflows, and measures value of enterprise in economic prices before inclusion of land costs and public expenditures.

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 1: CAPITAL REQUIREMENTS

ITEM	QUANT.	PRICE NAD	FINAN. COST	LIFE Years	AMORT. + INT.	DEPREC- IATION	ECON. DEPR.	FOREX ADJ.	TAX ADJ.	ECON. COST
FIXED CAPITAL										
DOMESTIC ITEMS										
Houses Manager	3	233539	945834	40	103613	23646	20099	1.00	0.85	803959
Houses Labour	18	35119	853385	40	93485	21335	18134	1.00	0.85	853385
Storerooms	1	28930	39055	40	4278	976	830	1.00	0.85	33197
Tourist Lodges	1	4582993	6187040	40	677768	154676	131475	1.00	0.85	5258984
Borehole	0	438984	0	40	0	0	0	1.00	0.85	0
Reservoir (Whole Water System)	1	1141358	1540834	40	168793	38521	32743	1.00	0.85	1309709
Reticulation/Pans	0	7862	0	40	0	0	0	1.00	0.85	0
Firebreaks	0.00	10745	0	40	0	0	0	1.00	0.85	0
Hiking Trails	0.00	1572	0	40	0	0	0	1.00	0.85	0
Power/Road to Site	1	87797	118526	40	12984	2963	2519	1.00	0.85	100747
CONTINGENCIES @ 5%			484234	40	53046	12106	10290	1.00	0.85	411599
SUBTOTAL DOMESTIC ITEMS			10168907							8771579
TRADABLE ITEMS										
Boma	0	91990	0	20	0	0	0	1.10	0.85	0
Hiker Camps	0	0	0	15	0	0	0	1.10	0.85	0
Pump/Windmill	1	170352	229975	15	28530	15332	14335	1.10	0.85	215027
Fencing Perimeter	0.00	153658	0	15	0	0	0	1.10	0.85	0
Fencing Internal	0.00	139689	0	15	0	0	0	1.10	0.85	0
CONTINGENCIES @ 5%			11499	15	1427	767	717	1.10	0.85	10751
SUBTOTAL TRADABLES			241474							225778
SUBTOTAL- FIXED CAPITAL			10410381							8997357
MOVABLE CAPITAL										
TRADABLE ITEMS										
Land Cruisers/Trucks/Vans	4	472839	2553330	4	788133	638332	596841	1.10	0.85	2387363
Tools/Office Equipment	1	77838	105081	6	23425	17513	16375	1.10	0.85	98251
Lodge Equipment	1	102486	138356	6	30842	23059	21561	1.10	0.85	129363
Boats	0	17297	0	6	0	0	0	1.10	0.85	0
CONTINGENCIES @ 10%			279677	6	62345	46613	43583	1.10	0.85	261498
SUBTOTAL TRADABLES			3076444							2876475
DOMESTIC ITEMS										
Capture: Small Antelope	0	0	0	40	0			1.00	0.85	0
: Large Antelope	0	0	0	40	0			1.00	0.85	0
: Ostrich	0	0	0	40	0			1.00	0.85	0
: Other Animals	0	0	0	40	0			1.00	0.85	0
Horses and Donkeys	0	0	0	40	0			1.00	0.85	0
CONTINGENCIES @ 10%			0	40	0			1.00	0.85	0
SUBTOTAL- DOMESTIC ITEMS			0							0
SUBTOTAL- MOVABLE CAPITAL			3076444							2876475
WORKING CAPITAL										
VARIABLE			2079437		280724			1.10	1.00	2287380
OVERHEAD			398765		53833			1.10	1.00	438641
SUBTOTAL- WORKING CAPITAL			2478201		334557					2726022
TOTALS			15965027		334557	2048670	995839	909501		14599854

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 2: STOCK COMPOSITION BY SPECIES AT FULL PRODUCTION

ITEM	HEAD	LSU FACTOR	LSU
Baboon	3	0.00	0
Black Rhinoceros	0	1.50	0
Buffalo	24	1.00	24
Burchells Zebra	6	0.63	4
Bushbuck	3	0.14	0
Bushpig	6	0.20	1
Cheetah	1	0.00	0
Crocodile	2	0.00	0
Duiker	4	0.07	0
Eland	4	1.00	4
Elephant	120	3.33	400
Giraffe	5	1.43	7
Hippo	12	1.50	18
Impala	20	0.14	3
Kudu	16	0.40	6
Lechwe	8	0.16	1
Leopard	2	0.00	0
Lion	1	0.00	0
Oribi	1	0.08	0
Ostrich	4	0.26	1
Reedbuck	4	0.14	1
Roan	2	0.65	1
Sable	6	0.40	3
Sitatunga	3	0.16	1
Spotted Hyaena	2	0.00	0
Steenbok	4	0.06	0
Tsessebe	2	0.26	1
Warthog	12	0.20	2
Waterbuck	0	0.37	0
Wildebeest	2	0.40	1
TOTAL	280		478
GAME DENSITY:	6.23	LSU PER SQ.KM.;	RANCH SIZE: 14400 HECTARES

TABLE 3: SALES AT FULL PRODUCTION

ITEM	VISITOR DAYS	@	RATE NAD/Day	FINANCIAL VALUE	FOREX ADJ.	TAX ADJ.	ECON. VALUE
Overseas Adults	2720	@	4833	13145172	1.10	1.00	14459690
Regional Adults	340	@	4833	1643147	1.10	1.00	1807461
Resident Adults	170	@	4833	821567	1.10	1.00	903724
Citizen Adults	680	@	4833	3286269	1.00	1.00	3286269
Overseas Children	302	@	3625	1094626	1.10	1.00	1204088
Regional Children	38	@	3625	137734	1.10	1.00	151508
Resident Children	19	@	3625	68464	1.10	1.00	75310
Citizen Children	19	@	3625	68867	1.00	1.00	68867
Optional Excursions				0	1.10	1.00	0
Bar				0	1.10	1.00	0
Crafts/Curios				86830	1.10	1.00	95513
TOTALS	4288		GROSS INCOME	20352676			22052430

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)
TABLE 4: VARIABLE EXPENDITURE AT FULL PRODUCTION

ITEM	FINANCIAL VALUES			FOREX ADJ.	TAX ADJ.	ECONOMIC VALUES		
	NAD/LSU	NAD/HA.	VALUE			NAD/LSU	NAD/HA.	VALUE
TRADABLE ITEMS								
Marketing Costs: Advertising	2127	71	1017634	1.10	0.85	1989	66	951488
: Agents Fees	4254	141	2035268	1.10	0.85	4680	155	2238794
Lodge Running Costs : Accomodation	8509	283	4070535	1.10	0.85	7956	264	3805950
: Transport	129	4	61657	1.10	0.85	121	4	57649
: Optional Activ.	0	0	0	1.10	0.85	0	0	0
: Bar	169	6	81041	1.10	0.85	158	5	75773
: Crafts/Curios	100	3	48046	1.10	0.85	94	3	44923
Fodder and Supplements	0	0	0	1.10	0.85	0	0	0
Offtake Costs: Ammunition	0	0	0	1.10	0.85	0	0	0
: Supplies and Packaging	0	0	0	1.10	0.85	0	0	0
: Transport	0	0	0	1.10	0.85	0	0	0
: Live Game Distribution	0	0	0	1.10	0.85	0	0	0
: Biltong Distribution	0	0	0	1.10	0.85	0	0	0
Fuels, Oils and Miscellaneous Costs	63	2	30101	1.10	0.85	59	2	28144
SUBTOTAL TRADABLES	15352	510	7344281			15056	500	7202722
DOMESTIC ITEMS								
Veterinary and Medicine Costs	0	0	0	1.00	0.85	0	0	0
Licence Fees: Park Entrance Fees	0	0	0	1.00	1.00	0	0	0
: Hunting Licences	0	0	0	1.00	1.00	0	0	0
Sales Tax	6381	212	3052901	1.00	1.00	0	0	0
SUBTOTAL DOMESTIC ITEMS	6381	212	3052901			0	0	0
TOTAL VARIABLE EXPENDITURE	21733	722	10397183			15056	500	7202722

TABLE 5: OPERATING OVERHEAD EXPENDITURE AT FULL PRODUCTION

ITEM	FINANCIAL VALUES			FOREX ADJ.	TAX ADJ.	ECONOMIC VALUES		
	NAD/LSU	NAD/HA.	VALUE			NAD/LSU	NAD/HA.	VALUE
DOMESTIC ITEMS								
Salaries and Wages: Unskilled Labour	914	30	437400	1.00	1.00	914	30	131220
: Skilled Labour	853	28	408240	1.00	1.00	853	28	347004
: Managers	1463	49	699840	1.00	1.00	1463	49	699840
Administration	12	0	5832	1.00	0.85	12	0	4957
Maintenance and Repairs	603	20	288690	1.00	0.85	603	20	245387
Insurance	322	11	153822	1.00	0.85	322	11	130749
Travelling	0	0	0	1.00	0.85	0	0	0
TOTAL OPERATING OVERHEAD EXPEND.	4168	138	1993825			4168	138	1559157

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 6: STATIC FINANCIAL MODEL (AT FULL PRODUCTION)

ITEM	UNITS		TOTAL
Concession Extent	Hectares		14400
Concession Stock	Large Stock Units (LSU)		478
Total Capital Requirement	NAD		15965027
	NAD/LSU	NAD/HA.	NAD
GROSS INCOME	42543	1413	20352676
VARIABLE COSTS	21733	722	10397183
GROSS MARGIN	20810	691	9955493
OVERHEAD COSTS			
Overhead Operating Costs	4168	138	1993825
Loan Amortisation and Interest	1071	36	512168
Provisions for Capital Replacement	1561	52	746879
Interest on Variable Working Capital	587	19	280724
Interest on Overhead Working Capital	113	4	53833
Land Rental	0	0	0.00
Resource Royalty	0	0	0.00
TOTAL OVERHEAD COSTS	7499	249	3587429
NET CASH INCOME	13311	442	6368065
NET CASH INCOME/P100 TOTAL CAPITAL INVESTMENT	40		
"TOTAL BENEFITS"/P100 TOTAL CAPITAL INVESTMENT	69		
"TOTAL BENEFITS"/HECTARE	762		

