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# Botswana Environmental and Climate Change Analysis

*29 May, 2008*

This Environmental and Climate Change Analysis was carried out as a brief desk study in April 2008. [1] In line with the Swedish cooperation development goal[2] the document aims to summarise the key environmental risks and opportunities Botswana faces, related to poverty reduction and economic development.[3]



## Introduction

Botswana is a landlocked and arid to semiarid country. It is one of the largest countries on the African continent, sparsely populated but with a growing population. Rainfall is unreliable

[1] This Environmental and Climate Change Analysis was written at the request of Sida INEC, Stockholm (att: Rolf Folkesson) by Gunilla Ölund Wingqvist and Emelie Dahlberg at Sida Helpdesk for Environmental Economics, University of Gothenburg as part of Sida-EEU's institutional collaboration on environmental economics and strategic environmental assessment. Comments are welcome and can be sent to gunilla.wingqvist@economics.gu.se

[2] The development goal is to contribute to creating conditions for poor people to improve their living conditions through stimulating and strengthening the development of sustainable relations of mutual interest between actors in Botswana and Swedish actors. The rights perspective, gender and environmental impacts shall be assessed for all areas of cooperation. SidaArbetspapper: PD2 Botswana 2008-03-26

[3] The ECCA is mainly based on the Country Environmental Profile for Botswana developed by European Union 2006. If no other references are made this is the source that has been used.

and unevenly distributed and varies from 250 mm annually in the southwest to 650 mm in the northeast. Botswana is situated in the catchment basins of the Limpopo, Okavango, Orange, and Zambezi rivers, all which are shared with other countries. About two-thirds of the country is covered by the Kalahari Desert sands, and is not suitable for agricultural production. The country is highly vulnerable to seasonal variations in climate, influenced by the La Nina and El Nino events. In 2007, the population of Botswana was estimated to 1.8 million people.[4] Botswana's natural resources consist of range and arable land, woodlands and wetlands, wildlife and mineral resources as well as the unique Okavango Delta. The country has a large mineral deposit and is a model for the use of natural resources for development. It has evolved from one of the ten least developed countries at the time independence in 1966 to a middle-income country, characterised by sustained economic growth, anchored in good governance, peace, political stability and sound macroeconomic management. Botswana currently belongs to the "Medium Human Development" group of countries, as reflected in the evolution between 1993 and 2004 of the ten selected Millennium Development Goals (MDGs) indicators. Despite the success-story, poverty is still widespread in Botswana, rooted primarily in the country's adverse physical conditions and narrow economic base.[5]

## 1. Key Environmental Problems, their Causes and Opportunities

### 1.1 Key environmental problems and their causes

The key environmental problems in Botswana are presented below (not in order of priority):

***Water scarcity and pollution:*** Water resources in Botswana is characterised by the fact that it is a shared and scare resource, unevenly distributed in time and space. All rivers, apart from the Okavango and Chobe, are ephemeral[6]. There are few other surface water resources mainly due to low rainfall, high seepage caused generally by sandy soils, and high evaporation rate. The limited supply of surface water and the increasing water demand[7] makes ground water highly important, especially for rural communities. In 2005, ground water accounted for 80% of the total water consumption. High reliance of ground water poses several challenges and makes ground water protection essential. Challenges include high uncertainty as recharge rate is unknown and the abstraction rates are thought to exceed recharge, resulting in boreholes and wells running dry. There are problems of high salinity and high cost of provision due to the dept at which water is available. Another major challenge is protection from pollution. Studies show of aquifers, contaminated with nitrates due to leakage from septic tanks and pit latrines, constituting a potential health threat. Discharge effluents from mining operations include high concentrations of various metals polluting the water resources.

***Land degradation:*** Two-thirds of Botswana is covered with the Kalahari Desert sand which has poor water retention capacity, low nutrient levels, low organic matter and is marginally productive. Most arable farming occurs in the eastern part of the country as it has relatively more fertile soils than the west. Land degradation is a serious environmental problem, especially in the eastern parts. The main factors contributing to land degradation are the growing human population with increased number of livestock, overgrazing, tree-felling,

[4] UNFPA, 2007
[5] UN, 2001.
[6] An ephemeral river is a river in which flow does not occur throughout the year, also referred to as a temporary river.
[7] Botswana's limited water supplies are under growing pressure due to increasing urban population, mining industry and large numbers of livestock.

inappropriate farming techniques and, locally, mining activities. Negative impacts from mining operations include high levels of emissions (especially sulphur dioxide emissions), and sites, which have not been rehabilitated. In 2004, the level of pH, total dissolved solids, sulphates and nickel exceeded allowable concentrations. At the furthest point of monitoring contamination had fallen within acceptable levels except for nitrate and sulphate levels.

