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The Real Jewels of the Kalahari

Drylands Ecosystem Goods and Services in Kgalagadi South District, Botswana

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SUMMARY

This study seeks to identify the contribution of drylands ecosystem goods and services to poverty reduction, livelihood security and the national economy, illustrated by a case study of two dryland communities in the Kgalagadi District of Botswana. We consider how a better understanding of the economic contribution of drylands could influence national and international decision making. The study seeks to answer the following questions:

- What are the ecosystem goods and services found in the study sites?
- Which of these services are key to the livelihood strategies of the local communities?
- What is the social and economic value of these ecosystem services?
- What are the implications of the case study findings to local and national development planning?

This valuation helps us answer practical questions of environmental policy such as: how much do our ecosystems contribute to our economic activities at national level? Does a given conservation investment justify its costs? How are costs and benefits of ecosystems distributed?

Botswana is an arid to semi-arid landlocked country that borders South Africa, Zimbabwe and Zambia. Over 80% of Botswana is drylands and three quarters of the total land area is covered by the Kalahari sands. The mean annual rainfall ranges from over 650mm in the northeast to less than 250mm in the southwest, but rainfall is highly erratic and the country is subject to periodic droughts. Roughly half of Botswana's population lives in the rural areas, using mixed agro-pastoral farming practices. Botswana's natural resources comprise range and arable land, woodlands, a large wildlife population and a variety of mineral deposits. Botswana produces over 30% of the world's diamonds by value.

Kgalagadi District is located in the southwestern corner of Botswana and constitutes about 10.5% of the country's total area. The district has an average annual rainfall of 150mm in the south to 250mm in the north; the terrain is flat, with occasional low rocky hills, plains or pans and sand dunes. There is no surface water except in seasonal shallow pans and fossil valleys.

The study methodology combined reviews of existing literature, household questionnaire surveys, focus group discussions and interviews with key informants. At the conclusion of field work, a seminar was organised to bring together experts on valuation from the region, local communities in Kgalagadi District and from another desert district, NGOs and Government economic development planners, in order to review the results of this study and to share experiences and lessons.

A combination of tools was used in the Kgalagadi study to assess the economic value of ecosystem goods and services:

- Market prices were used to derive direct use values
- Benefits transfer methodology was used to assess indirect use values. This method involved the modification of land use economics studies conducted in Namibia or elsewhere in Botswana. These models were re-run with adjustments for a lower carrying capacity and slightly different plant species mixes, to get results that could be transferred to the Kgalagadi study area. Models for veld products use and fuel wood harvesting were based on

empirical data from semi-arid northern Botswana and Namibia, adjusted to fit with the lower production conditions in the study area.

- Both private and economic values were measured in this study. Private values quantified the turnovers, net profits and returns to investment realised by households or enterprises, as expressed in transactions in money or in kind. Economic values, on the other hand, represented the estimated amounts that activities added to the national income. These estimates consisted of outputs less the costs of production, leaving the returns to internal factors of production, i.e., the capital, labour and entrepreneurship.
- To measure total economic impact, the multiplier effect of an activity on the broader economy was considered. At the national level, the social accounting matrix (SAM) model for Botswana was used to derive the income or value added multipliers for different activities. The SAM is an input-output model of the whole economy, expanded to include income and expenditures at household level.

Dryland ecosystems in Kgalagadi South sub district provide a wide range of goods and services that are pertinent for local peoples' lives such as fuel wood, construction material, grazing for livestock, medicines, veld foods (vegetables and fruits) and scenic landscape with high tourism potential. Contemporary livelihood strategies combine Government drought relief projects, social welfare programmes, livestock rearing and collection of veld products (especially by female-headed households). Plant resources contribute to the livelihoods of the local communities on a seasonal basis and also in times of good rains. In droughts, wildlife and livestock become even more important because there is diminished plant nutrition and availability. Access to wildlife resources is now at a collective community level through a quota allocation. The community auctions this quota to private safari operators and uses only part of it for subsistence.

The following results were established in comparing the economic values of key resources:

Private direct use values were measured at a household level in order to ascertain the value of costs and benefits from the preference of the individuals affected. The net annual private profit for households was highest from livestock production at a mean USD 1,124 per household, followed by the utilisation of natural plants at a mean USD 270 per household. The community as whole realised a net private value of USD 3,590 from community –based natural resource management (CBNRM) and as a result of joint ventures with the community private sector realised an annual private net profit of USD 8,735. Private resources were more highly valued by local residents because they were controlled at a household level as opposed to CBNRM and tourism which accrued to a collective community fund.

Economic direct use values were estimated for Kgalagadi South ecosystems. These values estimated changes at national level in terms of incremental additions to national income. The total direct annual contribution made by the Kgalagadi case study ecosystem to the gross national income in 2006 was estimated at USD 191,260 (Pula 1.2 million). Of this amount, the biggest contribution came from the various plant uses (Pula 577,800), and the livestock production activities (Pula 429,000) of households. When the effect of the income multiplier on the broader economy was added, the total impact of natural resource use in the study area on the national income was USD 335, 680 (Pula 2.1 million). The multiplier effect was greater for tourism than for household and community activities, because tourism had many more backward linkages into the wider national economy.

The asset value of the study area represents the present value of the expected future contribution of the dryland ecosystem in terms of economic rent. The asset value of the study area was USD 984,200 (Pula 6.2 million), with the highest contribution – about half the value – coming from plant utilisation (Pula 3.8 million), followed by private sector tourism (Pula 2. 3 million) and CBNRM trophy hunting (Pula 170,000). Although the main economic activity in Kgalagadi South sub district is livestock production, the valuation exercise revealed that livestock production contributed nothing to the asset value of the study area since it generated very minimal economic rent.

Among the **indirect use values or ecosystem regulating and supporting services** were carbon sequestration, protection from erosion, and value as a wildlife refuge. These values were roughly calculated using benefits transfer methods based on more detailed work that has been done elsewhere in semi-arid Botswana. The main indirect use value was the annual net change in carbon sequestration, at USD 111,300 (Pula 700,0000). Protection from wind erosion, measured as annual production losses averted, was valued at USD 68,400 (Pula 430,000). The value of the study area in protecting wildlife which disperses i.e. the wildlife refuge value, was estimated at Pula 15,000 per annum. The value for groundwater recharge was estimated to be negligible.

This study raised some fundamental issues and challenges for national economic and development planning. These included:

- Veldt product markets are not formalised and remain underdeveloped and invisible in formal land use and investment plans at national and district levels.
- Cultural values are not adequately rewarded; for example, no formal benefits are derived by local residents for local knowledge and innovations through patents and royalties from the use of herbal teas or medicinal plants.
- There is a general lack of economic diversification at the local level i.e. livestock production concentrates only on beef production and not on the development of other by-products and small stock farming.
- Failure to pay attention to gender roles means that village institutions generally support male-dominated livelihood strategies such as cattle farming and wildlife-based CBNR, which has left the livelihood strategies of female-headed households underdeveloped and vulnerable to poverty.
- Sectoral approaches to development planning have reduced opportunities to address dryland degradation and diversify livelihood supporting initiatives. For example, agricultural policies fail to take into account other goods and services provided by dryland ecosystems.

In sum, decisions regarding management of dryland ecosystems are made on the basis of economic, social, cultural and political considerations, but are often mainly based on economic calculations comparing the costs and the benefits of any planned initiative. It is therefore important that comprehensive information is available on the total economic valuation of drylands. This will require the design of innovative conceptual frameworks for the inclusive valuation of local social and ecological systems. Holistic and multidisciplinary approaches will enable a more accurate valuation of dryland ecosystem goods and services. Finally, improving the sustainability of dry lands depends on appropriate market incentives, product development in order to strengthen the economic base, and the transfer to the local level of knowledge on the valuation of environmental goods and services.

PURPOSE OF THE STUDY

This study assesses the contribution of drylands ecosystem goods and services to poverty reduction, livelihood security and the national economy through a case study of two communities in Botswana, southern Africa. The study's purpose is to show how such assessments can and should influence national and international decision-making processes.

There is increasing evidence concerning the economic importance of ecosystem services for local livelihoods. This evidence, however, has rarely been aggregated to make the case for investment in dryland management at the national level. Combined with the compartmentalization of dryland management issues into different sectors, this had led to a situation in which proponents of the Ecosystem Approach and other holistic frameworks have had to rely on special pleading rather than concrete evidence of the contribution to the national economy of dryland ecosystem services. As a consequence, the development of economic incentives for improved dryland management, contributing to local livelihood security and poverty alleviation, is still in its infancy.

It is thus important to quantify and document the value of these ecosystem goods and services in order to justify investment in the development of the dryland areas. Understanding the opportunity costs - at both local and national level - of *not* managing dryland ecosystems is central to influencing decision making on the need to invest in drylands and reduce the vulnerability of populations living in these areas.

There is a need for cost and benefit analysis of different land uses in Southern Africa's drylands. This is critical for changing the perceptions of development planners who view dryland areas as 'sinks' and areas for social welfare (Mortimore, 2006). Without an understanding of costs and benefits, practitioners and policy makers in the region and elsewhere will continue to design inappropriate interventions with perverse incentives. It is against this background that this study was carried out in Kgalagadi District of Botswana.

Background on dryland ecosystems

Dryland ecosystems – including dry sub-humid, semi-arid, arid and hyper-arid areas – occupy approximately 50% of the Earth's terrestrial surface. More than 35% of the world's population lives in drylands, and many people depend directly for their livelihoods on goods and services provided by drylands ecosystems, such as food, fodder, fibre, medicine, provision of clean water and protection against erosion.

Due to the particular adaptations to extreme environmental conditions, dryland ecosystems harbour a distinctive biological diversity, with many endemic species and genetic variants that occur nowhere else in the world. Though species numbers tend to be moderate in semi-arid areas and decline to low levels in arid and hyper-arid zones, diversity in some animal and plant groups can in contrast to this general rule increase as aridity becomes more intense. An article in *Dryland Agrobio* (2003) shows that although the number of species is less in the drylands than the tropics or semi-tropics, drylands are characterised by high degree of endemism and also contain high value products for industrial and pharmaceutical uses. Dryland species have developed a wide range of adaptive traits to harsh environments, making them also important sources of genes for stress resistance in breeding for drought, cold, salinity, diseases and pests as well as other production constraints. Drylands also

provide habitats for wildlife and are critical to the survival of many migrating species (Christiansen and Vaughan 1997), Despite comparatively low species numbers, biodiversity is crucial to maintaining ecosystem functions in drylands. Losing species in dryland systems may result in the reduction of resilience, productivity and livelihood security far more quickly than in more humid environments.

A major concern in dryland ecosystems is degradation, as defined by the United Nations Convention to Combat Desertification (UNCCD). Degradation continues to impoverish farmers and pastoralists and has important consequences outside of the drylands, such as siltation of water bodies and the environmental impacts caused by displaced people. Human activity is expanding more and more into the very dry and hyper-arid areas; it has been estimated that approximately 70% of the worldwide dryland area is affected by some form of desertification and land degradation, resulting from a variety of factors including climatic variations and intensification of human activity. Global warming is likely to make drylands drier and increase even their size.