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)
TABLE 7: STATIC ECONOMIC MODEL (AT FULL PRODUCTION)

ITEM	UNITS		TOTAL
Concession Extent	Hectares		14400
Concession Stock	Large Stock Units (LSU)		478
Total Capital Requirement	NAD		14599854
Economic Depreciation Cost	NAD		909501
Foreign Financing (Prorated)	NAD		273856
Foreign Amortisation	NAD		68464
Foreign Capital Replacement Provision	NAD		205392
Foreign Interest Cost	NAD		381532
Domestic Interest Cost	NAD		1144595
ECONOMIC BENEFITS	NAD/LSU	NAD/HA	NAD
Gross Income	✓ 46096	✓ 1531	22052430
ECONOMIC COSTS			
DOMESTIC COMPONENT			
Shadow Unskilled Citizen Wages	✓ 274	✓ 9	131220
Other Citizen Wages	✓ 2188	✓ 73	1046844
Opportunity Cost of Capital	✓ 3052	✓ 101	1459985
Other Domestic Economic Costs	✓ 797	✓ 26	381093
SUBTOTAL DOMESTIC COMPONENT	✓ 6311	✓ 210	3019142
TRADABLE COMPONENT			
Foreign Remuneration	✓ 0	✓ 0	0
Foreign Services	✓ 3668	✓ 122	1754655
Foreign Interest	✓ 798	✓ 26	381532
Foreign Lease Payments	✓ 0	✓ 0	0
Foreign Rentals	✓ 0	✓ 0	0
Foreign Net Income	✓ 3661	✓ 122	1751218
Other Tradable Economic Costs	✓ 11388	✓ 378	5448067
SUBTOTAL TRADABLE COMPONENT	✓ 19514	✓ 648	9335472
TOTAL ECONOMIC COSTS	✓ 25825	✓ 858	12354614
NET ECONOMIC BENEFIT (Gross Value Added)	✓ 20271	✓ 673	9697816
NET VALUE ADDED (Excluding Depreciation)	✓ 18370	✓ 610	8788315
DOMESTIC RESOURCE COST RATIO =	✓ 0.33		
NET VALUE ADDED/NAD100 TOTAL CAPITAL COST =	✓ 60.19		
Capital COST/EMPLOYMENT OPPORTUNITY CREATED =	521423		
NUMBER OF EMPLOYMENT OPPORTUNITIES/1000 HA.	✓ 1.94		

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 8: CAPITAL PHASING, DEPRECIATION SCHEDULE AND CALCULATION OF RESIDUAL VALUE (NAD)

ITEM	LIFE (Yrs)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
DEPRECIABLE ASSETS												
"Forty Year" Items	40											
Total expenditure		10168907										
Phased expenditure		6101344	4067563	0	0	0	0	0	0	0	0	0
DePreciation		152534	254223	254223	254223	254223	254223	254223	254223	254223	254223	254223
Residual value		6101344	10016374	9762151	9507928	9253706	8999483	8745260	8491038	8236815	7982592	7728370
"Twenty Year" Items	20											
Total expenditure		0										
Phased expenditure		0	0	0	0	0	0	0	0	0	0	0
DePreciation		0	0	0	0	0	0	0	0	0	0	0
Residual value		0	0	0	0	0	0	0	0	0	0	0
"Fifteen Year" Items	15											
Total expenditure		241474										
Phased expenditure		144884	96590	0	0	0	0	0	0	0	0	0
DePreciation		9659	16098	16098	16098	16098	16098	16098	16098	16098	16098	16098
Residual value		144884	231815	215717	199618	183520	167422	151324	135225	119127	103029	86931
"Six Year" Items	6											
Total expenditure		523114						523114				
Phased expenditure		366180	156934	0	0	0	0	366180	156934	0	0	0
DePreciation		61030	87186	87186	87186	87186	87186	87186	87186	87186	87186	87186
Residual value		366180	462084	374898	287713	200527	113341	392336	462084	374898	287713	200527
"Four Year" Items	4											
Total expenditure		2553330				2553330				2553330		
Phased expenditure		2553330	0	0	0	2553330	0	0	0	2553330	0	0
DePreciation		638332	638332	638332	638332	638332	638332	638332	638332	638332	638332	638332
Residual value		2553330	1914997	1276665	638332	2553330	1914997	1276665	638332	2553330	1914997	1276665
NON DEPRECIABLE ASSETS												
Stock	-											
Phased expenditure		0	0	0	0	0	0	0	0	0	0	0
Residual value		0	0	0	0	0	0	0	0	0	0	0
Working Capital	-											
Phased expenditure		2478201	0	0	0	0	0	0	0	0	0	0
TOTAL PHASED CAPITAL EXPENDITURE												
Domestic ComPonent		6101344	4067563	0	0	0	0	0	0	0	0	0
Tradable ComPonent		3064394	253524	0	0	2553330	0	366180	156934	2553330	0	0
Total Financial Value		9165738	4321087	0	0	2553330	0	366180	156934	2553330	0	0
Total Economic Value		8051351	3694473	0	0	2387363	0	342378	146734	2387363	0	0
TOTAL ASSET RESIDUAL VALUE												
Domestic ComPonent		6101344	10016374	9762151	9507928	9253706	8999483	8745260	8491038	8236815	7982592	7728370
Tradable ComPonent		3064394	2608896	1867280	1125664	2937377	2195761	1820324	1235642	3047355	2305739	1564123
Financial Value		9165738	12625270	11629431	10633592	12191083	11195244	10565584	9726680	11284170	10288331	9292492
Economic Value		8051351	10953236	10043735	9134235	10612097	9702597	9135474	8372707	9850570	8941069	8031569

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURI
TABLE 9: LOAN FINANCING SCHEDULE (NAD)

ITEM	PERIOD (Yrs)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
LONG TERM LOANS												
TWENTY YEAR LOAN	20											
Total expenditure		2542227										
Loan Disbursements		1525336	1016891	0	0	0	0	0	0	0	0	0
Loan Payments		167095	278492	278492	278492	278492	278492	278492	278492	278492	278492	278492
Amortisation		76267	127111	127111	127111	127111	127111	127111	127111	127111	127111	127111
Interest Payments		90828	151381	151381	151381	151381	151381	151381	151381	151381	151381	151381
Loans Outstanding		1525336	2465960	2338849	2211737	2084626	1957515	1830403	1703292	1576181	1449069	1321958
FIFTEEN YEAR LOAN	15											
Total expenditure		60368										
Loan Disbursements		45276	15092	0	0	0	0	0	0	0	0	0
Loan Payments		5617	7489	7489	7489	7489	7489	7489	7489	7489	7489	7489
Amortisation		3018	4025	4025	4025	4025	4025	4025	4025	4025	4025	4025
Interest Payments		2599	3465	3465	3465	3465	3465	3465	3465	3465	3465	3465
Loans Outstanding		45276	57350	53325	49301	45276	41252	37227	33203	29178	25154	21129
SIX YEAR LOAN	6											
Total expenditure		130779						130779				
Loan Disbursements		91545	39234	0	0	0	0	91545	39234	0	0	0
Loan Payments		20407	29153	29153	29153	29153	29153	29153	29153	29153	29153	29153
Amortisation		15257	21796	21796	21796	21796	21796	21796	21796	21796	21796	21796
Interest Payments		5150	7357	7357	7357	7357	7357	7357	7357	7357	7357	7357
Loans Outstanding		91545	115521	93725	71928	50132	28335	98084	115521	93725	71928	50132
FOUR YEAR LOAN	4											
Total expenditure		638332				638332				638332		
Loan Disbursements		638332	0	0	0	638332	0	0	0	638332	0	0
Loan Payments		197033	197033	197033	197033	197033	197033	197033	197033	197033	197033	197033
Amortisation		159583	159583	159583	159583	159583	159583	159583	159583	159583	159583	159583
Interest Payments		37450	37450	37450	37450	37450	37450	37450	37450	37450	37450	37450
Loans Outstanding		638332	478749	319166	159583	638332	478749	319166	159583	638332	478749	319166
SHORT TERM LOANS												
Working Capital	1											
Overdraft		2478201	2478201	2478201	2478201	2478201	2478201	2478201	2478201	2478201	2478201	2478201
Interest Payments		334557	334557	334557	334557	334557	334557	334557	334557	334557	334557	334557
TOTAL LONG TERM LOAN DISBURSMENTS												
Domestic Component		1725367	803412	0	0	478749	0	68659	29425	478749	0	0
Foreign Component		632635	294585	0	0	175541	0	25175	10789	175541	0	0
TOTAL LONG TERM LOAN AMORTISATION												
Domestic Component		190594	234387	234387	234387	234387	234387	234387	234387	234387	234387	234387
Foreign Component		69885	85942	85942	85942	85942	85942	85942	85942	85942	85942	85942
TOTAL INTEREST PAYMENTS												
Domestic Component		352938	400657	400657	400657	400657	400657	400657	400657	400657	400657	400657
Foreign Component		129411	146908	146908	146908	146908	146908	146908	146908	146908	146908	146908
TOTAL LOANS OUTSTANDING												
Domestic Component		1725367	2338185	2103799	1869412	2113775	1879388	1713660	1508699	1753062	1518675	1284289
Foreign Component		632635	857335	771393	685451	775051	689109	628342	553190	642789	556848	470906

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 10: FINANCIAL ANALYSIS - 5 YEARS (NAD)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
EXPENDITURE						
Capital expenditure	9165738	4321087	0	0	2553330	0
Variable expenditure	1039718	6238310	10397183	10397183	10397183	10397183
Overhead expenditure	1993825	1993825	1993825	1993825	1993825	1993825
TOTAL expenditure	12199281	12553221	12391007	12391007	14944337	12391007
INCOME						
Gross Income	0	10176338	18317408	20352676	20352676	20352676
Asset Residual Value	0	0	0	0	0	11195244
TOTAL INCOME	0	10176338	18317408	20352676	20352676	31547919
NET BENEFIT/COST	-12199281	-2376883	5926401	7961669	5408339	19156912