***Biodiversity loss:*** Botswana possesses a wide diversity of wild fauna and flora including populations of globally endangered species. Over several decades wildlife numbers have been declining due to illegal hunting, drought and habitat destruction. Major threats to biodiversity include rangeland degradation, inappropriate harvesting methods, habitat destruction, climate change, increased elephant population (especially in the northern parts), fuel wood collection, and inadequate management of waste in rural areas and lack of information on hazardous waste. A recent potential threat to biodiversity is biotechnology. Risks include the creation of super weeds by transferring herbicides tolerance to weeds. Botswana's nature provides important ecosystem services as it absorb more greenhouse gases than the country produces. Tree and woodland products, including medicine, are an important part of rural livelihood.

***Deforestation:*** Over 80% of the land surface of Botswana has a significant tree and scrub cover, but less than 20% mostly in the north-east, is tall and dense enough to be considered a forest. Deforestation is not assessed to be a significant problem. However, fuel wood from forests and woodlands accounts for 70% of net energy supply in Botswana.[8] High reliance of wood for fuel has resulted in significant depletion around towns and major settlements. The sustainable use of biomass energy emits no net $CO_2$ to the atmosphere, and very small quantities of other greenhouse gases. Furthermore, woodlands, which are increasing in biomass, take up more $CO_2$ than they release. The woodlands are therefore the main reason for the favourable greenhouse gas emission situation in the country.

***Natural disaster risks***: Botswana is among the countries in the world with the highest number of people affected by natural disasters (13,529 per 100,000 inhabitants) the last three decades.[9] Besides periodic droughts, which seem to occur with increasing frequency and that affect the whole population and all water using sectors, Botswana has in the past experienced few natural disaster events. Despite generally arid conditions occasional floods are occurring. Invasion of crop pests have also occurred and there has been a minimal damage to property due to rare incidents of significant seismic activity.

***Climate change:*** Climate change will add to existing stresses in Botswana including the above mentioned issues particularly related to water scarcity and land degradation (increased erosion from over grazing or intense occasional rains), affecting health and food production. Climate projections, adaptation and mitigation challenges are described in section 3.

### 1.2 Opportunities

Botswana has a national and global ecological importance that supports the country's tourism industry. Wildlife viewing is an increasingly important contributor to tourism. Benefits of a well-managed environment and natural resources include potential in higher tourism income, and also, improved agricultural yields.

[8] Botswana Initial Communication to UNFCCC, 2001

[9] All 11 natural disasters between 1974 and 2003 are hydrometeorological disasters, of which 7 are related to drought, 3 to flooding and 1 to windstorm disasters. More than 1 person out of 10 is affected in Botswana. Of the total number of victims (13,529), over 93% are affected by droughts, 2.5% by floods, and 4% by windstorms (Guha-Sapir et al., 2004).

Wastewater and rainfall preservation are recognized as important water resources that could be used more extensively. Interest in energy and water demand management and water harvesting is growing but still lacking societal acceptance and support. Integrated water resources management including water demand management and water efficiency measures constitute an opportunity to reduce water scarcity.[10] Improved urban and rural planning provides an opportunity to decide future demand for energy, transportation, and industrial development.

Mineral resources have been largely responsible for the transformation of the Botswana economy and for improvements in living standards. Besides diamonds, Botswana holds large reserves of coal. Improved efforts for a sustainable management of mineral resources will contribute to continued growth and poverty reduction.

The global attention to climate change can create markets for business (consultancy services, clean technologies, bio-energy, etc). Solar energy has an enormous potential but is greatly under-utilised, mainly due to high investment costs or new, immature, technologies. Green electricity could in the future be generated locally from upgraded solar energy,[11] and has potential to improve income for farmers and create new jobs. Botswana has also been investigating the possibilities to produce oil bearing, drought resistant plants, like Jetropha, for bio fuels. The abundance of land would allow for both solar energy and jetropha production; if the water availability is a binding constraint is, however, not known. (Barriers to new energy sources are discussed further in section 3). Wind regimes are low and therefore not sufficient for electricity generation.[12]