In Southern Africa the underlying causes of dryland degradation are a combination of lack of alternative economic opportunities and weak regulatory framework and institutional structures (Scholes and Biggs, 2004). The application of holistic frameworks such as the Ecosystem Approach and other natural resource management approaches that address environmental and socioeconomic factors in an integrated manner is an essential part of the solution. There is also considerable agreement that in many contexts there is a big gap between the social profitability of improved land management and the (limited) private benefits accruing to the land managers as a result of both market and policy failure. As a consequence, government policy and institutional reforms such as incentives are often needed.

Southern African countries have various initiatives for addressing issues of desertification through their National Action Plans and other programmes. Some of the emerging interventions are tackling the underlying causes of land degradation by focusing on both conservation and development challenges i.e geared towards poverty alleviation. Of relevance are the community-based natural resource management (CBNRM) programmes. A recent series of case studies in southern Africa by IUCN and USAID/FRAME has shown that CBNRM has successfully increased the management authority and responsibility of local communities and promoted integrated approaches. Capacity building of communities undertaking measures to manage their resources and diversify their livelihoods has resulted in sustainable resource management (Von Malthias, 2007). Though CBNRM initiatives have yielded positive results, more is required to address the needs of local people in drylands. In particular, CBNRM in southern Africa remains mainly wildlife-based and there is more potential to develop veld products and tourism.

Objectives of the study

This study seeks to identify the contribution of drylands ecosystem goods and services to poverty reduction, livelihood security and the national economy, illustrated by a case study of two dryland communities, Khawa and Struizendam, in the Kgalagadi District of Botswana. The aim is to consider how a better understanding of this contribution of drylands could influence national and international decision making. The study seeks to answer these questions:

- What are the ecosystem goods and services found in the study sites?
- Which of these services are key to the livelihood strategies of the local communities?

- What is the social and economic value of these ecosystem services?
- What are the implications of the case study findings to local and national development planning?

The economic value of dryland resources in the semi-arid area of Kgalagadi district is demonstrated through the application of valuation methods. These methods are complimented with other approaches, namely sustainable rural livelihoods and a gender perspective, which highlight the complexities around valuation of ecosystem goods and services. These approaches provide insights into what determines values at a local level, according to the ways communities make use of natural resources and the variation between the values that different members of a community may attach to the same resource. Such insights are useful for guiding appropriate interventions and designing incentives for sustainable dryland management.

The case study also explores the value of local knowledge systems as an asset for strengthening the participation of local communities in the sustainable management of their local resources. In this case study, we refer to this as the cultural value of drylands ecosystem goods and services.

Botswana drylands

Botswana is an arid to semi-arid landlocked country that borders South Africa, Zimbabwe and Zambia. Over 80% of Botswana is drylands and three quarters of the total land area (581,730km^2) is covered by the Kalahari sands. The mean annual rainfall ranges from over 650mm in the northeast to less than 250mm in the southwest, but rainfall is highly erratic and the country is subject to periodic droughts.

In four decades Botswana has experienced the most rapid economic expansion in Africa, with an average GDP growth rate of 9.6% per annum between 1966 and 2004. The country has a population of 1.8 million with a growth rate of 0.18%. Although it has enjoyed steady economic growth, two-fifths of the population lives below the poverty datum line, defined as living on or earning just under a dollar a day. The HIV/AIDS pandemic has reduced life expectancy to 35.3 years, and is the leading cause of death. Approximately 35.8% of the total adult population in Botswana is infected.

Botswana's natural resources comprise range and arable land, woodlands, a large wildlife population and a variety of mineral deposits. Botswana produces over 30% of the world's diamonds by value. Diamonds account for 45% of GDP, 74% of exports, 35% of government revenue, and 70% of foreign exchange. The government has taken steps to diversify the economy beyond the mineral sector, with an eye to long-term sustainability. Conservation is critical to that goal in each sector.

Roughly half of Botswana's population lives in the rural areas, using mixed farming practices. Crop production in Botswana's drylands is limited, due to the soil quality and climatic conditions. Less than 5% of the land area is suitable for cultivation. Beef production, primarily for foreign markets, is the most common land use in Botswana's drylands. However, periodic droughts have had serious impacts on cattle industry.

Botswana boasts a thriving tourism industry, based mainly on hunting and photographic safaris tracking large, healthy and diverse species of wildlife. Cultural tourism is a growing sub-sector of this economic driver. The share of tourism economic activity was 10.5% in the countries' GDP in 2002/03 and is growing rapidly.

The productivity of Botswana's drylands and communal rangelands is often underestimated, stemming from a narrow focus on livestock, especially beef. Although beef production is the dominant type of land use in the drier parts of Botswana, this industry however only benefits a minority of the people, mainly because of the increasing privatisation of tribal land or communal land through acquisition of boreholes (de-facto privatisation) and leasehold areas. These changes were introduced under the Tribal Grazing Land Policy and the fencing component of the 1991 National Policy on Agriculture. A significant result of this privatisation has been the displacement of many dryland dwellers, particularly the San hunter-gathering ethnic group, and many rural poor who could not afford to sink boreholes or acquire ranches (Cullis and Watson 2005; Madzwamuse 2006). Due to loss of access to land and resources and increases in poverty, more dryland inhabitants have become dependent on government handouts and drought relief programmes.

In practice, communal rangelands are used for a mixture of purposes; livestock, wildlife and gathering wild products. The rangelands therefore produce a range of products in addition to beef (CAR 2004). There are efforts to support other land uses, as the country strives to diversify its rural economy in order to reduce poverty levels. The Revised National Policy for Rural Development calls for a more integrated and diversified approach to rural development, incorporating other sectors besides agriculture such as tourism and community-based natural resource management. (CBNRM). This approach promotes tourism, wildlife, forests and veld[1] products sectors that rely on a healthy environment. In 2005 the rural communities in Botswana earned USD 2.8 million from CBNRM activities, which include auctioning wildlife quota, basketry, land rentals etc. However CBNRM in some of Botswana's drylands remains underdeveloped due to relatively low wildlife populations. Diversifying CBNRM beyond wildlife, to cover other types of natural resources such as rangelands and veld products is a challenge, which Botswana shares with the rest of the region.

National development economic planning does not yet fully address how to diversify the rural drylands economy. Biodiversity and environmental issues in general have so far not been coherently incorporated into government planning, policies or legal frameworks in Botswana, although there is a trend to change this. While Botswana's biological resources of wildlife and agriculture have been addressed in planning, other natural resources have not and a long-term holistic approach is still missing. While this holds true for most of the biomes in the country, it is even truer for the drier parts of the country where the tourism industry, cultivation and other economic sectors are not that well developed. The NBSAP Stocktaking Report identified the following issues relevant to drylands, in terms of economic and development planning:

- Resource use charges and property rights are the most commonly used environmental –economic instruments in Botswana. Charges have however no common foundation, leading to distortions in resource use. Moreover, most charges are low and not regularly reviewed.
- Subsidies are common, but virtually no environmental subsidies are given to improve natural resource management. Most subsidies aim to boost economic growth and production.
- The uneven sectoral distribution of subsidies and tax relief give an artificial advantage to agriculture, at the expense of non-subsidised sectors such as wildlife and veld product utilisation.

[1] The term "veld" is from the Afrikaans language of southern Africa, and refers to the open grazing lands or wilderness of that region. See http://encyclopedia.thefreedictionary.com/veld

- Veld products and wood resources have long been neglected in policy development and implementation.
- Participation of the commercial private sector in biodiversity activities has so far been restricted to wildlife.

The NAP to combat desertification could facilitate the mainstreaming of these sectors with regards to drylands, but implementation has been slow according to Botswana's Country Report to the UNCCD for 2004. Botswana has also been slow in adopting the NAP, even though steps have been taken to incorporate the NAP into National Development Plan 9 under the agriculture, forestry, and wildlife and land administration sectors.

The implementation of pilot projects under the NAP has yielded mixed results. Although there are some successes in 'halting desertification' with community involvement, participation over time has dwindled due to a lack of incentive-based methods. The Government of Botswana recognises the role of communities in combating desertification, but interventions have been in the form of woodlots and similar environmental activities, with very limited focus on improving incomes and appropriate incentives. Part of the problem is because some of these interventions are not holistic and there is no direct link between ecosystem well-being and improved livelihoods.

DEFINITION OF CONCEPTS

Ecosystem goods and services are generally defined as processes and products derived from ecosystems benefiting people and sustaining human life (MA 2003). Ecosystem goods are directly, or indirectly, utilised by humans and include food, water, construction material, medicines, fuel, utensils, waxes, handicraft materials, wild genes from plants and animals for agriculture etc.

Ecosystem services are conditions and processes through which natural ecosystems maintain biodiversity and the production of ecosystem goods to sustain and fulfil human life and are usually classified in the Millennium Ecosystem Assessment Framework as follows:

- **Provisioning services** are products and services harvested or passively provided by ecosystems, (e.g., wildlife and forest products for food, fibre and medicines; agricultural products, livestock pasturage; water, extracted minerals, and genetic resources).
- **Regulating services** regulate overall environmental conditions on Earth, such as maintenance of air and water quality, erosion control, and storm and landslide protection provided by vegetation.
- **Cultural services** are the 'non-material' benefits from ecosystems, including spiritual and cultural benefits, unique knowledge systems; diversity of cultures, languages, understandings; recreational demands.
- **Supporting services** maintain conditions for life on Earth, such as pollination for plant reproduction, production of oxygen and capture of carbon, and nutrient cycling.

These ecosystem services in drylands are in decline as land is being degraded mainly because of population growth, unsustainable human activities and climate change. One consequence is deterioration in the already harsh conditions for the people living in drylands. However, it is important to acknowledge that people living in drylands are remarkably resilient and their sustainable and flexible lifestyles may permit them to recover from some of the most severe natural calamities.

Even though dryland ecosystem processes are essential to sustain life and are technologically irreplaceable, ecosystem services and to a large extent also goods are usually not valued. Economic valuation can reveal the social costs or benefits that otherwise would remain hidden or unappreciated.

Why economic valuation?

Economic valuation - sometimes just shortened to valuation - is used by economists to articulate costs or benefits in monetary units, a common measuring rod often used by people to express their preferences. For example, when buying goods, consumers indicate their willingness to pay by exchanging money for goods and in turn their willingness to pay reflects their preferences.

The basic aim of valuation is therefore to determine people's preferences: how much they are willing to pay for ecosystem goods and services, and how much better or worse off they would consider themselves to be as a result of changes in their supply (Emerton and Karanja, 2004).

Thus valuation can increase our appreciation of ecosystems. It helps us answer questions that we are faced frequently such as: how much do our ecosystems contribute to our economic activities at national level? Does a given conservation investment justify its costs? How are costs and benefits of ecosystems distributed?