FINANCIAL RATE OF RETURN (FRR) OVER 5 YEARS = 30.41%
 NET PRESENT VALUE (NPV) @ 10.00% = 11007628

TABLE 11: FINANCIAL ANALYSIS - 7 YEARS (NAD)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
EXPENDITURE								
Capital expenditure	9165738	4321087	0	0	2553330	0	366180	156934
Variable expenditure	1039718	6238310	10397183	10397183	10397183	10397183	10397183	10397183
Overhead expenditure	1993825	1993825	1993825	1993825	1993825	1993825	1993825	1993825
TOTAL expenditure	12199281	12553221	12391007	12391007	14944337	12391007	12757187	12547942
INCOME								
Gross Income	0	10176338	18317408	20352676	20352676	20352676	20352676	20352676
Asset Residual Value	0	0	0	0	0	0	0	9726680
TOTAL INCOME	0	10176338	18317408	20352676	20352676	20352676	20352676	30079355
NET BENEFIT/COST	-12199281	-2376883	5926401	7961669	5408339	7961669	7595489	17531414

FINANCIAL RATE OF RETURN (FRR) OVER 7 YEARS = 33.34%
 NET PRESENT VALUE (NPV) @ 10.00% = 16764426

TABLE 12: FINANCIAL ANALYSIS - 10 YEARS (NAD)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
EXPENDITURE											
Capital expenditure	9165738	4321087	0	0	2553330	0	366180	156934	2553330	0	0
Variable expenditure	1039718	6238310	10397183	10397183	10397183	10397183	10397183	10397183	10397183	10397183	10397183
Overhead expenditure	1993825	1993825	1993825	1993825	1993825	1993825	1993825	1993825	1993825	1993825	1993825
TOTAL expenditure	12199281	12553221	12391007	12391007	14944337	12391007	12757187	12547942	14944337	12391007	12391007
INCOME											
Gross Income	0	10176338	18317408	20352676	20352676	20352676	20352676	20352676	20352676	20352676	20352676
Asset Residual Value	0	0	0	0	0	0	0	0	0	0	9292492
TOTAL INCOME	0	10176338	18317408	20352676	20352676	20352676	20352676	20352676	20352676	20352676	29645168
NET BENEFIT/COST	-12199281	-2376883	5926401	7961669	5408339	7961669	7595489	7804734	5408339	7961669	17254161

FINANCIAL RATE OF RETURN (FRR) OVER 10 YEARS = 35.05%
 NET PRESENT VALUE (NPV) @ 10.00% = 23637568 Per Hectare = 1641.50

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 13: ECONOMIC ANALYSIS - 5 YEARS (NAD)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ECONOMIC COSTS						
Capital expenditure	8051351	3694473	0	0	2387363	0
Unskilled Wages	131220	131220	131220	131220	131220	131220
Other Domestic Costs	1142350	1427937	1427937	1427937	1427937	1427937
Tradable Costs	713426	4280555	7134258	7134258	7134258	7134258
Foreign Amortisation	69885	85942	85942	85942	85942	85942
Foreign Profits	0	122585	1400974	1751218	1751218	1751218
Foreign Loans Outst.	0	0	0	0	0	689109
TOTAL COSTS	10108231	9742712	10180331	10530575	12917938	11219684
ECONOMIC BENEFITS						
Gross Income	0	11026215	19847187	22052430	22052430	22052430
Asset Residual Value	0	0	0	0	0	9702597
Foreign Financing	632635	294585	0	0	175541	0
TOTAL BENEFITS	632635	11320799	19847187	22052430	22227971	31755027
NET BENEFIT/COST	-9475596	1578087	9666856	11521855	9310033	20535343
ECONOMIC RATE OF RETURN (ERR) OVER 5 YEARS				=	68.13%	
NET PRESENT VALUE (NPV) @					10.00%	= 25194924

TABLE 14: ECONOMIC ANALYSIS - 10 YEARS (NAD)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
ECONOMIC COSTS											
Capital expenditure	8051351	3694473	0	0	2387363	0	342378	146734	2387363	0	0
Unskilled Wages	131220	131220	131220	131220	131220	131220	131220	131220	131220	131220	131220
Other Domestic Costs	1142350	1427937	1427937	1427937	1427937	1427937	1427937	1427937	1427937	1427937	1427937
Tradable Costs	713426	4280555	7134258	7134258	7134258	7134258	7134258	7134258	7134258	7134258	7134258
Foreign Amortisation	69885	85942	85942	85942	85942	85942	85942	85942	85942	85942	85942
Foreign Profits	0	122585	1400974	1751218	1751218	1751218	1751218	1751218	1751218	1751218	1751218
Foreign Loans Outst.	0	0	0	0	0	0	0	0	0	0	470906
TOTAL COSTS	10108231	9742712	10180331	10530575	12917938	10530575	10872953	10677308	12917938	10530575	11001480
ECONOMIC BENEFITS											
Gross Income	0	11026215	19847187	22052430	22052430	22052430	22052430	22052430	22052430	22052430	22052430
Asset Residual Value	0	0	0	0	0	0	0	0	0	0	8031569
Foreign Financing	632635	294585	0	0	175541	0	25175	10789	175541	0	0
TOTAL BENEFITS	632635	11320799	19847187	22052430	22227971	22052430	22077605	22063219	22227971	22052430	30083999
NET BENEFIT/COST	-9475596	1578087	9666856	11521855	9310033	11521855	11204652	11385911	9310033	11521855	19082518
ECONOMIC RATE OF RETURN (ERR) OVER 10 YEARS					=	70.76%					
NET PRESENT VALUE (NPV) @						10.00%	=	46247258	Per Hectare =	3212	

FINANCIAL/ECONOMIC MODEL - HIGH QUALITY AREA TOURISM - WOODLANDS BIOME - BASE CASE (NAD,2012)

TABLE 15: SUMMARY OF RESULTS

ITEM		UNITS			TOTAL
Concession Extent		Hectares			14400
Concession Stock		Large Stock Units (LSU)			478
Annual Visitor Days (VD)		Number			4288
ITEM	% of TCI	NAD/VISITOR DAY	NAD/LSU	NAD/HECTARE	NAD
Total Financial Capital (TCI)	-	3723	33371	1109	15965027
Financial Gross Income	127%	4747	42543	1413	20352676
Variable Financial Costs	-	2425	21733	722	10397183
Fixed Financial Costs	-	837	7499	249	3587429
Net Cash Income	40%	1485	13311	442	6368065
Local Community Cash Income	5%	197	1768	59	845640
Land Rental	-	0	0	0	0.00
Resource Royalty	-	0	0	0	0.00
FRR (@ 10 Years)	-	-	-	-	35.05%
FNPV (@ 10%, @ 10 Years)	-	-	-	1641	23637568
Total Economic Capital	-	3405	30518	1014	14599854
Economic Gross Income	151%	5143	46096	1531	22052430
Economic Costs	85%	2881	25825	858	12354614
Net Economic Benefit	66%	2262	20271	673	9697816
Net Value Added	60%	2050	18370	610	8788315
ERR (@ 10 Years)	-	-	-	-	70.76%
ENPV (@ 10+B17%, @ 10 Years)	-	-	-	3212	46247258
Economic Capital Cost/Job	-	-	-	-	521423
Domestic Resource Cost Ratio	-	-	-	-	0.33
Policy Analysis Matrix	: Effects of Policy / Market ImPerfections		: on Output		-1699754
			: on Tradable Inputs		1991190
			: on Domestic Factors		-2711687
	: Net Effects of Policy / Market ImPerfections		: on Annual Net Income		-2420251
			: on Net Present Value (10 Years)		-22609690

Appendix 2.b: Example of small-scale livestock enterprise

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

ASSUMPTIONS*

Production System:	Small-scale cattle keeping for milk, meat, draft, manure and as a stor of value with secondary use of goats										
Site:	Household use of unfenced open access grazing near village in woodland habitat with <i>Burkea africana</i> and economic carrying capacity of 12 ha/LSU and water provided from communal borehole										
Grazing land Size:	180	Hectares or,	1.8	Square Kilometres							
Carrying Capacity:	12	Hectares per LSU Equivalent or,	8.33	LSU Equivalents/Sq. Km.							
Stock Density:	15.10	LSU Equivalents/Sq. Km. or,	6.5	Hectares per LSU Equivalent							
	100%	Initial Purchases:	10								
Calving Rates	100%	Heifers:	60%	Cows < 7 Years:	60%	Cows > 7 Years:	60%				
Bull Rate	100%	5.0%	Bull Replacement Rate:	10%							
Mortality Rates	100%	Calves:	18%	Cows:	11%	Steers:	11%	Heifers:	11%	Bulls	11%
Selected Prices:	135%	Capital Items	135%	Livestock	135%	for Sensitivity analysis					
Capital Sources:	100%	Loan =	0%	Equity =	100%	and:	100%	Foreign	0%	Domestic	100%
Interest Rates:	50%	Rate for Capital Loans:	9%	Rate for Working Capital Loans:	14%						
Working Capital as Proportion of Annual Operating Costs	0%										
Marketing Fees	100%	MEATCO/Agents Fee as Percentage of Turnover									
Land Rental and Resource Royalty (NAD):	100%	Rental:	0.00	per Ha.	100%	Royalty:	0%	of Turnover			
Manpower Needs:	100%	Managers	0	Skilled Labour	0	Unskilled Labour	1.3				
		Management:	Foreign	0%	Citizen	100%					
Shadow Wage Adjustment:	100%	Managers	1.00	Skilled Labour	1.00	100%	Unskilled Labour	0.50			
Foreign Exchange Premium:	100%	10%	Adjustment Factor =	1.10							
Tax Adjustments:	100%	General VAT/Sales Tax:	15%	Import Taxes: from SACU:	0%	to SACU:	n/a				
Discount Rates:	100%	Financial Discount Rate:	10%	Economic Discount Rate:	10%						
Opportunity Cost of Capital	100%	10%									

Static models depict enterprise at full production. Static financial model includes interest, amortisation government fees, royalties and land rentals. Static economic model takes foreign inflows and outflows into account, excludes other interest and transfers and values enterprise in economic prices before land and government costs

Dynamic models presented over 5 and 10 years, to measure IRR and NPV. Financial dynamic model, at constant prices, excludes interest and depreciation, and includes asset residual values. Economic model includes foreign inflows and outflows, and measures value of enterprise in economic prices before inclusion of land costs and public expenditures.