## 2. Effects of the Environmental Problems

### 2.1 Impacts on Poverty (Vulnerability, Security, Opportunity)

***Vulnerability***: Botswana is on target to reach many of the MDGs, including the poverty reduction target. However, the incidence of poverty is high; although poverty is declining over 23% of the people in Botswana are still living below USD 1/day[13] and the income inequality is high.[14] The Human Development Report for 2006 ranked Botswana as 93rd out of 102 developing countries in terms of the Human Poverty Index.[15] A 2002/03 Household Income and Expenditure Survey identified higher levels of poverty among women than men. Also geographical differences in poverty have been identified, which appear to be influence by natural resources endowment and climate, with Ghanzi, Kgalgadi, and parts of Kweneng and Southern Districts particularly less well off than other parts of the country. The rate of unemployment increased from 14 per cent in early 1990s to 24 per cent in 2004/05. Unemployment is much higher among women (24 per cent) than among men (17 per cent), even though the labour force participation rate for women is far lower than that for men.[16]

[10] Government of Botswana, 2002
[11] Ibid.
[12] Government of Botswana, 2004
[13] CIA Factbook
[14] The Gini-coefficient is 0.63, according to FAO Statistical Yearbook. A Gini-coefficient of 0 implies equally distributed income.
[15] Of the 102 countries, only nine (Mozambique, Sierra Leone, Guinea, Swaziland, Ethiopia, Niger, Chad, Burkina Faso and Mali) have worse poverty situations than Botswana. African Economic Outlook 2007.
[16] Acrican Economic Outlook, 2007.

Poverty is identified as a major cause *and* consequence of environmental degradation and depletion of natural resources; activities such as illegal hunting and depletion of firewood are typically associated with poverty, while unsustainable consumption of resources such as water and energy are associated with improved livelihoods. However, the linkages between living standards and environment are complex. The rate of urbanisation is high; 52% (2002) of the population lives in urban areas (compared to 18% in 1981). Despite a high rate of urbanisation high levels of access to sanitation have been achieved. Access to electricity varies between urban and rural areas with 61% and 25% respectively. Further, 23% of the urban population and 77% of the rural population rely on fuel wood for cooking; the highest proportion of fuel-wood users being the poorest 20% of households.[17] The average distance for fuel wood collection is 6 km, and the time for collection is about 3.5 hours, constraining particularly women from participating in other activities.[18] Rural women and children are the most vulnerable group to environmental degradation. Violation of rights of minority groups such as the Basarwa (San) is an issue of concern. Specifically this refers to movements of Basarwa off land they regard as traditionally theirs, to make way for mining and tourism.[19]

Land degradation mainly affects the rural poor as it reduces the productivity of soils, reduces ground water recharge due to increased runoffs and results in the replacement of perennial grasses with grasses of low nutrient value which contributes to high livestock mortality in periods of droughts. Land is becoming increasingly scarce and unaffordable, leading towards conflict in some areas. Around Gaborone self-allocation of land, as a manifestation to scarcity and unaffordable land prices, has occurred. Land use conflicts have also occurred in Boteti sub district where grazing of cattle in national parks has been reported and livestock has been killed by wildlife.

***Security:*** Conflicts over natural resources in Botswana can be found on national and transboundary levels. Examples of conflicts include: local conflicts over land; concerns from international experts and local populations over the ecology of the Okavango Delta in Botswana; Namibian plans to construction a hydroelectric dam at Popavalle (Popa Falls) along the Angola-Namibia border; Botswana has built electric fences to stem the thousands of Zimbabweans who flee to find work and escape political persecution; Namibia has long supported, and in 2004 Zimbabwe dropped objections to, plans between Botswana and Zambia to build a bridge over the Zambezi River, thereby de facto recognising the short, but not clearly delimited, Botswana-Zambia boundary.[20] Formal agreements have been issued to prevent conflict over transboundary resources, aiming at achieving judicious use, environmentally sound development of and equitable access to water resources.

***Opportunities:*** Botswana has an enviable reputation of democracy and good governance and is regarded as the least corrupt nation on the African continent. Transparency internationals Corruption Perception index 2007 ranks Botswana 38$^{th}$ in the world (score 5.4), significantly less corrupt than any other African country (although the corruption ranking has decreased from 26$^{th}$ place in 2000 (score 6.0) the corruption is still considered to be low).