Answering these questions is important for planning and management. Valuations can help governments to decide how much of their scarce income resources should be invested in looking after a particular ecosystem. Likewise, valuations can suggest the mechanisms to compensate those who may experience more costs than the benefits they receive, for example in CBNRM. Thus valuation can help identify the beneficiaries of conservation and the magnitude of the benefits they receive, and help in designing mechanisms to capture some of these benefits and make them available for conservation (Pagiola et al. 2004).

One of the most widely used frameworks for identifying and categorising environmental benefits is the total economic valuation framework. This encompasses the subsistence and non-market values, ecological functions and non-use benefits associated with the environment (Nherera and Emerton 2006). It essentially involves considering the full range of an ecosystem's characteristics as an integrated system – its resource stocks or assets, flows of environmental services, and the attributes of the ecosystem as a whole (Barbier 1994). Broadly defined, total economic value includes:

- **Direct use values:** raw materials and physical products which are used directly for production, consumption and sale
- **Indirect use values:** the ecological functions which maintain and protect natural and human systems through services
- **Option values:** the premium placed on maintaining a pool of species and genetic resources for future possible uses
- **Existence values:** the intrinsic value of ecosystems and their component parts, regardless of their current or future use possibilities, such as cultural, aesthetic, heritage and bequest significance.

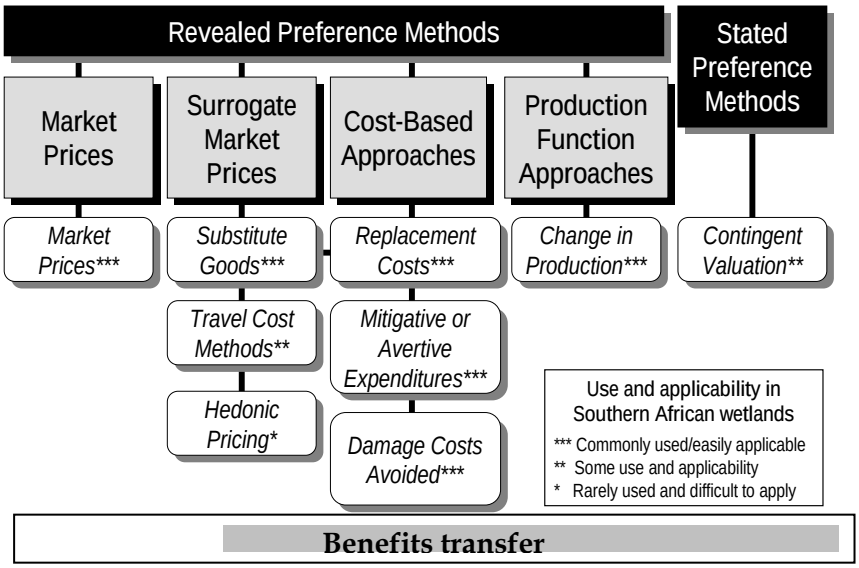
Whilst economic values have been defined to some extent for other ecosystems such as wetland and forest, very few studies have been carried out in drylands. The case

study presented here attempts to define some of the values obtained from drylands in Botswana and assesses both direct and indirect use values.

TOOLS AND METHODS USED FOR VALUING ECOSYSTEMS

There are a number of generic tools that can be used for valuing ecosystems such as wetlands and also drylands. Each of the methods has different data and analytical requirements and has varying suitability in different contexts and situations. The methods can be categorised into i) Revealed preference methods (market prices, surrogate market prices, cost based approaches, production function approaches) and ii) Stated preference (Contingent valuation) as illustrated in figure 1, and iii) Benefits transfer.

Figure 1: Methods for valuing ecosystem benefits/costs



Adapted from Emerton and Karanja (2004)

- **Market prices:** This approach looks at the *market price* of ecosystem goods and services. There is often a need to adjust the market prices to take into account price distortions that sometimes occur as a result of policies such as introduction of subsidies, or as result seasonal variations where quantities demanded or supplied affect prices.
- **Surrogate market approaches:** These approaches, including *substitute goods*, *travel costs* and *hedonic pricing*, look at the ways in which the value of ecosystem goods and services are reflected indirectly in people's expenditures, or in the prices of other market goods and services.
- **Cost-based approaches:** These approaches, including *replacement costs, mitigative or avertive expenditures* and *damage costs avoided*, look at the market trade-offs or costs avoided of maintaining ecosystems for their goods and services. It is noted that these are 'second best' methods as they use costs as proxy for benefits, and costs and benefits are in most cases not the same.
- **Production function approaches:** These approaches, including *effect on production*, attempt to relate changes in the output of a marketed good or service to a measurable change in the quality of quantity of ecosystem goods and services by establishing a biophysical or dose-response relationship

between ecosystem quality, the provision of particular services, and related production.

- **Stated preference approaches:** Rather than looking at the way in which people reveal their preferences for ecosystem goods and services through market production and consumption, these approaches ask consumers to state their preference directly. The most well known technique is *contingent valuation* However Choice Models are increasingly being used compared multiple sites with varying attributes.

Benefits transfer

Benefits transfer uses valuation estimates obtained (by whatever method) in one ecosystem to similar ecosystems under consideration. Benefit transfer is only reliable if based on a robust (quantitative) understanding of the determinants of value and how they vary by location, combined with systematic transfer models.

As indicated in Figure 1, there are some methodologies commonly applied in southern Africa and there are some with limited application. Arntzen (1998) applied market prices and surrogate market prices methodologies for valuing rangelands in Botswana.

Although there was a possibility of using the travel cost method in principle in Arntzen's (1998) study, where the travel costs to boreholes could serve as a reflection of rangeland value, his study did not use this method. This was mainly because distance to boreholes is determined primarily by family and cultural factors hence travel costs would have been misleading. The hedonic pricing method was found to be difficult to apply to communal areas where no market exists.

Methodology used for the Kgalagadi case study

Kgalagadi District is located in the south-western corner of Botswana and covers an area of approximately 110,110 km^2. This constitutes about 10.5% of the country's total area. The district has an average annual rainfall of 150mm in the south to 250mm in the north. The altitude is 110 metres with a flat terrain characterised by occasional low rocky hills, plains or pans and sand dunes. There is no surface water except in seasonal shallow pans and the Molopo and Nossop fossil valleys. Underground water, though available in large quantities, is often found in isolated perched aquifers which are extremely saline. Kgalagadi District is divided into northern and southern sub districts, which have some ecological differences; this case study was carried out in the southern sub district.

Household questionnaire surveys carried out by MSc students from the University of Botswana and reviews of existing literature were used to estimate direct use values. Three components of fieldwork were undertaken. The first round of fieldwork was carried out in 2005 and early 2006. One component of the case study assessed the value of ecosystem goods and services from a gender perspective i.e. the values that men and women attach to the ecosystem goods and services. The overall questions addressed are listed below;

What are the ecosystem goods and services found in the study sites?
Which of these services are pertinent to the livelihood strategies of the local communities?
What is the social and economic value of these ecosystem services?

What are the implications of the case study findings to national development planning?

In Khawa community interviews were carried out over a period of 14 days. Khawa has a total population of 725; 104 head of households were interviewed and 6 key informants (chief, school teachers, 2 trust members and 1 former trust member, Indigenous Vegetation Project officer). Focus group discussions were also held with the Village Development Committee and CBNRM Trust Committee (Photo 1 below and Annex A). Discussions were also held with civil servants in the Department of Wildlife and National Parks (Community Extension Officers), Remote Area Development Programme Officer and the District Officer Development in the district headquarters in Tsabong.

Photo 1: Village Development Committee and Trust Committee Focus Group discussion in Khawa (Picture by Nathaniel Tlhalerwa)

The findings highlight the different values and challenges posed to rural women and men due to their gender-based roles, relations and responsibilities, uneven access and control of resources and their different opportunities and constraints.

The second stage of the fieldwork used a sustainable rural livelihoods framework and also household questionnaire surveys. A total of 52 questionnaires were administered in Khawa and 65 questionnaires were completed in Struizendam, which covered 100% of the households. Key informant interviews and focus group discussions were also held in early 2006.

A subsequent field trip was undertaken to cover the data gaps in economic values. Using the data collected through the first fieldwork components, the focus group discussions were restricted to the valuation of resources that were identified as key

to the livelihood strategies of the communities during the course of the earlier surveys.

A seminar was then organised to bring together experts on valuation from the region, local communities from Kgalagadi District and from Gantsi District (another desert district), NGOs and Government economic development planners, in order to review the results of this study and to share experiences and lessons from the desert region and other parts of the country.

A combination of tools was used to assess the economic value of ecosystem goods and services in the Kgalagadi study. Market prices were used to derive direct use values while the benefits transfer methodology was used to assess the indirect use values. The benefits transfer methodology had to be used due to the lack of data for Kgalagadi, hence data from similar landscapes in arid southern Namibia were used. Some data were extracted from landscapes in semi-arid northern Botswana and Namibia were also used and adjusted for the study. The values were adjusted to reflect the Botswana situation, i.e. vegetation density.

Benefits transfer involved use of a detailed land use economics study conducted in the Gondwana Nature Park in southern Namibia (Barnes and Humavindu, 2003). Here, detailed empirically-based financial and economic spreadsheet budget and cost-benefit models had been developed for commercial small-stock farming, small-scale communal small-stock production, and tourism. The small-scale communal model involved similar ecological conditions, the same species, the same farming systems, and the same socio-economic conditions as the Kgalagadi study area. The results data for the models could be transferred with only slight modifications to allow for the slightly higher carrying capacities in the study area.

Similarly, models for safari hunting, tourism, cattle production, and community use of natural resources, were used in benefits transfer, reworking from Barnes et al. (2001), Turpie et al. (2006), Barnes et al. (2002) and unpublished models from the Economics Unit of the Ministry of Environment and Tourism, Namibia (MET unpublished data 2006). Here, models were re-run with adjustments for the lower carrying capacity and slightly different species mixes, to get results that could be transferred to the study area. Models for veld products use and fuelwood harvesting were derived in a similar way from those of Turpie et al. (2006) and Barnes et al. (2005). These were based on empirical data from semi-arid northern Botswana and Namibia, and models were adjusted to fit with the lower production conditions in the study area.

The valuation methodology used in the case study followed the enterprise approach where values are derived as private returns to the investing household or enterprise (annual turnover and net profit), and also in economic terms as the contributions the activities make to the national income (annual gross output, direct contribution to gross national income, and total – direct plus indirect – impact on the national income). To measure the total impact, the multiplier effect of the activity on the broader economy is considered.

It is important to point out the difference between the two types of value measured in the models. These are private values, which measure the turnovers, net profits and returns to investment realised by the households or enterprises. The private values represent transactions in money or in kind. The economic values, on the other hand, represent the amounts that the activities add to the national income. These represent the outputs less costs of production that come from outside the enterprises, leaving the returns to internal factors of production, i.e., the capital, labour and

entrepreneurship. The economic values are measured as opportunity cost to the nation, and for this some adjustments need to be made to the private values. Thus, because some jobs reduce unemployment, the economic costs for unskilled labour are lower than the private ones. Also, excess demand for foreign exchange means that the economic prices for tradable items are higher than the private costs and benefits for these. Taxes and subsidies represent private costs and benefits, but they do not change the national income so are eliminated from the economic models.