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)
TABLE 1: CAPITAL REQUIREMENTS

ITEM	UNIT	QUANT.	PRICE NAD	FINAN. COST	LIFE Years	AMORT. + INT.	DEPREC- IATION	ECON. DEPR.	FOREX ADJ.	TAX ADJ.	ECON. COST
FIXED CAPITAL											
DOMESTIC ITEMS											
Houses Manager		0	69300	0	40	0	0	0	1.00	0.85	0
Houses Labour		1	1155	2027	40	222	51	43	1.00	0.85	2027
Office/Storerooms		0	13869	0	40	0	0	0	1.00	0.85	0
Tourist/Hunter Lodges		0	46385	0	40	0	0	0	1.00	0.85	0
Boreholes		0.05	34650	2339	40	256	58	50	1.00	0.85	1988
Plunge Dip		0	27738	0	40	0	0	0	1.00	0.85	0
Reservoirs/Pipes/Troughs		0	8805	0	40	0	0	0	1.00	0.85	0
Firebreaks/Roads (km)		0	2310	0	40	0	0	0	1.00	0.85	0
Power/Road to Site		0	14726	0	40	0	0	0	1.00	0.85	0
CONTINGENCIES @ 5%				218	40	24	5	5	1.00	0.85	186
SUBTOTAL DOMESTIC ITEMS				4584							4201
TRADABLE ITEMS											
Pens, Boma		1	12936	17464	20	1913	873	816	1.10	0.85	16328
Scale and Crush		0.25	3465	1169	15	145	78	73	1.10	0.85	1093
Pump/Windmill/Borehole Equipmer		0.05	21830	1473	15	183	98	92	1.10	0.85	1378
Fencing Perimeter (km)		0.00	10418	0	15	0	0	0	1.10	0.85	0
Fencing Crop Lands (km)		0.40	9471	5114	15	634	341	319	1.10	0.85	4782
CONTINGENCIES @ 5%				1261	15	156	84	79	1.10	0.85	1179
SUBTOTAL TRADABLES				26482							24761
SUBTOTAL- FIXED CAPITAL				31066							28961
MOVABLE CAPITAL											
TRADABLE ITEMS											
LDVs/Trucks/Carts/Sleds		1	693	936	4	289	234	219	1.10	0.85	875
Tools/Ranch Equipment		1	3465	4678	6	1043	780	729	1.10	0.85	4374
Office/Other Equipment		0	43890	0	6	0	0	0	1.10	0.85	0
Feed/Salt Drums		0	2599	0	6	0	0	0	1.10	0.85	0
CONTINGENCIES @ 10%				561	6	125	94	87	1.10	0.85	525
SUBTOTAL TRADABLES				6175							5773
DOMESTIC ITEMS											
Breeding Stock/Calves (batch)		1	63386	63386	40	6944			1.00	0.85	53878
Other Heifers, Steers (batch)		1	19562	19562	40	2143			1.00	0.85	16628
Bulls (batch)		1	3011	3011	40	330			1.00	0.85	2560
Goats/Sheep (batch)		1	1975	1975	40	216			1.00	0.85	1679
Game (batch)		1	0	0	40	0			2.00	0.85	0
Horses and Donkeys (batch)		1	178	178	40	20			1.00	0.85	151
CONTINGENCIES @ 10%				8811	40	965			1.00	0.85	7490
SUBTOTAL- DOMESTIC ITEMS				96924							82386
SUBTOTAL- MOVABLE CAPITAL				103099							88159
WORKING CAPITAL											
VARIABLE											
OVERHEAD				0	0				1.10	1.00	0
SUBTOTAL- WORKING CAPITAL				0	0				1.10	1.00	0
TOTALS				134165	0	15608	2696	2511			117120

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 2: STOCK COMPOSITION BY SPECIES AT FULL PRODUCTION

ITEM	HEAD	OFF-TAKE	Number	LSU FACTOR	LSU
Breeding Cows	12	✓	1	1.00	12
Breeding Heifers	3	✓	0	0.70	2
Bulls	1	✓	0	1.33	1
Surplus Heifers	0	✓	0	1.00	0
Calves	7	✓	0	0.31	2
1st Year Steers	3	✓	0	0.71	2
1st Year Heifers	3	✓	0	0.61	2
2 Year Steers	2	✓	1	0.89	2
3 Year Steers	1	✓	0	1.11	2
4 Year Oxen	1	✓	0	1.18	1
5 Year Oxen	1	✓	0	1.25	1
6 Year Oxen	0	✓	0	1.25	0
7 Year Oxen	0	✓	0	1.25	0
8 Year Oxen	0	✓	0	1.25	0
9 Year Oxen	0	✓	0	1.25	0
Goats/Sheep	3	✓	1	0.14	0
Donkeys/Horses	0	✓	0	0.63	0
Gemsbok	0	✓	0	0.40	0
Kudu	0	✓	0	0.45	0
Ostrich	0	✓	0	0.26	0
TOTAL	37		4		27
STOCK DENSITY:	15.10	LSU PER SQ.KM.; GRAZING LAND SIZE:		180	HECTARES

TABLE 3: SALES AT FULL PRODUCTION

ITEM	QUANTITY	PRICE (NAD)	FINANCIAL VALUE	MEAT	FOREX ADJ.	TAX ADJ.	ECON. VALUE
Cull Cows	1 Head		3550		1.10	1.00	3351
Cull Heifers	0 Head		689		1.10	1.00	651
Heifers	0 Head		723		1.10	1.00	683
Steers/Oxen	2 Head		9030		1.10	1.00	8522
Weaners	0 Head		0		1.10	1.00	0
Bulls	0 Head		1349		1.10	1.00	1273
Goats/Sheep	1 Head		395	15736	1.10	1.00	435
Milk	1346 Litres	7.91	24578		1.10	1.00	18385
Manure (houses and crops)	300 Kgs	0.09	66		1.10	1.00	49
Draft (transport and ploughing)	220 Oxen days	14.08	7156		1.10	1.00	5352
Donkeys/Horses	0 Head		17		1.10	1.00	13
TOTALS	4 Head	GROSS INCOME	47553				38713

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)
TABLE 4: VARIABLE EXPENDITURE AT FULL PRODUCTION

ITEM	FINANCIAL VALUES			FOREX ADJ.	TAX ADJ.	ECONOMIC VALUES			
	NAD/LSU	NAD/HA.	VALUE			NAD/LSU	NAD/HA.	VALUE	
TRADABLE ITEMS									
Supplements	0.00	0.00	0	1.10	0.85	100.05	15.11	2719	
Dip Costs	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
Replacement Bulls	37.22	5.62	1012	1.10	0.85	49.63	7.49	1349	
Ear Tags	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
Transport	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
Water Costs	33.35	5.03	906	1.10	0.85	31.18	4.71	847	
Live Game: Aerial Support	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
: Field Ops.	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
: Transport	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
Cropping: Ammunition	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
: Supplies and Packaging	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
: Transport	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
: Other	0.00	0.00	0	1.10	0.85	0.00	0.00	0	
Miscellaneous Costs	40.59	6.13	1103	1.10	0.85	37.95	5.73	1032	
SUBTOTAL TRADABLES	111.16	16.78	3021			218.80	33.04	5947	
DOMESTIC ITEMS									
Veterinary and Medicine Costs	0.00	0.00	0	1.00	0.85	31.01	4.68	843	
MEATCO Marketing Fees	26.25	3.96	713	1.00	1.00	0.00	0.00	0	
Game Licence Fees	0.00	0.00	0	1.00	1.00	0.00	0.00	0	
VAT/Sales Tax	262.46	39.63	7133	1.00	1.00	0.00	0.00	0	
SUBTOTAL DOMESTIC ITEMS	288.70	43.59	7846			31.01	4.68	843	
TOTAL VARIABLE EXPENDITURE	399.86	60.37	10867			249.82	37.72	6789	

TABLE 5: OPERATING OVERHEAD EXPENDITURE AT FULL PRODUCTION

ITEM	FINANCIAL VALUES			FOREX ADJ.	TAX ADJ.	ECONOMIC VALUES			
	NAD/LSU	NAD/HA.	VALUE			NAD/LSU	NAD/HA.	VALUE	
DOMESTIC ITEMS									
Salaries and Wages: Unskilled Labour	348.71	52.65	9477	1.00	1.00	348.71	52.65	4739	
: Skilled Labour	0.00	0.00	0	1.00	1.00	0.00	0.00	0	
: Managers	0.00	0.00	0	1.00	1.00	0.00	0.00	0	
Administration	57.37	8.66	1559	1.00	0.85	57.37	8.66	1325	
Maintenance and Repairs	25.06	3.78	681	1.00	0.85	25.06	3.78	579	
Insurance	0.00	0.00	0	1.00	0.85	0.00	0.00	0	
Miscellaneous Fixed Costs	0.00	0.00	0	1.00	0.85	0.00	0.00	0	
TOTAL OPERATING OVERHEAD EXPEND.	431.14	65.10	11717			431.14	65.10	6643	

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 6: STATIC FINANCIAL MODEL (AT FULL PRODUCTION)

ITEM	UNITS		TOTAL
Ranch Extent	Hectares		180
Ranch Stock	Large Stock Units (LSU)		38
Total Capital Requirement	NAD		134165
	NAD/LSU	NAD/HA.	NAD
GROSS INCOME	✓ 1251.40	✓ 264.18	47553
VARIABLE COSTS	✓ 285.98	✓ 60.37	10867
GROSS MARGIN	✓ 965.42	✓ 203.81	36686
OVERHEAD COSTS			
Overhead Operating Costs	✓ 308.35	✓ 65.10	11717
Loan Amortisation and Interest	✓ 0.00	✓ 0.00	0
Provisions for Capital Replacement	✓ 70.95	✓ 14.98	2696
Interest on Variable Working Capital	✓ 0.00	✓ 0.00	0
Interest on Overhead Working Capital	✓ 0.00	✓ 0.00	0
Land Rental	✓ 0.00	✓ 0.00	0
Resource Royalty	✓ 0.00	✓ 0.00	0
TOTAL OVERHEAD COSTS	✓ 379.30	✓ 80.07	14413
NET CASH INCOME	✓ 586.12	✓ 123.74	22272
NET CASH INCOME/P100 TOTAL CAPITAL INVESTMENT	✓ 16.60		
"TOTAL BENEFITS"/P100 TOTAL CAPITAL INVESTMENT	✓ 29.51		
"TOTAL BENEFITS"/HECTARE	✓ 219.98		