[17] ESMAP, 2006.
[18] Ketlogetswe et al., 2006.
[19] UN, 2001
[20] CIA Factbook

## 2.2 Impacts on Economic Development

*Botswana's economic performance is linked to its natural resources such as minerals, land for agriculture and pasture, and tourism. Mining is associated with environmental problems while agriculture and tourism are depending on a healthy environment. Availability of energy and water could become a binding constraint for future economic development.*

Mineral resources (especially diamonds) have been largely responsible for the transformation of the Botswana economy, and for improvements in living standards. However, the growth rate in the mining sector is expected to decline as no further expansion of mining operations is anticipated in the near future.[21] The contribution to GDP from agriculture has declined from 40% at independence, to the present 3% (mostly cattle; see Appendix 1), largely due to the rapid development of the mining sector and increasing urbanisation. Despite this decline, *the agricultural sector remains an important source of food, income, employment and capital formation of the majority of the population living in rural areas.* Food imports are high and exceed the national production in Botswana.[22] Food trade can be considered a certain reallocation of water on a global basis; virtual water.[23] There is an ongoing debate over the relevance of trade in *Virtual water* in solving the water scarce situation. However, higher imports of food would make Botswana more vulnerable to increasing global food prices and low global production, which could threaten food security in the country.

The energy sector is important for Botswana's development process, since it plays a vital role for both households and industries. Energy, as an input to all productive facilities, influences production costs and thus the economic competitiveness of industry. Electrical energy provision is generally correlated to poverty alleviation and easing of gender imbalances.[24] However, expansion of the national electricity grid to remote areas with small electricity load requirements is not economically attractive, why local power solutions are required. Today, households in Botswana in general spend a quarter of their income on fuel and electricity.[25] With improved living standards, increasing urbanisation and industrialisation, the energy demand is expected to increase. As southern Africa has already reached the point were demand for electricity is higher than the supply, Botswana is exploring new, domestic energy sources. The country is endowed with biomass (mainly fuel wood), coal, and solar energy. All petroleum products[26] and 70% of the country's electricity requirements are imported. Solar energy is becoming increasingly popular but still only accounts for less than 1%.[27] Energy use has significant environmental impacts, both local (e.g. deforestation and land degradation) and global (e.g. increased greenhouse gas emissions).

Tourism contributes significantly to the country's GDP (5%) and it is one of the sectors identified for having potential for economic diversification and job creation. Beside agriculture and tourism, other important sectors include manufacturing and financial services. Water scarcity affects many aspects of the nation's economy; concrete examples being the costly infrastructure (e.g. water transfer schemes and dams) to improve water supply mainly

[21] Govt of Botswana, 2004.
[22] Agricultural imports in 2004 was USD 155 million (4% of total imports) and the agricultural exports were USD 52 million (2% of total exports). FAO Statistical Yearbook.
[23] Obuobie, 2005
[24] Ketlogetswe et al., 2006.
[25] Rural households tend to spend a higher proportion of their income on energy (especially fuelwood) than do urban (more electricity, gas and kerosene). ESMAP, 2006.
[26] Govt. of Botswana, 2004.
[27] Matshameko, 2004.

to urban areas, or deep boreholes for groundwater abstraction. Fluctuation in annual rainfall has already a clear effect on the national economy, human welfare and the state of the environment. These issues are expected to be further aggravated by climate change.

HIV/AIDS: The HIV/AIDS pandemic remains the biggest threat to human development and economic growth. Botswana is one of the countries in the world most affected by HIV and AIDS. In 2004, almost 26% of the population aged 15-49 was infected with HIV. The virus contributes to aggravating poverty, unemployment and inequality. It draws resources away from other priority areas, reverses Botswana's achievements in the economic and social spheres, and places the health system and the social fabric under considerable stress. There is great concern over the possible loss to HIV/AIDS of much of the country's skilled and experienced labour over the next two decades, and a significant reduction in labour supply, productivity, foreign direct investment and economic growth. Current trends are fought through the successful implementation of HIV/AIDS programmes under the Botswana National HIV/AIDS Strategic Framework. The high rate of people affected by HIV/AIDS also have a negative impact on different sectors (including environment and natural resources) as the illness results in reduced productivity, high staff turnover, and shortage of skills leading to a poorer service. The fight against HIV/AIDS will remain a major challenge in the medium and long term, and will continue to require large-scale human and financial resource.