At the national level, the social accounting matrix (SAM) model for Botswana was used to derive the income or value added multipliers for the different activities. The SAM is an input-output model of the whole economy, expanded to include income and expenditures at household level. The national level income multipliers used for this study were those derived by Turpie et al. (2006) for similar activities, using empirical data in a disaggregated SAM.

DRYLAND ECOSYSTEM GOODS AND SERVICES IN KGALAGADI SOUTH

Livelihood Strategies in Kgalagadi

Due to its ethnic composition (San, Bakgalagadi and Coloureds), livelihood strategies in Kgalagadi District traditionally combined pastoralism and hunting and gathering. Most settlements in the district are situated near pans or fossil river valleys, or on rock outcrops that serve as sources of water through ground water supplies.

Contemporary livelihood strategies combine Government drought relief projects, social welfare programmes, livestock rearing and collection of veld products especially in the case of female-headed households. Plant resources tend to contribute to the livelihoods of the local communities on a seasonal basis and also in times of good rains. In droughts, the communities in Kgalagadi stated that wildlife and livestock become even more important because there is diminished nutrition in plants as well as diminished availability. Access to wildlife resources is now at a collective community level through the quota allocation for the CBNRM programme. The community auctions this quota to private safari operators and uses only part of it for subsistence.

The main source of wealth in the district is commercial cattle rearing for meat production. Food, domestic supplies and production inputs to the district are supplied from Lobatse (500km), Jwaneng (360kms) and the capital Gaborone, 530km away from the Kgalagadi South district centre. The Meat Commission in Lobatse absorbs 90% of the Districts' livestock sales. Overgrazing occurs due to open access on communal lands, as a result of a breakdown of traditional institutions, inadequate policies, and a limited water supply. Although the dominant landuse is grazing cattle, farming benefits only the minority as there are an increasing number of families who own no cattle (see Table 1 below). In Khawa only 22 of the 73 households own cattle while at least half own small stock. The rest are involved in a combination of livelihood strategies, which include subsistence hunting, collection of veld products for subsistence and to supplement their income, and employment as cattle herders and in drought relief schemes. None of the households are involved in crop production due to the unfavourable soil and climatic conditions.

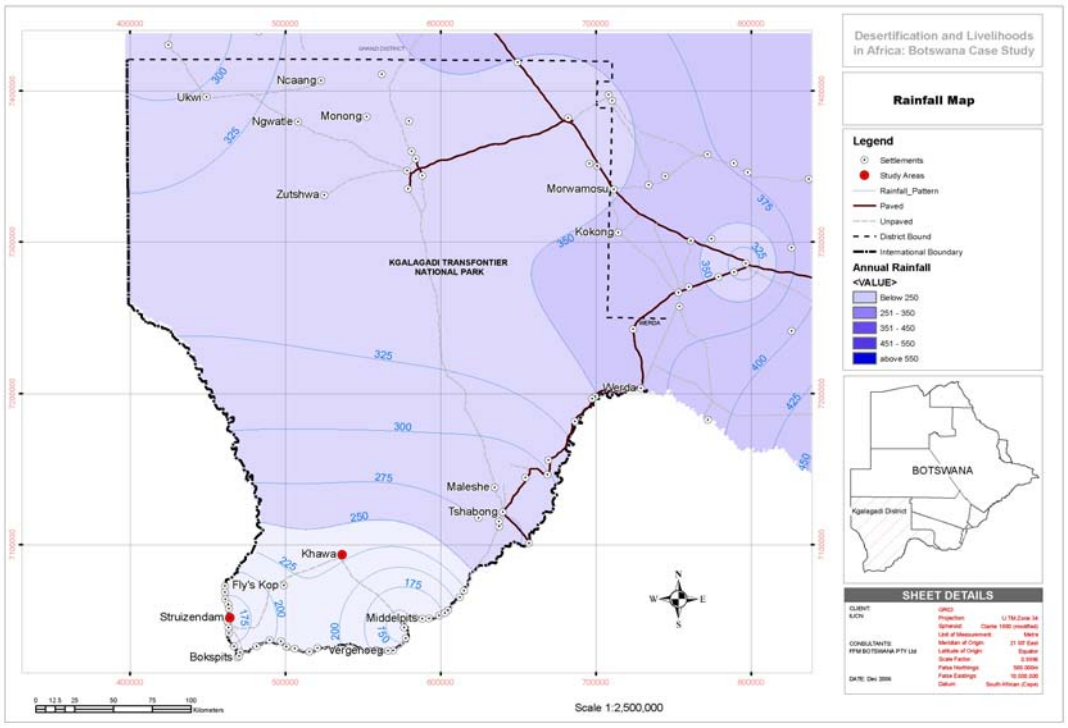
Table 1: Distribution of Cattle at Household Level in Botswana

Year	Rural households without cattle		Households with 1-20 cattle		Households with more than 20 cattle	
	'000s	%	'000s	%	'000s	%
1981	61.3	51.6	27.9	23.4	29.8	25.0
1991	104.7	67.6	26.9	17.4	23.5	15.2

Source: Cullis and Watson 2005, citing White 1998a

Tourism is emerging as a potential source of livelihood as a result of the establishment of the Kalahari Transfrontier Park that merged the Gemsbok National Park on the South African side and Kalahari Gemsbok Park in Botswana. Tourism is also been boosted by the introduction of community based natural resources management projects.

There are limited incentives for people to invest in sustainable natural resource uses other than those that are livestock-related. Grazing is currently the dominant landuse in the western portion of the Kgalagadi district while the areas surrounding the settlements are typically multiple use areas, for grazing of livestock, fuelwood and veld product harvesting (see Map 1 below).



Map 1 Land use in Kgalagadi District

DRYLAND GOODS AND SERVICES IN KGALAGADI

The study identified a variety of goods and services key to the livelihoods of communities in the study area within Kgalagadi District. These comprise wild foods, timber, fuel, fibre, medicines, forage for livestock, wildlife refuge, soil fertility

regeneration, water storage and supply, carbon sequestration, air and water purification, tourism potential and cultural values among others. Table 2 below provides a summary of provisioning services of the Kgalagadi drylands which are provisioning, regulating, supporting and cultural services are distinguished.

Table 2: Overview of provisioning services in the drylands of Botswana

	Livestock	**Wildlife**	**Plants/veld products**
Food	beef, goat, poultry milk eggs	game meat	Truffles wild melon bush raisin mopane worms honey various leaf vegetables (morogo) cucumbers and many others (see Mars 1996)
Fuel			fire wood
Fertiliser	manure		
Medicine			grapple plant hoodia herbal teas (Lengana) many other (see Mars 1996)
Construction material			various thatching grasses for roofing poles for fencing
Utensils		belts, skins and hides	bowls, spoons, cups, mortars etc.
Handicraft material	skins, hides	skins, skulls, hides, ostrich shells, feathers, animal horns	mokolwane palm, seeds wood for carvings clay
Oils / lipids / waxes			Morula bush candle water melon seeds and many others
Recreation		trophy hunting, photographic and cultural tourism	

Provisioning services of Botswana's drylands

Livestock production

Drylands in Botswana provide pastures, browse and underground water and are therefore commonly used as rangelands for cattle and small stock - mainly goats and donkeys (Arntzen 1998). Though livestock numbers are decreasing in low rainfall areas, cattle production supports 50% of the population in Kgalagadi North (Chanda and Totolo 2001). However, the majority of cattle owners do not entirely depend on livestock production and have only small herds (see Table 1 above); 90% of the cattle are owned by only 12% of the people living in this area (Chanda and Totolo 2001). Due to traditional gender roles in the country, 90% of cattle are owned by men.

Consumption and sale of meat are still the primary outputs from animal husbandry, representing a use value of USD 0.04/ha for cattle and USD 0.01/ha for goats, respectively (Amusa 2000). The importance of milk production mainly for subsistence is increasing and achieves high returns of USD 0.17/ha in the Kgalagadi District (Amusa 2000). Manure production and provision of draught power as other functions of livestock production are highly valued by people involved in arable agriculture and horticulture. Cattle are not only economically important but are also an important cultural marker for the Setswana ethnic identity, with strong cultural symbolism and value.

However, despite the high resilience of drylands, the productivity and value of rangelands appear to be gradually declining in Botswana as a consequence of land degradation and bush encroachment around boreholes and settlements; a process exacerbated by global climate change (CAR, 2006).

Furthermore, it is widely observed that government policies have made livestock artificially attractive through heavy subsidies in the form of;

- Free veterinary drugs and vaccination provided to farmers
- Direct subsidies for bulls, artificial insemination and borehole drilling;
- Indirect subsidies such as subsidised bank loans for the National Development Bank and tax advantages for livestock owners
- Low rentals for Tribal Grazing Land Policy (TGLP) ranches which are roughly USD 20/ha/year. The TGLP ranches were established from 1975, designed to halt degradation through promoting enclosure and privatisation of grazing areas.
- The Botswana Meat Commission (BMC) pricing policy which aims to revitalise the cattle industry and increasing incentives for cattle raising. In 2006 the BMC increased the price paid to producers by an average of 40%.

Agricultural production

Even though arable land covers only 0,1% of the Kgalagadi District, a report by Chanda and Totolo (2001) showed that more than 50% of all families were engaged in this livelihood strategy in Kgalagadi North sub district, which differs from the Kgalagadi southern region. The main crops in this area comprise maize, watermelon, cowpeas and sorghum.

Plant genetic resources

Dryland species have evolved a diversity of traits that are adapted to harsh environments, making them important sources of genes for stress resistance in breeding for drought, cold, salinity, diseases and pests as well as other production constraints. The drylands of Botswana harbour wild relatives or land races of water melon and cowpea and varieties of breeding lines of sorghum, pearl millet, groundnuts, cowpea and water melon (State of the Environment Report 2002).

Veld products

A wide range of products such as fire wood, veld foods and medicinal plants are provided by the drylands of Botswana; some plants like Devil's Claw, (discussed later under 'Medicinal Plants'), are endemic to this ecosystem. Nationally, approximately USD 77,000 was generated from veld products sales in 2005 (CBNRM Status Report 2006). However, data on marketed veld products other than Devil's Claw and Morula products are largely lacking, though for example thatching grass is critical for the livelihoods of rural people.

Almost all people in Kgalagadi District harvest different veld products for home consumption (Amusa 2000; Chanda and Totolo 2001; Velempini 2006). About one quarter of the people also generate income from harvesting veld products (Velempini, 2006). Veld product gathering accounted for USD 0.10/ha mainly due to the high use value of firewood (Amusa 2000). There is however a need to gain a better understanding of the commercial market for veld products and develop formal markets for these (IVP 2006).