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)
TABLE 7: STATIC ECONOMIC MODEL (AT FULL PRODUCTION)

ITEM	UNITS		TOTAL
Ranch Extent	Hectares		180
Ranch Stock	Large Stock Units (LSU)		38
Total Capital Requirement	NAD		117120
Economic Depreciation Cost	NAD		2511
Foreign Financing (Prorated)	NAD		0
Foreign Amortisation	NAD		0
Foreign Capital Replacement Provision	NAD		0
Foreign Interest Cost	NAD		0
Domestic Interest Cost	NAD		12912
ECONOMIC BENEFITS	NAD/LSU	NAD/HA.	NAD
Gross Income	✓ 1019	✓ 215	38713
Stock Appreciation	✓ 25	✓ 5	939
TOTAL ECONOMIC BENEFITS	✓ 1043	✓ 220	39652
ECONOMIC COSTS			
DOMESTIC COMPONENT			
Shadow Unskilled Citizen Wages	✓ 125	✓ 26	4739
Other Citizen Wages	✓ 0	✓ 0	0
Opportunity Cost of Capital	✓ 308	✓ 65	11712
Other Domestic Economic Costs	✓ 72	✓ 15	2747
SUBTOTAL DOMESTIC COMPONENT	✓ 505	✓ 107	19198
TRADABLE COMPONENT			
Foreign Remuneration	✓ 0	✓ 0	0
Foreign Services	✓ 0	✓ 0	0
Foreign Interest	✓ 0	✓ 0	0
Foreign Lease Payments	✓ 0	✓ 0	0
Foreign Rentals	✓ 0	✓ 0	0
Foreign Net Income	✓ 0	✓ 0	0
Other Tradable Economic Costs	✓ 156	✓ 33	5947
SUBTOTAL TRADABLE COMPONENT	✓ 156	✓ 33	5947
TOTAL ECONOMIC COSTS	✓ 662	✓ 140	25144
NET ECONOMIC BENEFIT (Gross Value Added)	✓ 382	✓ 81	14507
NET VALUE ADDED (Excluding Depreciation)	✓ 316	✓ 67	11996
DOMESTIC RESOURCE COST RATIO =	✓ 0.98		
NET VALUE ADDED/NAD 100 TOTAL CAPITAL COST =	✓ 10.24		
CAPITAL COST/EMPLOYMENT OPPORTUNITY CREATED =	90092		
NUMBER OF EMPLOYMENT OPPORTUNITIES/1000 HA.	✓ 7.22		

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 8: CAPITAL PHASING, DEPRECIATION SCHEDULE AND CALCULATION OF RESIDUAL VALUE

ITEM	LIFE (Yrs)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
DEPRECIABLE ASSETS												
"Forty Year" Items	40											
Total Expenditure		4584										
Phased Expenditure		2751	1834	0	0	0	0	0	0	0	0	0
Depreciation		69	115	115	115	115	115	115	115	115	115	115
Residual value		2751	4515	4401	4286	4172	4057	3942	3828	3713	3599	3484
"Twenty Year" Items	20											
Total Expenditure		17464										
Phased Expenditure		17464	0	0	0	0	0	0	0	0	0	0
Depreciation		873	873	873	873	873	873	873	873	873	873	873
Residual value		17464	16590	15717	14844	13971	13098	12225	11351	10478	9605	8732
"Fifteen Year" Items	15											
Total Expenditure		9018										
Phased Expenditure		5411	3607	0	0	0	0	0	0	0	0	0
Depreciation		361	601	601	601	601	601	601	601	601	601	601
Residual value		5411	8658	8056	7455	6854	6253	5651	5050	4449	3848	3247
"Six Year" Items	6						6					
Total Expenditure		5239						5239				
Phased Expenditure		3667	1572	0	0	0	0	3667	1572	0	0	0
Depreciation		611	873	873	873	873	873	873	873	873	873	873
Residual value		3667	4628	3755	2881	2008	1135	3929	4628	3755	2881	2008
"Four Year" Items	4											
Total Expenditure		936				936				936		
Phased Expenditure		936	0	0	0	936	0	0	0	936	0	0
Depreciation		234	234	234	234	234	234	234	234	234	234	234
Residual value		936	702	468	234	936	702	468	234	936	702	468
NON DEPRECIABLE ASSETS												
Stock	-											
Phased Fin. Expenditure		85960	1174	1174	1188	1297	1383	1364	1349	1352	1352	1349
Phased Econ. Expenditure		85960	1174	1174	1188	1297	1383	1364	1349	1352	1352	1349
Residual value		88113	96537	103500	111003	119422	123097	125377	126799	127496	127715	127792
Working Capital	-											
Phased Expenditure		0	0	0	0	0	0	0	0	0	0	0
TOTAL PHASED CAPITAL EXPENDITURE												
Domestic Component		88710	3008	1174	1188	1297	1383	1364	1349	1352	1352	1349
Tradable Component		27477	5179	0	0	936	0	3667	1572	936	0	0
Total Financial Value		116188	8187	1174	1188	2232	1383	5031	2921	2288	1352	1349
Total Economic Value		101095	7399	998	1010	1977	1175	4588	2616	2024	1149	1146
TOTAL ASSET RESIDUAL VALUE												
Domestic Component		90863	101053	107901	115289	123594	127154	129319	130627	131210	131313	131276
Tradable Component		27477	30578	27996	25415	23769	21187	22273	21263	19617	17036	14454
Financial Value		118341	131630	135897	140704	147362	148341	151592	151890	150827	148349	145730
Economic Value		102925	114485	117892	121758	127278	127891	130747	130914	129870	127545	125099

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 9: STOCK PROJECTION

STOCK ON HAND (August)	Growth	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows		10	12	11	11	12	12	12	12	12	12	12
Breeding Heifers		3	1	2	3	2	2	2	3	3	3	3
Bulls		0	1	1	1	1	1	1	1	1	1	1
Surplus Heifers		0	0	0	0	0	0	0	0	0	0	0
Calves		4	6	6	6	7	7	7	7	7	7	7
1st Year Steers		1	2	3	3	3	3	3	3	3	3	3
1st Year Heifers		1	2	3	3	3	3	3	3	3	3	3
2 Year Steers		1	1	1	2	2	2	2	2	2	2	2
3 Year Steers		1	1	0	1	1	1	1	1	1	1	1
4 Year Oxen		1	0	0	0	1	1	1	1	1	1	1
5 Year Oxen		1	0	0	0	0	0	1	1	1	1	1
6 Year Oxen		0	0	0	0	0	0	0	0	0	0	0
7 Year Oxen		0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen		0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen		0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	0.20	3	3	3	3	3	3	3	3	3	3	3
Donkeys/Horses	0.10	0	0	0	0	0	0	0	0	0	0	0
Gemsbok	0.12	0	0	0	0	0	0	0	0	0	0	0
Kudu	0.12	0	0	0	0	0	0	0	0	0	0	0
Ostrich	0.14	0	0	0	0	0	0	0	0	0	0	0
TOTALS		26	29	31	33	35	36	37	37	37	37	37
PERCENT OF ORIGINAL NO.		100%	112%	121%	128%	136%	141%	143%	144%	145%	145%	145%
PERCENT OF FINAL NO.		69%	77%	83%	88%	94%	97%	99%	99%	100%	100%	100%
ANNUAL INCREASE (%)			12%	8%	6%	6%	3%	2%	1%	0%	0%	0%

STOCK SALES (No.)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	0	0	0	0	0	1	1	1	1	1	1
Breeding Heifers	0	0	0	0	0	0	0	0	0	0	0
Bulls	0	0	0	0	0	0	0	0	0	0	0
Surplus Heifers	0	0	0	0	0	0	0	0	0	0	0
Calves	0	0	0	0	0	0	0	0	0	0	0
1st Year Steers	0	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	0	0	0	0	0	0	0	0	0	0	0
2 Year Steers	0	0	0	1	1	1	1	1	1	1	1
3 Year Steers	0	0	0	0	0	0	0	0	0	0	0
4 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
5 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
6 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	0	1	1	1	1	1	1	1	1	1	1
Donkeys/Horses	0	0	0	0	0	0	0	0	0	0	0
Gemsbok	0	0	0	0	0	0	0	0	0	0	0
Kudu	0	0	0	0	0	0	0	0	0	0	0
Ostrich	0	0	0	0	0	0	0	0	0	0	0
TOTALS	1	1	1	1	2	3	3	3	3	3	3
PERCENT OFFTAKE RATE	3%	4%	4%	4%	5%	8%	8%	9%	9%	9%	9%
PERCENT OF FINAL SALES	22%	33%	34%	41%	47%	81%	91%	96%	99%	100%	100%

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 9: STOCK PROJECTION (Continued)

STOCK PURCHASES (No.)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	10*	0	0	0	0	0	0	0	0	0	0
Breeding Heifers	3	0	0	0	0	0	0	0	0	0	0
Bulls	0	0	0	0	0	0	0	0	0	0	0
Surplus Heifers	0	0	0	0	0	0	0	0	0	0	0
Calves	4	0	0	0	0	0	0	0	0	0	0
1st Year Steers	1	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	1	0	0	0	0	0	0	0	0	0	0
2 Year Steers	1	0	0	0	0	0	0	0	0	0	0
3 Year Steers	1	0	0	0	0	0	0	0	0	0	0
4 Year Oxen	1	0	0	0	0	0	0	0	0	0	0
5 Year Oxen	1	0	0	0	0	0	0	0	0	0	0
6 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	3	0	0	0	0	0	0	0	0	0	0
Donkeys/Horses	0	0	0	0	0	0	0	0	0	0	0
Gemsbok	0	0	0	0	0	0	0	0	0	0	0
Kudu	0	0	0	0	0	0	0	0	0	0	0
Ostrich	0	0	0	0	0	0	0	0	0	0	0
TOTALS	22	0	0	0	0	0	0	0	0	0	0

LSU ON HAND (August)	LSU /UNIT	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	1.00	10	12	11	11	12	12	12	12	12	12	12
Breeding Heifers	0.70	2	1	1	2	2	2	2	2	2	2	2
Bulls	1.33	1	1	1	1	1	1	1	1	1	1	1
Surplus Heifers	1.00	0	0	0	0	0	0	0	0	0	0	0
Calves	0.31	1	2	2	2	2	2	2	2	2	2	2
1st Year Steers	0.71	1	1	2	2	2	2	2	2	2	2	2
1st Year Heifers	0.61	1	1	2	2	2	2	2	2	2	2	2
2 Year Steers	0.89	1	1	1	2	2	2	2	2	2	2	2
3 Year Steers	1.11	1	1	0	1	1	1	1	1	2	2	2
4 Year Oxen	1.18	1	1	0	0	1	1	1	1	1	1	1
5 Year Oxen	1.25	1	0	0	0	0	0	1	1	1	1	1
6 Year Oxen	1.25	1	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	0.14	0	0	0	0	0	0	0	0	0	0	0
Donkeys/Horses	0.63	0	0	0	0	0	0	0	0	0	0	0
Gemsbok	0.40	0	0	0	0	0	0	0	0	0	0	0
Kudu	0.45	0	0	0	0	0	0	0	0	0	0	0
Ostrich	0.26	0	0	0	0	0	0	0	0	0	0	0
TOTAL STOCK LSU		19	20	21	23	25	25	26	26	27	27	27
PERCENT OF ORIGINAL LSU		100%	108%	115%	123%	133%	137%	140%	142%	143%	144%	144%
PERCENT OF FINAL LSU		70%	75%	80%	86%	93%	95%	97%	99%	100%	100%	100%

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 9: STOCK PROJECTION (Continued)

LSU SALES	LSU /UNIT	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	1.00	0	0	0	0	0	1	1	1	1	1	1
Breeding Heifers	0.70	0	0	0	0	0	0	0	0	0	0	0
Bulls	1.33	0	0	0	0	0	0	0	0	0	0	0
Surplus Heifers	1.00	0	0	0	0	0	0	0	0	0	0	0
Calves	0.31	0	0	0	0	0	0	0	0	0	0	0
1st Year Steers	0.71	0	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	0.61	0	0	0	0	0	0	0	0	0	0	0
2 Year Steers	0.89	0	0	0	1	1	1	1	1	1	1	1
3 Year Steers	1.11	0	0	0	0	0	0	0	0	1	1	1
4 Year Oxen	1.18	0	0	0	0	0	0	0	0	0	0	0
5 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
6 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	0.14	0	0	0	0	0	0	0	0	0	0	0
Donkeys/Horses	0.63	0	0	0	0	0	0	0	0	0	0	0
Gemsbok	0.40	0	0	0	0	0	0	0	0	0	0	0
Kudu	0.45	0	0	0	0	0	0	0	0	0	0	0
Ostrich	0.26	0	0	0	0	0	0	0	0	0	0	0
TOTAL LSU SALES		1	1	1	2	2	3	3	3	3	3	3
PERCENT OFFTAKE RATE (LSU)		4%	7%	7%	7%	7%	10%	11%	12%	13%	13%	13%
BEEF PRODUCTION (% LSU)		20%	41%	41%	45%	48%	77%	87%	94%	100%	99%	100%
LSU PURCHASES	LSU /UNIT	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	1.00	10	0	0	0	0	0	0	0	0	0	0
Breeding Heifers	0.70	2	0	0	0	0	0	0	0	0	0	0
Bulls	1.33	1	0	0	0	0	0	0	0	0	0	0
Surplus Heifers	1.00	0	0	0	0	0	0	0	0	0	0	0
Calves	0.31	1	0	0	0	0	0	0	0	0	0	0
1st Year Steers	0.71	1	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	0.61	1	0	0	0	0	0	0	0	0	0	0
2 Year Steers	0.89	1	0	0	0	0	0	0	0	0	0	0
3 Year Steers	1.11	1	0	0	0	0	0	0	0	0	0	0
4 Year Oxen	1.18	1	0	0	0	0	0	0	0	0	0	0
5 Year Oxen	1.25	1	0	0	0	0	0	0	0	0	0	0
6 Year Oxen	1.25	1	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	1.25	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	0.14	0	0	0	0	0	0	0	0	0	0	0
Donkeys/Horses	0.63	0	0	0	0	0	0	0	0	0	0	0
Gemsbok	0.40	0	0	0	0	0	0	0	0	0	0	0
Kudu	0.45	0	0	0	0	0	0	0	0	0	0	0
Ostrich	0.26	0	0	0	0	0	0	0	0	0	0	0
TOTAL LSU PURCHASES		19	0	0	0	0	0	0	0	0	0	0

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 9: STOCK PROJECTION (Continued)

VALUE OF STOCK (August)	Value (NAD)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	4273	42730	49257	47062	47623	51983	51000	50296	49756	49883	49861	49746
Breeding Heifers	3798	11215	3220	5731	9587	9160	9269	9308	9926	9789	9684	9709
Bulls	6324	3011	3913	3960	4322	4609	4546	4497	4508	4506	4496	4489
Surplus Heifers	3255	0	0	0	0	0	0	0	0	0	0	0
Calves	2478	9442	15794	15090	15270	16668	17775	17530	17341	17385	17378	17338
1st Year Steers	3255	3100	5518	9231	8819	8925	9742	10388	10245	10135	10161	10156
1st Year Heifers	3255	3100	5518	9231	8819	8925	9742	10388	10245	10135	10161	10156
2 Year Steers	3798	2894	2415	4298	7190	6870	6952	7588	8092	7980	7895	7915
3 Year Steers	4658	3105	2369	1976	3518	5885	5623	5690	6210	6623	6531	6461
4 Year Oxen	4657	2661	2073	1581	1319	2348	3928	3753	3798	4145	4421	4360
5 Year Oxen	4541	2595	1732	1349	1029	859	1528	2556	2442	2472	2698	2877
6 Year Oxen	4424	2107	1688	1126	877	669	558	994	1663	1589	1607	1755
7 Year Oxen	4192	0	888	711	475	370	282	235	419	701	670	678
8 Year Oxen	3959	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	3726	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	593	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975	1975
Donkeys/Horses	1871	178	178	178	178	178	178	178	178	178	178	178
Gemsbok	2202	0	0	0	0	0	0	0	0	0	0	0
Kudu	1069	0	0	0	0	0	0	0	0	0	0	0
Ostrich	3430	0	0	0	0	0	0	0	0	0	0	0
TOTALS		88113	96537	103500	111003	119422	123097	125377	126799	127496	127715	127792
PERCENT OF ORIGINAL NO.		100%	110%	117%	126%	136%	140%	142%	144%	145%	145%	145%
PERCENT OF FINAL NO.		69%	76%	81%	87%	93%	96%	98%	99%	100%	100%	100%
ANNUAL VALUE INCREASE			8424	6963	7502	8419	3675	2280	1422	697	218	77

VALUE OF SALES	Value (NAD)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Breeding Cows	4273	0	0	0	0	0	3701	3631	3581	3543	3552	3550
Breeding Heifers	3798	0	0	0	0	0	652	660	663	707	697	689
Bulls	6324	0	903	1174	1188	1297	1383	1364	1349	1352	1352	1349
Surplus Heifers	3255	0	0	0	0	0	0	694	740	729	722	723
Calves	2478	0	0	0	0	0	0	0	0	0	0	0
1st Year Steers	3255	0	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	3255	0	0	0	0	0	0	0	0	0	0	0
2 Year Steers	3798	724	805	1433	2397	2290	2317	2529	2697	2660	2632	2638
3 Year Steers	4658	776	790	659	1173	1962	1874	1897	2070	2208	2177	2154
4 Year Oxen	4657	665	691	527	440	783	1309	1251	1266	1382	1474	1453
5 Year Oxen	4541	649	577	450	343	286	509	852	814	824	899	959
6 Year Oxen	4424	527	563	375	292	223	186	331	554	530	536	585
7 Year Oxen	4192	0	888	711	475	370	282	235	419	701	670	678
8 Year Oxen	3959	0	0	747	598	399	311	237	198	352	589	563
9 Year Oxen	3726	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	593	0	395	395	395	395	395	395	395	395	395	395
Donkeys/Horses	1871	0	17	17	17	17	17	17	17	17	17	17
Gemsbok	2202	0	0	0	0	0	0	0	0	0	0	0
Kudu	1069	0	0	0	0	0	0	0	0	0	0	0
Ostrich	3430	0	0	0	0	0	0	0	0	0	0	0
TOTALS		3341	5217	5329	6307	7210	12214	13444	14153	14635	14709	14778
PERCENT OF FINAL VALUE		23%	35%	36%	43%	49%	83%	91%	96%	99%	100%	100%

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 9: STOCK PROJECTION (Continued)

VALUE PURCHASES	Value	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Financial Value	(NAD)	0	1	2	3	4	5	6	7	8	9	10
Breeding Cows	4273	42730	0	0	0	0	0	0	0	0	0	0
Breeding Heifers	3798	11215	0	0	0	0	0	0	0	0	0	0
Bulls	6324	3011	903	1174	1188	1297	1383	1364	1349	1352	1352	1349
Surplus Heifers	3255	0	0	0	0	0	0	0	0	0	0	0
Calves	2478	9442	0	0	0	0	0	0	0	0	0	0
1st Year Steers	3255	3100	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	3255	3100	0	0	0	0	0	0	0	0	0	0
2 Year Steers	3798	2894	0	0	0	0	0	0	0	0	0	0
3 Year Steers	4658	3105	0	0	0	0	0	0	0	0	0	0
4 Year Oxen	4657	2661	0	0	0	0	0	0	0	0	0	0
5 Year Oxen	4541	2595	0	0	0	0	0	0	0	0	0	0
6 Year Oxen	4424	2107	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	4192	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	3959	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	3726	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	593	1975	0	0	0	0	0	0	0	0	0	0
Donkeys/Horses	1871	178	0	0	0	0	0	0	0	0	0	0
Gemsbok	2202	0	0	0	0	0	0	0	0	0	0	0
Kudu	1069	0	0	0	0	0	0	0	0	0	0	0
Ostrich	3430	0	0	0	0	0	0	0	0	0	0	0
TOTALS		85960	1174	1174	1188	1297	1383	1364	1349	1352	1352	1349