Wild fruits and vegetables, particularly truffles *(Terfezia pseilii)*, wild melons (*Citrullus lanatus*), bush raisins (*Grewia flava* fruits) as well as Mopane worms and honey, represent regular supplementary sources of food for rural people in Botswana's dryland areas. The variety and diversity of veld foods collected varies significantly from area to area and from district to district. Veld foods are mainly used for subsistence and when sold only earn very little money. They are not only an important part of people's diet, but livestock also forage on vegetation in the veld. Amongst veld foods, watermelons were rated as most important for livelihoods by rural communities in Kgalagadi South, followed by truffles and bush raisins, though only found occasionally (Velempini 2006).

Fuel wood

Fuel wood is still a major energy source for the majority of rural households and for about 40% of urban households in Botswana (State of the Environment Report 2002). In rural areas, fuel wood is also used to scare wild animals away from the vicinity of villages (Velempini 2006). In Kgalagadi District, firewood represented the key resource for 89% of the households and contributed significantly to the high use value of veld products gathered in the area. However, overexploitation, overstocking and overgrazing continues to put pressure on available fuel wood resources and fuel wood shortages around villages in Kgalagadi have been reported (State of the Environment Report 2002).

Construction material

Wooden poles usually taken from live trees are typically used for fencing, roofing timbers and structure frames. The State of the Environment Report (2002) estimated that nationally 180 tonnes/year were used in the fencing of kraals (livestock pens) and 35 tonnes/year in construction. There is no data available specifically for drylands. Furthermore, several types of thatching grasses, particularly *Eragrosits pallens* and *Stipagrostis uniplumis,* are harvested as construction material for roofs, hut walls, yards and mats, both for home consumption and sale. Thatching grass was reported to be the second most important veld product for rural people in Kgalagadi North after fire wood (Amusa 2000).

Medicinal plants

The use of medicinal plants is still a common practice in Botswana's drylands, both for human and livestock health. Devil's Claw (*Harpagophytum procumbens*) is currently the most important commercially exploited medicinal plant in Botswana and endemic to drylands in southern Africa. This medicinal plant was rated as having the highest priority for the livelihoods of rural communities in Kgalagadi South (Velempini 2006). Nationally, approximately 20 tonnes of dried material with a value of USD 20,700 to USD 27,000 have been harvested and marketed in 2005 (DFRR 2006). Sales in Kgalagadi District have been estimated at between 5 and 10 tonnes with returns of USD 7,000 to 13,000. Likewise, *Hoodia goordonii,* a succulent plant with appetite suppressant qualities*,* growing only in the driest parts of the country (Kgalagadi South), provides a unique opportunity for livelihood diversification in rural communities. First cultivation trials in three communities in Kgalagadi South have been initiated by the DFRR in 2006. Besides these high value medicinal plants, a

large variety of other medicinal plants is consumed and marketed locally as various herbal teas. The Morula tree and the candle bush (*Sarcocaulon* sp) from semi-arid areas of Botswana contain ingredients interesting for the cosmetic industry such as valuable lipids and waxes.

Handicraft production
Though the mokola palm and dyeing plants (*Berchemia* sp and *Euclea* sp) are nationally important as natural resources for basket production, this particular handicraft production is less common in drylands, where the palm hardly occurs. Nationally some 45 plants have been reported to have aesthetic value, typically pods, fruits, stems and dried inflorescences (State of the Environment Report 2002). However, unattractively low prices have hindered large-scale marketing of these resources. More commonly exploited in the drylands of Botswana are ostrich shells, often used in jewellery and craft production particularly in Gantsi District.

Subsistence hunting
Vegetarian veld foods play a more important role in local people's diet than game meat, as hunting is strictly limited by current legislation and policies. Only around 10% of people in Kgalagadi District hunt animals such as gemsbock, eland, springbok, steenbok, hartebeest, duiker and ostrich (Amusa 2000; Velempini 2006). An annual raffle determines who receives a hunting permit for one animal in that particular year, but often the winners cannot afford to pay for the permits that range in cost between USD 16 (duiker) and USD 111 (eland and gemsbok). Birds that are not particularly protected can be hunted with an annual permit issued by the Department of Wildlife and National Parks (DWNP).

Tourism potential
Though wildlife in Kgalagadi District is less abundant than in northern Botswana, the CBNRM programme in Botswana provides an excellent opportunity for communities to engage in wildlife-based tourism activities such as trophy hunting and photographic tourism. Dry areas outside Chobe and Ngamiland Districts in the north account for almost half of the country's lion population; these are however mainly restricted to protected areas under the Department of Wildlife and National Parks. Typical dryland inhabitants comprise species such as gemsbok, springbok and ostrich. While 90% of all CBNRM revenues are generated in Ngamiland District in the north (Status Report 2006), there is evidence that districts in the southern drier parts of the country also have potential to derive economic benefits from the wildlife-based tourism sector. In 2005 four communities in Kgalagadi District earned altogether USD 48,000 through auctioning of wildlife quota and land leases. These revenues significantly contributed to the direct use value of USD 0.08/ha for hunting activities in this district (Amusa 2000).

However, over the past decades the decline in wildlife numbers in Botswana's drylands, particularly in Kgalagadi District, together with bush encroachment, has reduced the scenic beauty and tourism potential of the savanna. This has limited economic diversification options, particularly in the tourism sector.

ECONOMIC VALUES OF DRYLAND GOODS AND SERVICES IN KGALAGADI

There does not seem to be much evidence of dryland ecosystem valuation in Botswana. Attempts have been made to value rangelands, some of which are found in dry lands ecosystems, but most of this valuation shows that there is no inclusion of costs in the studies (Arntzen 1998). Economic valuation has also been carried out for

rangelands in a limited number of communities in Kgalagadi, the driest district in Botswana (Amusa 2000; Chanda and Totolo 2001). However, in all these studies values are mainly limited to direct use values, thus undervaluing drylands. Gathering of veld products (non timber) is the most undervalued activity, although it is of critical importance for low-income households.

Previous valuation exercises at a national level have found that livestock represents the bulk use value (around 70%) in rangelands which are mainly in semi-arid areas (Arntzen 1998). In contrast, livestock sales, slaughter and milk production accounted for only roughly 30% of the direct use value in Kgalagadi North sub-district, while non-livestock related land uses, namely gathering and hunting activities, made up two thirds of the direct use value (Amusa 2000).

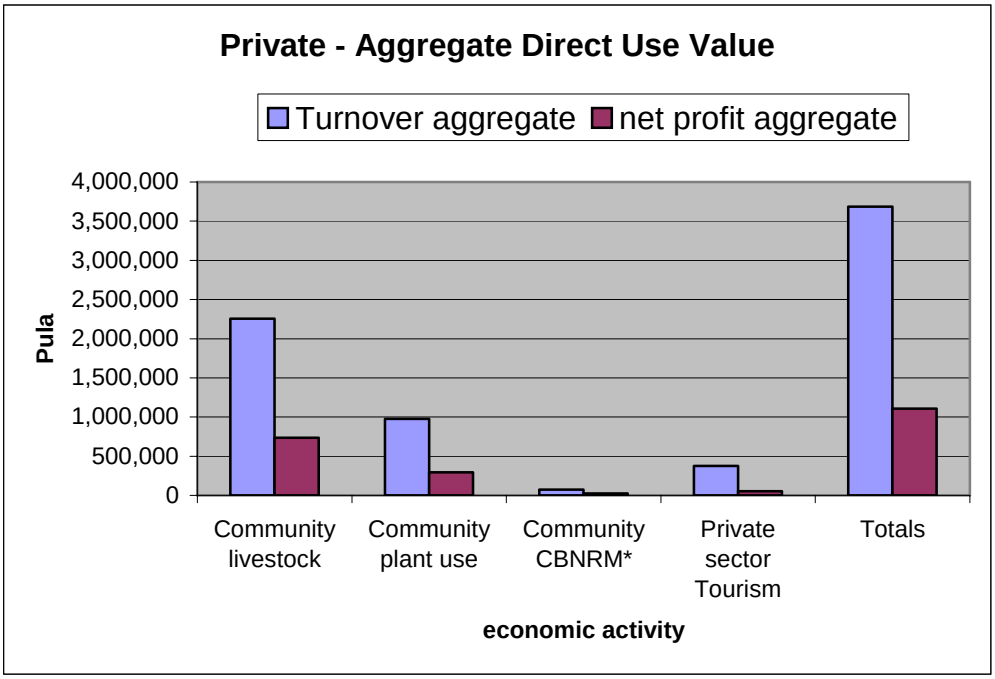
As previously outlined, the dryland ecosystems in Kgalagadi South sub district provide a wide range of goods and services that are pertinent for local peoples' lives such as fuel wood, construction material, grazing for livestock, medicines, veld foods (vegetables and fruits) and scenic landscape with high tourism potential. These are direct use assessments which draw attention to the consumptive and non-consumptive uses pertinent to the livelihood strategies of the local communities. There are also indirect use values such as those resulting from the land's services in carbon sequestration, as a wildlife refuge and in protection from wind erosion. These indirect use values benefit the nation as a whole, but often the society is not aware of these values.

The following results were established in further comparing the economic values of the key resources noted above.

Private Direct Use Values

The direct values were measured at a household level in order to ascertain the value of costs and benefits from the preference of the individuals affected. Note that, as discussed above, these private values are different from the economic ones given below. The net annual private profit for households was highest from livestock production at a mean USD 1,124 per household, followed by the utilisation of natural plants at a mean USD 270 per household. The community as whole realised a net private value of USD 3,590 from CBNRM, and as a result of joint ventures with the community private sector realised an annual private net profit of USD 8,735. The values for these private resources are considered higher by the communities as the benefits in the form of consumptive use and cash income accrue at a household level as opposed to CBNRM and tourism, e.g. selling of hunting quota, which accrue to a collective community fund (calculations based on Barnes et al. 2001).

Figure 2: Private household and community direct use values, Kgalagadi case study

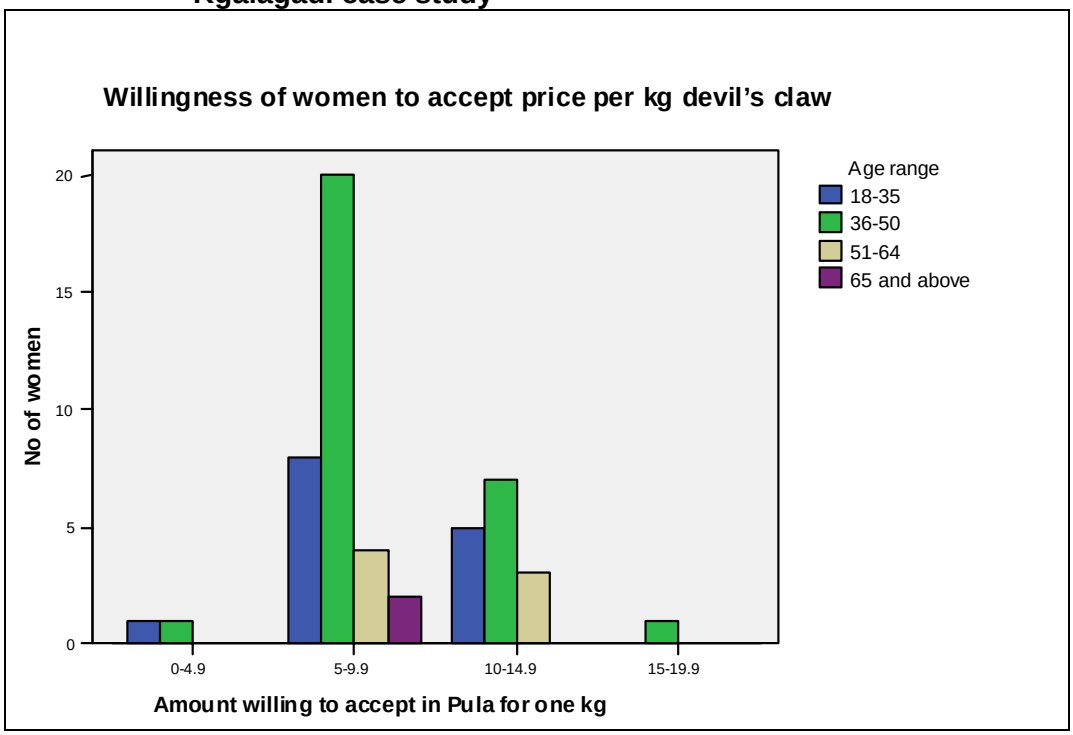


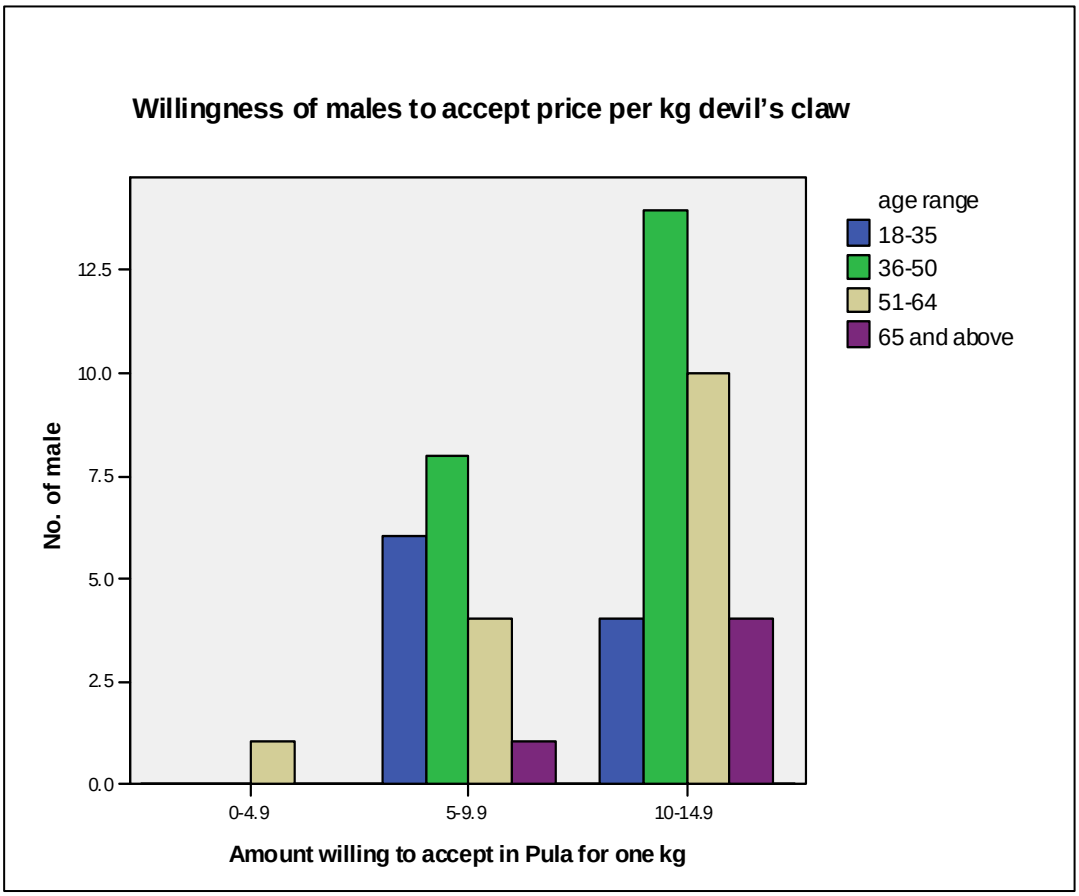
Note: Exchange rate for one Pula = USD 0.159 in 2007

Livestock and plant resources play a critical role contributing to cash income at a household level. Although the enterprise values of tourism and CBNRM are higher than livestock and plants, the actual returns are reduced significantly when divided by the number of households.

Asking the question how valuable is an ecosystem also begs the questions 'how valuable to whom'? The benefits provided by an ecosystem often fall unequally across different groups (Pagiola et al. 2004). This is certainly the case for the benefits of livestock and veld products in the Kgalagadi case study, as we see a clear distinction between the values men and women place on the two resources. A further analysis of the direct values using gender disaggregated data draws the conclusion that different members of the community attach varying opportunity costs of their labour to the different resources depending on their gender and age group. Tlhalerwa (2006) for instance draws the conclusion that women between the ages of 36 and 50 years have a pressing need to raise household income and limited alternatives sources of income; women in this age group therefore value the plant resources and are more actively involved in the collection of veld resources than men in the same age group (see Figure 3 below for price acceptance for Devil's Claw). The women are willing to accept a lower price than the men, which is realistic as the prices match the market value of between Pula 8.00 and Pula 10.00 per kg (equivalent to USD 1.30 to 1.60/kg).

Figure 3: Willing to accept price for Devil's Claw, by women and men in Kgalagadi case study





Economic - Direct Use Values

Table 4 shows the economic values estimated for the ecosystem valuation in Kgalagadi South. Note that, as discussed above, the economic values are different from the private values given in Figure 2 above. Values in Table 4 represent income changes at national level in terms of incremental additions to national income. The total direct annual contribution made by the Kgalagadi case study ecosystem to the gross national income in 2006 was estimated at USD 191,260 (Pula 1.2 million). Of this amount, the biggest contribution currently comes from the various plant use (Pula 577,800), and livestock production (Pula 429,000) activities of households.

When the effect of the income multiplier on the broader economy is added, the total impact of natural resource use in the study area on the national income is USD 335, 680 (Pula 2.1 million). The multiplier effect is greater for tourism than it is for the household and community activities, because tourism has many more backward linkages in the economy. These results suggest that investment in tourism needs to be made at a macroeconomic level. However, at a micro-economic level, investment to the district needs to increase the economic direct use values, to stimulate economic growth. Measures will be needed to ensure that tourism ventures will make a difference to income generation at a household level, as this is where local livestock and plant resources have been shown to contribute directly to livelihood security.

Table 4: Economic – Direct Use values of Kgalagadi case study, in Pula (2006)

		Community Livestock	Community plant use	Community CBNRM*	Private sector Tourism	Totals
Gross output	Per hh/enterprise	22,978	5,492	82,500	355,000	465,970
	Aggregate	**2,389,712**	**950,178**	**82,500**	**355,000**	**3,777,390**
Gross national income	Per hh/enterprise	4,125	3,340	48,695	147,342	203,482
	Aggregate	**429,031**	**577,821**	**48,675**	**147,342**	**1,202,869**
Income multiplier		1.64	1.64	1.64	2.58	
Total impact on national income	Per hh/enterprise	6,765	5,478	79,827	380,142	472,213
	Aggregate	**703,611**	**947,626**	**79,827**	**380,142**	**2,111,207**

* Selling of hunting quota

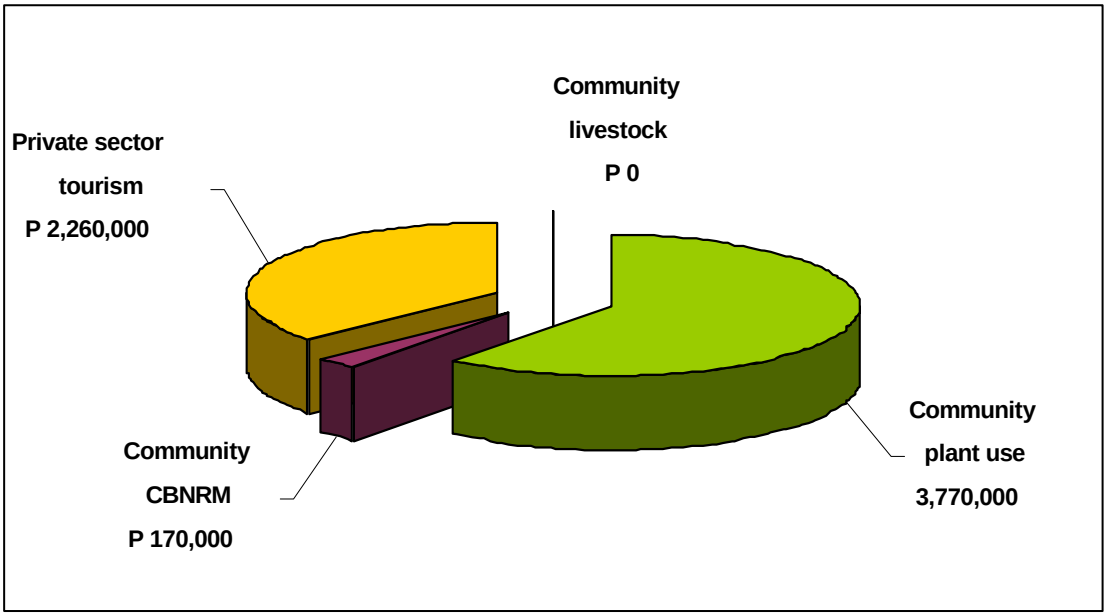
Note: Exchange rate for one Pula = USD 0.159 in 2007

Asset Values

The asset value of the study area represents the present value of the expected future contribution of the dryland ecosystem in terms of economic rent. To calculate asset value, the likely scenario in terms of future growth in different land and resource uses was determined. Then the models developed for each of the the land and resource uses were used to calculate the annual contribution made in terms of resource rent. This is the output, less the production costs and a reasonable return to capital. Then the stream of future resource rents which would acrrue in the predicted scenarion

was discounted to present value to derive an asset value. Various discount rates between 2 and 10 percent were tested. But the base case discount used was 6%. Figure 4 shows that the asset value of the study area was USD 984,200 (Pula 6.2 million), with the highest contribution – about half the value - coming from plant utilisation (Pula 3.8 million), followed by private sector tourism (Pula 2. 3 million) and CBNRM trophy hunting (Pula 170,000). Although the main economic activity in Kgalagadi South sub district is livestock production, the valuation exercise reveals that livestock production contributes nothing to the asset value of the study area since it generates very minimal economic rent. This result underlines the need for incentives to develop the sectors of plants and private sector tourism, considering that currently livestock seems to be overly subsidised. It is however important to regularly monitor the asset values.