VALUE PURCHASES	Value	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Economic Value	(NAD)	0	1	2	3	4	5	6	7	8	9	10
Breeding Cows	4273	42730	0	0	0	0	0	0	0	0	0	0
Breeding Heifers	3798	11215	0	0	0	0	0	0	0	0	0	0
Bulls	6324	3011	903	1174	1188	1297	1383	1364	1349	1352	1352	1349
Surplus Heifers	3255	0	0	0	0	0	0	0	0	0	0	0
Calves	2478	9442	0	0	0	0	0	0	0	0	0	0
1st Year Steers	3255	3100	0	0	0	0	0	0	0	0	0	0
1st Year Heifers	3255	3100	0	0	0	0	0	0	0	0	0	0
2 Year Steers	3798	2894	0	0	0	0	0	0	0	0	0	0
3 Year Steers	4658	3105	0	0	0	0	0	0	0	0	0	0
4 Year Oxen	4657	2661	0	0	0	0	0	0	0	0	0	0
5 Year Oxen	4541	2595	0	0	0	0	0	0	0	0	0	0
6 Year Oxen	4424	2107	0	0	0	0	0	0	0	0	0	0
7 Year Oxen	4192	0	0	0	0	0	0	0	0	0	0	0
8 Year Oxen	3959	0	0	0	0	0	0	0	0	0	0	0
9 Year Oxen	3726	0	0	0	0	0	0	0	0	0	0	0
Goats/Sheep	593	1975	0	0	0	0	0	0	0	0	0	0
Donkeys/Horses	1871	178	0	0	0	0	0	0	0	0	0	0
Gemsbok	2202	0	0	0	0	0	0	0	0	0	0	0
Kudu	1069	0	0	0	0	0	0	0	0	0	0	0
Ostrich	3430	0	0	0	0	0	0	0	0	0	0	0
TOTALS		85960	1174	1174	1188	1297	1383	1364	1349	1352	1352	1349

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 9: STOCK PROJECTION (Continued)

ASSUMPTIONS

	Growth Rate	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Calving Rate: Cows		0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Calving Rate: Heifers		0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Mortality Rate: Calves		0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Mortality Rate: Others		0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Culling Rate: Breeding Stock		0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08	0.08	0.08
%age 2nd Year Heifers Sold		0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08	0.08	0.08
Bull Rate		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
%age 1st Year Steers Sold		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%age 1st Year Heifers Sold		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%age 2nd Year Steers Sold		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
%age 3rd Year Steers Sold		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
%age 4th Year Oxen Sold		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
%age 5th Year Oxen Sold		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
%age 6th Year Oxen Sold		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
%age 7th Year Oxen Sold		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
%age 8th Year Oxen Sold		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
%age 9th Year Oxen Sold		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Goats/Sheep (% Sold)	0.20	0.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Donkeys/Horses (% Sold)	0.10	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Gemsbok (% Sold)	0.12	0.00	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Kudu (% Sold)	0.12	0.00	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Ostrich (% Sold)	0.14	0.00	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)
TABLE 10: LOAN FINANCING SCHEDULE

ITEM	PERIOD (Yrs)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
LONG TERM LOANS												
TWENTY YEAR LOAN	20											
Total Expenditure		0										
Loan Disbursements		0	0	0	0	0	0	0	0	0	0	0
Loan Payments		0	0	0	0	0	0	0	0	0	0	0
Amortisation		0	0	0	0	0	0	0	0	0	0	0
Interest Payments		0	0	0	0	0	0	0	0	0	0	0
Loans Outstanding		0	0	0	0	0	0	0	0	0	0	0
FIFTEEN YEAR LOAN	15											
Total Expenditure		0										
Loan Disbursements		0	0	0	0	0	0	0	0	0	0	0
Loan Payments		0	0	0	0	0	0	0	0	0	0	0
Amortisation		0	0	0	0	0	0	0	0	0	0	0
Interest Payments		0	0	0	0	0	0	0	0	0	0	0
Loans Outstanding		0	0	0	0	0	0	0	0	0	0	0
SIX YEAR LOAN	6						6					
Total Expenditure		0						0				
Loan Disbursements		0	0	0	0	0	0	0	0	0	0	0
Loan Payments		0	0	0	0	0	0	0	0	0	0	0
Amortisation		0	0	0	0	0	0	0	0	0	0	0
Interest Payments		0	0	0	0	0	0	0	0	0	0	0
Loans Outstanding		0	0	0	0	0	0	0	0	0	0	0
FOUR YEAR LOAN	4											
Total Expenditure		0				0				0		
Loan Disbursements		0	0	0	0	0	0	0	0	0	0	0
Loan Payments		0	0	0	0	0	0	0	0	0	0	0
Amortisation		0	0	0	0	0	0	0	0	0	0	0
Interest Payments		0	0	0	0	0	0	0	0	0	0	0
Loans Outstanding		0	0	0	0	0	0	0	0	0	0	0
SHORT TERM LOANS												
Working Capital	1											
Overdraft		0	0	0	0	0	0	0	0	0	0	0
Interest Payments		0	0	0	0	0	0	0	0	0	0	0
TOTAL LONG TERM LOAN DISBURSMENTS												
Domestic Component		0	0	0	0	0	0	0	0	0	0	0
Foreign Component *		0	0	0	0	0	0	0	0	0	0	0
TOTAL LONG TERM LOAN AMORTISATION												
Domestic Component		0	0	0	0	0	0	0	0	0	0	0
Foreign Component *		0	0	0	0	0	0	0	0	0	0	0
TOTAL INTEREST PAYMENTS												
Domestic Component		0	0	0	0	0	0	0	0	0	0	0
Foreign Component *		0	0	0	0	0	0	0	0	0	0	0
TOTAL LOANS OUTSTANDING												
Domestic Component		0	0	0	0	0	0	0	0	0	0	0
Foreign Component *		0	0	0	0	0	0	0	0	0	0	0

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 11: PROJECT FINANCIAL ANALYSIS - 5 YEARS (NAD, 2008)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
EXPENDITURE						
Capital Expenditure	116188	8187	1174	1188	2232	1383
Variable Expenditure	1087	6520	10867	10867	10867	10867
Overhead Expenditure	11717	11717	11717	11717	11717	11717
TOTAL EXPENDITURE	128992	26424	23759	23773	24817	23967
INCOME						
Gross Income	32788	35923	38514	41306	44439	45806
Asset Residual Value	0	0	0	0	0	148341
TOTAL INCOME	32788	35923	38514	41306	44439	194147
NET BENEFIT/COST	-96204	9498	14755	17533	19622	170179

PROJ. FINANCIAL RATE OF RETURN (FRR) OVER 5 YEARS = 22.91%
 PROJ. NET PRESENT VALUE (NPV) @ 10.00% = 51699

TABLE 12: PROJECT FINANCIAL ANALYSIS - 7 YEARS (NAD, 2008)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
EXPENDITURE								
Capital Expenditure	116188	8187	1174	1188	2232	1383	5031	2921
Variable Expenditure	1087	6520	10867	10867	10867	10867	10867	10867
Overhead Expenditure	11717	11717	11717	11717	11717	11717	11717	11717
TOTAL EXPENDITURE	128992	26424	23759	23773	24817	23967	27616	25505
INCOME								
Gross Income	32788	35923	38514	41306	44439	45806	46655	47184
Asset Residual Value	0	0	0	0	0	0	0	151890
TOTAL INCOME	32788	35923	38514	41306	44439	45806	46655	199074
NET BENEFIT/COST	-96204	9498	14755	17533	19622	21839	19039	173568

PROJ. FINANCIAL RATE OF RETURN (FRR) OVER 7 YEARS = 21.24%
 PROJ. NET PRESENT VALUE (NPV) @ 10.00% = 58705

TABLE 13: PROJECT FINANCIAL ANALYSIS - 10 YEARS (NAD, 2008)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
EXPENDITURE											
Capital Expenditure	116188	8187	1174	1188	2232	1383	5031	2921	2288	1352	1349
Variable Expenditure	1087	6520	10867	10867	10867	10867	10867	10867	10867	10867	10867
Overhead Expenditure	11717	11717	11717	11717	11717	11717	11717	11717	11717	11717	11717
TOTAL EXPENDITURE	128992	26424	23759	23773	24817	23967	27616	25505	24873	23937	23933
INCOME											
Gross Income	32788	35923	38514	41306	44439	45806	46655	47184	47443	47524	47553
Asset Residual Value	0	0	0	0	0	0	0	0	0	0	145730
TOTAL INCOME	32788	35923	38514	41306	44439	45806	46655	47184	47443	47524	193283
NET BENEFIT/COST	-96204	9498	14755	17533	19622	21839	19039	21678	22571	23588	169350

PROJ. FINANCIAL RATE OF RETURN (FRR) OVER 10 YEAR = 19.99%
 PROJ. NET PRESENT VALUE (NPV) @ 10.00% = 65870 Per Hectare = 366

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)
TABLE 14: ECONOMIC ANALYSIS - 5 YEARS (NAD, 2008)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ECONOMIC COSTS						
Capital Expenditure	101095	7399	998	1010	1977	1175
Unskilled Wages	4739	4739	4739	4739	4739	4739
Other Domestic Costs	1099	1648	2198	2747	2747	2747
Tradable Costs	595	2379	4757	5947	5947	5947
Foreign Amortisation	0	0	0	0	0	0
Foreign Profits	0	0	0	0	0	0
Foreign Loans Outst.	0	0	0	0	0	0
TOTAL COSTS	107527	16164	12691	14442	15409	14608
ECONOMIC BENEFITS						
Gross Income	26692	29245	31354	33627	36177	37290
Asset Residual Value	0	0	0	0	0	127891
Foreign Financing	0	0	0	0	0	0
TOTAL BENEFITS	26692	29245	31354	33627	36177	165181
NET BENEFIT/COST	-80835	13080	18663	19185	20768	150573
ECONOMIC RATE OF RETURN (ERR) OVER 5 YEARS = 28.62%						
NET PRESENT VALUE (NPV) @ 10.00% = 62339						

TABLE 15: ECONOMIC ANALYSIS - 10 YEARS (NAD, 2008)