Figure 4: Asset Values of the Kgalagadi study area, in Pula



Indirect Use Values: Regulating and supporting services of drylands

In addition to products and services that are directly harvested or provided by these ecosystems, drylands in Botswana, as is the case with other drylands, have a range of critical environmental functions that sustain human life. Some of the major services provided by dryland ecosystems are:

- *Carbon sequestration*: The importance of the vast dry areas is increasingly recognised, despite the relatively low carbon sink per ha. Interestingly land degradation caused mainly by overgrazing can have both negative and positive impacts on the carbon storage capacity of dry areas, and depends on the amount of rainfall. With increasing aridity there is a shift from bush encroachment to loss of vegetation cover.
- *Erosion control*: The ground vegetation cover has an important role in preventing dust storms in areas vulnerable to desertification. In the most arid areas, land degradation leads to a reduction in vegetation cover;
- *Reflecting and absorbing solar radiation*: is critical for global biophysical processes and local climate moderation;

- *Ground-water storage* (drought control): The water storage capacity of predominantly sandy soils in dry areas is poor and groundwater recharge low (below 1mm/year);
- *Habitat for species breeding and nursery*: This function is closely linked to biodiversity maintenance
- *Soil fertility regeneration*: The nutrient recycling process is determined by biochemical and physical processes and depends on biomass production and microorganisms.
- *Pollination services to crops and other plants:* This function is closely linked to maintenance of pollinator populations.

Among the indirect use values or ecosystem service values measured for the study area were carbon sequestration, protection from erosion, and value as a wildlife refuge. These values were roughly calculated using benefits transfer from more detailed work that has been done on them in semi-arid northern Botswana by Turpie et al. (2006). The calculations made in that study were adjusted to reflect the different productivity, cover values and species mixes in the Kgalagadi study area. The main indirect use value was the annual net change in carbon sequestration, at USD 111,300 (Pula 700,0000). Protection from wind erosion, measured as annual production losses averted, was valued at USD 68,400 (Pula 430,000). The value of the study area in protecting wildlife which disperses and is used elsewhere, i.e. the wildlife refuge value, was estimated at Pula 15,000 per annum. The value for groundwater recharge was estimated to be negligible.

These environmental functions, often referred to as regulating and supporting services, have not been valued in dry areas of Botswana or the southern African region, though they are fundamental ecological and human well-being.

SOCIAL AND CULTURAL VALUES

> *"Thank you for having the courage to put a monetary value on our ancestral lands"* Statement made by the Chairman of Tomku Trust following a presentation on the economic value of the Kalahari

The statement above refers to resource economists' and local communities' different perceptions of values. To develop interventions that support local livelihoods and increase the value of key resources, it is important to take note of local community values. These are embedded in the cultural practices and indigenous knowledge systems associated with the use of local natural resources. These cultural and spiritual values expressed in local practices, beliefs and norms are often referred to as social capital.

In some cases indigenous knowledge, which is part of a community's social capital, can be regarded as a commodity where intellectual property rights are considered and thus can be aggregated in economic terms. The use of Access and Benefit Sharing and Intellectual Property Rights framework provides an opportunity for demonstrating the economic benefits associated with indigenous knowledge. For example in 2002, South Africa's Council for Scientific and Industrial Research signed a benefit-sharing agreement with the South African Council on the licensing and sale of the *Hoodia* appetite suppressant drugs. The agreement acknowledges the San peoples' prior intellectual property rights to the *Hoodia*[2] as an appetite suppressant.

[2] *Hoodia gordonii* is a native plant found in the deserts of southern Africa, which is marketed internationally as an appetite suppressant.

There are other potential opportunities for similar benefit-sharing agreements. During the development of the Botswana National Biodiversity Strategy and Action Plan the local communities in Gantsi and Kgalagadi districts demonstrated a wealth of indigenous knowledge with regards to biodiversity, especially medicinal plants found in their locality.

This case study in the Kgalagadi district thus seeks to identify cultural values and norms as valuable assets that are worth protecting. These assets could be developed by the local communities for sustainable management of the dryland resources by tapping into the social and human capital that lies in the resource users themselves; the women that harvest plant resources and the men that work with livestock and wildlife.

These cultural practices could have a value in reducing dryland degradation and the consequent erosion of the ecosystem asset base. Where such cultural practices exist, it might be easier for people at a local community level to change their behaviour in order to address human-induced threats to biodiversity (McNeely 1998). Communities are likely to participate actively and effectively when they employ familiar methods of managing natural resources (Madzwamuse 2006). The cultural practices and norms illustrate the value that local people place on specific resources. Here we will focus on the practices relevant to the natural resources which are key to the livelihoods of the communities in Khawa and Struizendam in Kgalagadi District.

In Kgalagadi South sub district, examples of these values were found in taboos which have been noted by some conservationists as resulting in the protection of certain species and hence contributing to conservation. The taboos do not just relate to the environment: they cover all aspects of life in the village, the crop lands and the cattlepost. Management (including monitoring) of veld products has always been important in the lives of people of Kgalagadi, whether done consciously or not. Their adaptations, local beliefs and their taboos have always protected the environment within which they lived (Schapera, 1997). Such practices can even affect trade in products that are protected by local taboos, implying the seriousness with which development programmes need to consider local cultures and practices.

The community of Khawa spoke of certain rituals where plant resources were used, which shows the value of these resources to social and individual wellbeing. These included the use of plants for cleansing widows, pregnant women and new born babies.

- A woman who has had a miscarriage is smeared with a mixture of cow dung and a plant known as *Mogato* under her feet.
- *Sekanama* is used for cleansing a widow before she can remarry or be with another man.

Examples of other taboos and cultural practices related to ecosystem goods and services are listed in Figure 4:

See http://en.wikipedia.org/wiki/Hoodia_gordonii

Figure 4: Taboos and other cultural practices related to ecosystem goods and services

- People are prohibited from collecting firewood in the village "*motho ga a rwalele moteng ga motse"*
- During summer/ ploughing season people were not supposed to cut down thorny trees, e.g. m*ongana* and *mokgalo*. This is believed to prevent harsh and stormy rains which could destroy crops
- Children are not allowed to go harvesting alone without the guidance of parents. Apart from the danger of wild animals, this was a way of making sure that they do not harvest unripe products thus causing unnecessary damage to the environment
- Trees were not cut during flowering times. This was to allow the trees to produce seeds and allow future germination.
- *Mokgalo* was a protected tree and to cut it one had to seek permission from the chief.
- Bulls were not slaughtered during ploughing season. They were only slaughtered during winter and this was done with the permission from the chief.
- *Makatane* were not to be thrown, as it was believed this action would attract lion and other predators to the settlement
- Thatching grass was only harvested during winter. This was to allow formation of the seeds.
- The cutting of primary tubers from Devil's Claw (*Harpogophytum procumbes*) when harvesting the plant is prohibited. Local residents believe that if the primary tube is cut in the harvesting process, the patient who uses it will not heal. The protection of the primary tuber has benefits for conservation as it promotes regeneration of the plant.
- It is against tradition to cut the base of thatch grass during harvesting; again this practice promotes re-growth and thus avoids the build up of sand dunes in the drier areas. When cutting thatch the communities scatter the seeds on their way back home so as to encourage growth, especially in areas with deep sands.

Source: Velempini 2006; Madzwamuse 2003.

Indigenous or traditional knowledge

Using their indigenous knowledge, communities in Struizendam and Khawa have environmental markers for noting when to harvest various veld products, as well as the health of the ecosystem. Examples identified by Velempini (2006) for key livelihood resources of communities in the Kgalagadi South include;

- The winter season signals the harvesting period for Devil's Claw plants
- When plant species like umbrella thorn (*Acacia tortilis*) and silver leaf (*Termilia sericea*) shed leaves it signals the harvesting season for Devil's Claw;
- Thatch grass is cut when *Acacia erioloba* (camel thorn) blossoms;
- Wild melons are ripe and ready for harvesting in the height of summer
- The communities in Kgalagadi also state that when trees produce a lot of wax (*borokhu*) it signals a drought.

The study carried out by Tlhalerwa (2006) further indicates that the difference in the traditional or indigenous knowledge held by men and women in Khawa influences access to natural resources. Women have more knowledge about plant resources key to subsistence livelihoods, whereas men are more knowledgeable about wildlife and cattle which have made it into the mainstream economic activities and are thus supported by strong national policies and economic incentives. The knowledge that women have and the resources that are central to their livelihoods are communally owned and subject to open access while the men's livelihood resources and knowledge they possess is subject to men's exclusive ownership of cattle and membership of a local wildlife trust.

IMPLICATIONS FOR NATIONAL ECONOMIC AND DEVELOPMENT PLANNING: SOME RECOMMENDATIONS

The information from ecosystem valuation can be used to assist policy-makers and development planners to make informed decisions about what investments might yield optimum returns. Moreover, it is necessary to undertake valuation assessments regularly so as to monitor increases or declines in the assets and apply correctives in a timely manner.

This case study of a dryland region, Kgalagadi South sub district, provides evidence that some resources and economic activities at a local level remain undervalued; these may not therefore be well-reflected in national and local development plans. For instance the Kgalagadi District Landuse Plan, the overall framework for development, features cattle ranching as the main landuse, whereas this and several other studies have shown the economic value of non-livestock activities which may warrant investment, for example in development of veld products and ecotourism.

The community landuse plans being developed under the Indigenous Vegetation Project implemented by the Ministry of Agriculture and UNDP are making progress in this regard. But further information is still required for assessing costs and benefits of different land use options, each of which create value from local resources apart from pasture.

Some of the fundamental issues and challenges for policy and planning include;

- Veldt product markets are not formalised and remain underdeveloped. Hence these markets are not sufficiently visible in the formal landuse and investment plans at national and district levels
- Cultural values are not adequately rewarded; for example, no formal benefits for local knowledge and innovations through patents and royalties from the use of herbal teas or medicinal plants such as *hoodia* and Devil's Claw.
- There is a general lack of economic diversification at the local level i.e. livestock production concentrates only on beef production and not on the development of other by-products and small stock farming
- Failure to pay attention to gender roles means that village institutions generally support male-dominated livelihood strategies such as cattle farming and wildlife-based CBNR. This has left the livelihood strategies of female-headed households underdeveloped and vulnerable to poverty. Whereas there are a number of incentives and subsidies for boosting the cattle industry, there are no incentives for veld product based industries.
- Sectoral approaches to development planning have reduced opportunities to address dryland degradation and diversify livelihood supporting initiatives. For

example, agricultural policies fail to take into account other goods and services provided by dryland ecosystems.

Action is required at three distinct levels to change the delivery of ecosystem goods and services:

- Improving the governance of natural resources
- Increasing investment in biodiversity for livelihood security and
- Adopting appropriate technology

Next we offer recommendations on the first two items, but the development of appropriate technologies was not covered in this study.

Improving governance of natural resources in drylands

It is evident that at the level of national economic planning, what are critical issues at a micro-economic level become negligible, though they are important for rural development and poverty reduction interventions. As the macro-economic issues tend to dominate national development planning, there will always be a risk that the ecosystem values highlighted in studies such as this for Kgalagadi sub-district are lost, unless these values are incorporated into the natural resource accounts.

While our recommendations target the national planning process, it is also essential to strengthen the ability of local and district level institutions to undertake ecosystem valuations. If this exercise is successful, the issues and lessons can be scaled up to influence national planning. It is after all at the district level that relevant policies such as the Rural Development Policy and the Poverty Reduction Strategy are being implemented in Botswana.

Generally the influence from rural village to national level planning is weak, compared to the other way round, except from rural districts that bring significant national economic returns such as from the tourism industry i.e Chobe and Ngamiland Districts. However, there are opportunities for district planners to influence the planning process through the Ministry of Local Government to the Ministry of Finance's Rural Development Division, responsible for coordinating the implementation of the National Rural Development Policy and its associated strategies.

A strong justification can be made for larger budgetary investments into drylands, through aggregating the economic values of drylands, as in the example of Kgalagadi South sub district. Such investments should be implemented through integrated planning at district and local levels.

The issues raised in this case study should be of concern to national development and economic planners as they are relevant to:

- Poverty reduction strategy;
- Rural development strategy;
- CBNRM Programmes;
- National Biodiversity Strategy and Action Plan;
- National Action Plan for the UNCCD; and
- Vision 2016

The methods and findings in this case study should also help develop tools and guidelines for CBNRM practitioners to conduct cost/benefit analyses and resource

valuation. The application of these approaches will translate knowledge to local levels.

To further improve the governance of natural resources in drylands, local institutions need to be more equitable, strengthening the role of women in the local decision-making structures. This could be achieved by formally establishing resource user groups and linking these to the central Community Based Organisation committee. Women not only have a central role in sustaining livelihoods for households but they are also experts and custodians of indigenous knowledge about plant resources. (Tlhalerwa 2006; Velempini 2006)

Increasing investments in biodiversity for livelihoods security

The ecosystem valuations outlined in this case study provide pointers for private sector investment. It is also indicative how private sector organisations could invest their corporate social responsibility funds in order to contribute to rural development and poverty reduction. The case study further shows where economic incentives need to be developed.

Some practical recommendations made during the valuation workshop in the case study Kgalagadi community location include:

- Establishing conducive regulatory mechanisms to provide incentives for investments in dryland ecosystems – this includes incentives for product development for veld products
- Package the drylands in order to attract private sector
- Improve access to markets for dryland community products
- Provide security of land and resource tenure
- Establish microfinance schemes to allow community investment for entrepreneurial activities
- Establish effective benefit sharing mechanisms at a community level
- Provision of enterprise development support
- Capacity building and training as well as strengthening extension services through NGOs
- Supporting product development and value addition at the local level

CONCLUSIONS

Decisions regarding management of dryland ecosystems are made on the basis of economic, social, cultural and political considerations, but are often mainly based on economic calculations comparing the costs and the benefits of any planned initiative. Therefore it is important that comprehensive information is available on the total economic valuation of drylands.

Innovative conceptual frameworks must be designed for inclusive valuation of local social and ecological systems. Holistic and multidisciplinary approaches will enable more accurate valuation of dryland ecosystem goods and services. Resource economists need to work with ecologists and other social scientists to encourage practitioners in applying valuation tools.

Finally, improving the sustainability of dry lands depends on appropriate market incentives, product development in order to strengthen the economic base, and transferring knowledge on valuation to a local level.

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ANNEXES

ANNEX A:

Focus Group Discussion Veld Products Women

Number of participants: Youth_____ Elderly_____.

GENERAL QUESTIONS

1. What is the predominant ethnic group/tribe of this community?
2. Of those in the formal or informal employment (i.e. paid by someone else), what is the proportion of those employed in employed in:
3. Tourism_____%. DWNP_____% . Trade in natural Products_____% Government.

   Other_____%.

4. Could you provide a rough estimate of the total proportion of household source income last year from:

   Pensions _____%, Social welfare _____ %; Drought subsidy _____%

We would now like to shift to consideration of the various sources of income, in cash, in kind, and including own-production, that your community's lives on. Please consider how these various sources of **subsistence and cash income** contribute to your community's livelihood and wellbeing [Enum: put out each card and read out the title]: livestock, veldproducts, income from jobs or business, income from pensions, social welfare.

Imagine that this bag of beans represents the total **value** obtained by the majority households from all these things over the past 12 months, or since this time last year.

'**Livestock'** refers to the value of the livestock that you have slaughtered or sold, plus the value of eggs or milk that your livestock have produced.

Veld products' refers to harvested products that come from the vicinity of the settlement, such as poles, firewood, charcoal, grass, animals, birds, wild food plants and medicinal plants, and also includes the value of any products that you have made from these.

Tourism

Other 'Employment and other business' refers to income from formal employment, informal employment, small enterprises (unrelated to your own arable or livestock produce or the sales of products made from natural resources you have harvested), and remittances from members of this household living elsewhere.

'**Government/pension'** refers to pension monies from government or any source, social welfare payments (cash or goods), drought subsidy, compensation payments. [Enum: After the explanation, ensure that they understand the categories and where different sources of income fall. Once they have done this, have them take the beans and place them on the cards relative to the portion of the value derived from the source.]

Q. No	Activity	Proportion of income (# of beans)
4a	**Livestock**	
4b	**Veld products** – poles, firewood, grass, sengaparile , animals,	

	birds, wild food plants, medicinal plants, etc	
4c	**Tourism (hunting Safaris, tracking, e.t.c)**	
4d	Cash income from **jobs or other business** not related to own-production of arable produce or livestock or harvested resources (including money sent here by family members living elsewhere)	
4e	**Government/Pensions** = pensions, social welfare, drought subsidy	

WILD FOODS AND MEDICINAL PLANTS

5. We would like all of you to tell us about the wild food resources and medicinal plants that you collect. Where do you collect these plants from – which habitats?

Kindly confirm and rank species on the list:

6. Please tell us about the different **species** collected from (habitat X), what they are called and how are they used? (Get local names)
7. Are they ever sold, and how much can you sell them for (give units, and quantify in weight if possible).

8. How **common** are these different species – are they **abundant**, **enough** or **scarce**?

9. Are any becoming more scarce? If possible, we would like you to show us some of these plants after the discussion, if anyone has the time (get samples with local names, record where it came from and how long it took to get there).

Species	**Habitat/ Location/distribution**	**Part (Roots, stems, leaves, fruits or whole plant)**	**Used for**	**Local price (describe unit) e.g. P10/kg**	**Availability (Plenty/ Enough/ Scarce)**	**Trend (Increasing/ Decreasing)**

10. If you think of the total value of medicinal plants collected by households in the village, what are the most important areas for their distribution_____.

11. Which household members harvest these plants? _____

12. Using this pile of beans, could you describe how the amount of wild **foods** collected changes over the year.

13.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Relative amount harvested (# beans)												

14. Are these seasonal changes related to availability or to need? (Does availability of the resource change over the seasons? Is there a shortage of plants at certain times of year?) Explain_____

_____
_____
_____

For *month when most collected*,

15. How many collecting trips are made by a household per week? _____

16. How much wild foods are typically collected on a trip? _____(give units)

17. What is the length of a typical trip to collect food plants _____hours

18. What proportion of your family diet does this make up (in that month)? _____

19. What proportion of your family diet do wild foods make up in the month when least collected? _____

20. What proportion of the harvest is typically sold?_____

21. What quantity of medicinal plants is usually collected by a household in any one month?_____

22. How many trips are typically made by a household in a month to collect medicinal plants?_____

23. What is the length of a typical trip to collect medicinal plants _____hours

24. What proportion of the harvest is typically sold?_____

25. Using timelines record major changes with regards to use of and availability of veld products?

On a flip chart record the major timelines/trends identified by the group use either dates or major events i.e. independence/1966

Year/Event	Describe level of use of veld products (high/low/medium)	Explain the reasons for changes in level of use	Any other comments /observation

26. How can the constraints to use of veld products be addressed?

GRASSES/CRAFT MATERIAL/OILS AND WAXES

We would like to find out about which types of grasses, craft materials, oils and waxes that are harvested by people in the village, and the products that are made from them.

27.What types grasses and craft material are used by people in this village? How are they harvested e.g. what size bundle/other quantities, and how are they sold. How much are sold for? How plentiful or scarce are these resources

grasses/ craft materials/oils and waxes	**Local name**	**Use**	**Specify part of plant used (i.e. seed fruit, e.t.c)**	**Size of harvest bundle (cm diameter, weight)**	**# selling bundles from a harvest**	**Size of selling bundle (cm diameter)**	**Price of selling bundle**	**Availability (Plenty/ enough/ scarce)**	**Trend (incr/ Decr)**

28. For each type of resource, please describe **who** is involved in a typical collecting trip, how are the bundles **transported**, **how long** does it take, and **how many** bundles are collected?

Type of Reources	**Number & gender of people involved in a typical collecting trip**	**Length of a collecting trip**	**Number of bundles collected**	**Method of transportation**

29. What proportion of the harvest is typically sold?_____

30. Which of these resources are purchased by traders who sell outside the village? _____

Who are the traders?

Processing and selling

31. What products are made from the above resources? How much is needed to make one? Prices, how long does this product last? How many of these would you expect to find in a typical household?

Product	**Made from**	**Quantity required (bundles/weight, give size)**	**Time to make (hours)**	**Price of product**	**Lifespan**	**# in average hh**

32. What proportion of households produce the different products described?_____
33. Does anyone make these products for selling (which)?_____
34. What proportion of the production is typically sold?_____
35. Are they sold locally in this village?_____
36. How much is sold to outsiders or traders who sell outside the village?_____
37. What is the difference between the price paid to local producers and the price that traders get for the products elsewhere?

    _____

FIREWOOD

38. What proportion of households have electricity/other source of fuel apart from fuelwood? _____

39. What proportion of households rely mainly or entirely on firewood for fuel?

40. What proportion of households use both electricity/other source and firewood for fuel? _____

41. What are the most common types of wood collected for firewood?

Species	**%**	**Availability (plenty/enough/scarce)**	**Trend (increasing/decr)**

42. How much firewood is used per week in a household that does not have electricity?

_____headloads (summer) _____headloads (winter)

44. How much firewood is used per week in a household that does have electricity?

_____headloads (summer) _____headloads (winter)

45. What is the distance travelled to collect firewood? _____kms

46. What proportion is collected from areas surrounding the village?_____.

47. How is firewood collected and sold (size of headload/bundles/cartload)_____

48. Selling price_____

49. How many people would go on a collecting trip for a household, how much time would they take, and how much would they get?

Number of people_____ Time_____hours Number of loads_____

50. How is the firewood transported back to the household?_____

51. EQUIPMENT FOR HARVESTING AND PROCESSING PLANT RESOURCES

Please describe the equipment used to harvest and process wild plant resources– we would like to know what equipment is used for which resources, how much it costs and how long it lasts.

Equipment	Cost	How long it lasts (years)	Food & Medicinal plants	Grass	Fuel-wood	Crafts	Other (specify)