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
ECONOMIC COSTS											
Capital Expenditure	101095	7399	998	1010	1977	1175	4588	2616	2024	1149	1146
Unskilled Wages	4739	4739	4739	4739	4739	4739	4739	4739	4739	4739	4739
Other Domestic Costs	1099	1648	2198	2747	2747	2747	2747	2747	2747	2747	2747
Tradable Costs	595	2379	4757	5947	5947	5947	5947	5947	5947	5947	5947
Foreign Amortisation	0	0	0	0	0	0	0	0	0	0	0
Foreign Profits	0	0	0	0	0	0	0	0	0	0	0
Foreign Loans Outst.	0	0	0	0	0	0	0	0	0	0	0
TOTAL COSTS	107527	16164	12691	14442	15409	14608	18020	16049	15457	14581	14579
ECONOMIC BENEFITS											
Gross Income	26692	29245	31354	33627	36177	37290	37981	38412	38623	38689	38713
Asset Residual Value	0	0	0	0	0	0	0	0	0	0	125099
Foreign Financing	0	0	0	0	0	0	0	0	0	0	0
TOTAL BENEFITS	26692	29245	31354	33627	36177	37290	37981	38412	38623	38689	163812
NET BENEFIT/COST	-80835	13080	18663	19185	20768	22683	19961	22363	23167	24108	149233
ECONOMIC RATE OF RETURN (ERR) OVER 10 YEARS = 25.12%											
NET PRESENT VALUE (NPV) @ 10.00% = 82249 Per Hectare = 457											

FINANCIAL/ECONOMIC MODEL - TRADITIONAL SMALL-SCALE LIVESTOCK KEEPING - CAPRIVI - BASE CASE (NAD,2012)

TABLE 16: SUMMARY OF RESULTS

ITEM	UNITS	TOTAL		
Grazing Land Extent	Hectares	180		
Stock	Large Stock Units (LSU)	35		
ITEM	% of TCI	NAD/LSU	NAD/HECTARE	NAD
Total Financial Capital (TCI)	-	3833	745	134165
Financial Gross Income	35%	1359	264	47553
Variable Financial Costs	-	310	60	10867
Fixed Financial Costs	-	412	80	14413
Net Cash Income	17%	636	124	22272
Local Community Cash Income	24%	907	176	31749
Land Rental	-	0	0	0
Resource Royalty	-	0	0	0
FRR (@ 10 Years)	-	-	-	19.99%
FNPV (@ 10%, @ 10 Years)	-	-	366	65870
Total Economic Capital	-	3346	651	117120
Economic Gross Income	34%	1133	220	39652
Economic Costs	21%	718	140	25144
Net Economic Benefit (GNI)	12%	414	81	14507
Net Value Added (NNI)	10%	343	67	11996
ERR (@ 10 Years)	-	-	-	25.12%
ENPV (@ 10%, @ 10 Years)	-	-	457	82249
Economic Capital Cost/Job	-	-	-	90092
Domestic Resource Cost Ratio	-	-	-	0.98
Policy Analysis Matrix	: Effects of Policy / Market Imperfections	: on Output		7901
		: on Tradable Inputs		2926
		: on Domestic Factors		-551
	: Net Effects of Policy / Market Imperfections	: on Annual Net Income		10276
		: on Net Present Value (10 Years)		-16379

Appendix 3: A note on options for integrated management of livestock production & wildlife conservation in Caprivi

INTEGRATED MANAGEMENT OF LIVESTOCK PRODUCTION & WILDLIFE CONSERVATION IN THE CAPRIVI

A goal in the Caprivi is to commercialise livestock production (mainly beef because few other domestic livestock are present) and trade so that it becomes a more effective livelihood generator but at the same time does not conflict with enterprises based on wildlife conservation such as eco-tourism and trophy hunting.

From the livestock perspective, trading beef to higher-value markets is dependent on being able to satisfy the needs of the buyer (quality & price) as well as legitimate sanitary standards set by the regulatory (competent) authorities for ensuring food safety and the minimizing the risk of spreading dangerous animal diseases such as FMD and RVF.

It is difficult to achieve the above in the Caprivi because of a number of structural constraints to beef production (which renders creation of competitive advantage problematic), and also because of current international sanitary standards based on the geographic (fencing-based) exclusion of dangerous animal diseases like FMD from the locality of production because:

- it is impossible to effectively separate cattle from wildlife in the Caprivi because the eastern Caprivi lies at the heart of the KAZA TFCA and there are open borders with adjacent countries with large concentrations of wildlife in those border areas;
- significant but unquantified cross-border trade in cattle occurs between the eastern Caprivi and adjacent countries, so wildlife are not the only disease threat when it comes to contagious diseases;
- production system supplies (1) the official market (MeatCo) and (2) the unregulated local market for cattle;
- the quality of cattle in the Caprivi is not ideal or beef production (>80% of carcasses produced in recent years are C grade);
- the animal identification and traceability system is not fully functional because the recording of animal movement is not yet comprehensive, even though identification of cattle is in place;
- trekking of cattle over long distances to the two available quarantine stations (QS) before slaughter is a high risk practice for FMD, and quarantine significantly detracts from the quantity and quality of the final product.

Table 3.1: A summary of the essential requirements for three different options aimed at addressing sanitary constraints to export of deboned beef produced in the Caprivi to regional & international markets

Option 1	Essential features	Basic requirements for function	Implications
Option 1 Status quo	Animal disease/FMD management approach based on geographic approach		Makes integration of beef production & wildlife conservation difficult
	Occurrence of FMD outbreaks currently interrupts official marketing for 6+ months	Negative trend in FMD occurrence needs to be reversed	Creates unacceptable financial risk to initiatives based on promotion of commercialisation of beef production
	Prophylactic vaccination program against FMD in place	More effective vaccine required	Efficacy of vaccine unlikely to improve in near- to medium-term future
	Beef production constrained by seasonal grazing/water shortage	Supplementation in dry season needed	Financial viability & logistics uncertain
	Trekking (sometimes long distance) to Quarantine Station (QS) is high risk (FMD) & disincentive to producers marketing to MeatCo	Qs are needed nearer to the major source of cattle in eastern Caprivi and/or motorised transportation to QS introduced	Requires additional land for establishment of QS & finance for running costs; also finance for motorised transport
	Grazing inadequate in Qs seasonally	Additional Qs?	Land shortage in Caprivi
	Inadequate abattoir chiller capacity & requirement for operational shut-down for routine maintenance	Additional chiller capacity planned by MeatCo	
	Three week holding period for beef prior to shipment creates logistical difficulties (shortage of chiller space)	Probably unnecessary/unjustified	Possible cost saving
	Traditional market (RSA) no longer available as result of policy change in RSA	Bilateral negotiation needed to persuade RSA to resume beef imports from Caprivi or identification of alternative markets	RSA authorities demonstrate little enthusiasm for negotiation – possibly protectionist approach

Table 3.1: (continued)

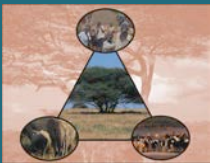
Option 2	Essential features	Basic requirements for function	Implications
Option 2 Modification of Article 8.5.25 (TAHC) - implies a value chain approach	A cattle ID & traceability system compatible with ensuring food safety & recent disease history	Further development of the permit/recording system used in the Caprivi	Essentially same as requirement for option 1 to operate effectively
	Producer protocol needed to ensure Good Agricultural Practices that are widely complied with by producers	System in development	Implies additional activity & expense for MeatCo but ultimately better product
	Heightened surveillance for FMD by expanding the system currently in place (but will not comply with full requirement of 8.5.25 as currently written)	Additional personnel, vehicles & budget to conduct field surveillance	Will need to be backed by risk assessment/risk management study; Increased DVS budget for vehicles, personnel & other operating costs
	FMD vaccination program consistent with 8.5.25 (in place)	As for option 1, improved vaccine required	Requirement not likely to be met in the short term
	Motor transport from home crush pen to QS	Additional loading ramps & animal transporters with associated personnel, vehicles & budget	Development of new system with considerable initial & on-going cost
	Abattoir approval/certification (export- & Good Handling Practices certification – essentially in place)	Some improvement in abattoir management; Some minor up-grading of the abattoir & expansion of chiller capacity (latter already planned by MeatCo)	Additional cost
	Three week quarantine (in place – requirement additional to 8.5.25 to satisfy DVS)	Management of QSs does not comply with accepted good practice	Upgrade of QS management will imply additional DVS staff & considerable increase in running costs
	Pre- & post-slaughter inspection; Removal of bones & lymph nodes; Maturation of beef (pH <6.0) all in place		

Table 3.1: (continued)

Option 3	Essential features	Basic requirements for function	Implications
Option 3 Modification of Article 8.5.25 plus processing	Same basic requirements as for option 2		Among the 4 options this is the only one which will not engender resistance from prospective markets, based on compliance with sanitary standards
	Additional processing plant linked to current abattoir	Construction of the plant	Initial & ongoing costs will be significant
	Associated equipment - minimum being a <i>sous vide</i> -like vessel in which deboned beef can be partially processed to heat to a core temperature of 70° C & equipment for subsequent vacuum packaging & chilling of the product (needs refrigeration system separate from that used for carcasses)	Purchase & installation of equipment; Staffing of the plant & operational budget; Operating plan to ensure HACCP- & GHP compliance	
	Production of other products (e.g. biltong) needs to be based on product-specific feasibility studies		



The Wildlife Conservation Society's Animal & Human Health for the Environment And Development (AHEAD) Program is a convening, facilitative mechanism, working to create enabling environments that allow different and often competing sectors to literally come to the same table and find collaborative ways forward to address challenges at the interface of wildlife health, livestock health, and human health and livelihoods. We convene stakeholders, help delineate conceptual frameworks to underpin planning, management and research, and provide technical support and resources for projects stakeholders identify as priorities. AHEAD recognizes the need to look at health and disease not in isolation but within a given region's socioeconomic and environmental context.



The World Wildlife Fund's (WWF) work in Namibia focuses on supporting the Namibia communal conservancy program -- a successful model for balancing the needs of people and wildlife. WWF works with Namibian partners (MET, NACSO, private sector, and others) to assist local communities with the sustainable management of their natural resources and to ensure a future for wildlife populations and sustainable economic growth. Today, there is a direct relationship between the health of wildlife populations and prosperity of local communities.