### 2.3 Impacts on Health

Safe drinking water and sanitation is vital for good health, especially for people living with HIV and AIDS. Adequate nutrition, water supply and sanitation is of utmost importance, for HIV infected people to remain healthy and productive as long as possible and for people with AIDS to reduce their exposure to infections.[28] Despite water scarcity, Botswana has achieved high levels of water provision. 97% of the population (100% of urban and 69% of rural households) has access to potable water within the distance of 2.5 kilometres, and 77% has access to adequate sanitation. In urban areas waste is frequently collected but in rural areas not as often. Waste disposal does not always occur in properly managed sites.

| **WHO estimates** | **Water Sanitation & Hygiene** | | **Indoor air pollution** | | **Outdoor air pollution** | |
|---|---|---|---|---|---|---|
| **Country** | Diarrhoea deaths/year | Diarrhoea DALYs/1000 capita per year | Deaths/year | DALYs/1000 capita per year | Deaths/year | DALYs/1000 capita per year |
| **Botswana** | **300** | **6,6** | **200** | **2,6** | **<10** | **0,0** |
| **Namibia** | 700 | 13 | 200 | 2,0 | <100 | 0,2 |
| **South Africa** | 11 900 | 9 | 1 000 | 0,5 | 1 000 | 0,2 |
| **Mozambique** | 26 900 | 47 | 9 700 | 16 | 900 | 0,6 |

*Source: WHO*

[28] Wegelin-Schuringa et al, 2003

WHO estimates 500 annual deaths due to diarrhoea caused by polluted water/bad hygiene[29], indoor and outdoor air pollution. DALY's for diarrhoea and outdoor air pollution are relatively low, while indoor air pollution (caused primarily by use of wood fuel for cooking) is somewhat higher than for neighbouring countries (see table above).

## 3. Climate change

The welfare of the people, the performance of the economy, and the state of the environment in Botswana are all very closely linked to the climate. According to the Botswana government, the country is "highly vulnerable to climate change" due to its fragile ecosystems and (semi-) aridity.[30] Climate change is likely to add to existing stresses in Botswana causing significant changes in prevalent vegetation and rangeland cover, affecting species types, composition and distribution, as well as those depending on them. The most vulnerable sectors are identified as agriculture/livestock, woodlands/forests, water and health.

### 3.1 Expected impacts of climate change

The temperature is projected to rise between 1 and 3 degrees by 2050, resulting in higher potential evaporation rates. Future trends in rainfall are uncertain, but the overwhelming majority of general circulation models predict a rainfall decrease, possibly with more intense rains locally. Desertification is a major concern to Botswana and IPCC estimates that, by the 2080s, the proportion of arid and semi-arid lands in Africa is likely to increase by 5-8%.[31] Water scarcity or water stress and land degradation will have negative impacts on GDP, poverty, health and food production.[32] Climate change is likely to impact on Botswana's ecosystems, especially the Okavango Delta, with a probable negative impact on tourism as well as livelihood opportunities for the peoples residing in the basin. Climate change impacts are expected to increase over years and decades to come, which will constitute a threat to development and diminish the chances of achieving the MDGs.

### 3.2 Response to climate change – adaptation

There are strong links between poverty and climate change vulnerability. Vulnerability is a reflection of human capacity to cope with risks or shocks. The Botswana population has always been exposed to climate variability, especially drought, and a range of individual and societal coping mechanisms have evolved. Wealth, access to technology and societal organisations are important determinants of a country's adaptive capacity, which reasonably well can be indicated by the HDI. Key adaptation priorities related to water resources are: inter-basin water transfers, water purchase from neighbouring countries, internal recycling of water, and water conservation. These measures would add an estimated BWP 300 million to the annual water supply costs in Botswana.[33] Other adaptation priorities include: community-based natural resources management for sustainable use of woodlands and grazing practices; policy incentives and regulatory control for sustainable herd management; encouragement of traditional coping mechanisms such as shifting to other agricultural activities during poor yield years, early drought warning systems, and minimum tillage farming methods for conservation of soil, water, and carbon.

[29] This figure only includes diarrhoeal diseases. Other water related diseases e.g. river blindness are not included. Hence, the total number of deaths related to hygiene, water and sanitation is higher.
[30] Govt of Botswana, 2001.
[31] Boko et al., 2007, IPCCC.
[32] Crop production is estimated to decrease by 30% for the main crops of maize and sorghum, possibly due in part to climate change (Govt. of Botswana, 2004).
[33] Govt. of Botswana, 2001. (1 Botswana Pula is equivalent to 0.93 SEK, exchange rate from 27 April 2008)

### 3.3 Response to climate change – mitigation

The sectors emitting most greenhouse gas emissions in Botswana (1994) are agriculture/livestock, energy, industry, waste as well as land use and forestry (in declining order of importance). Land use and forestry are largely carbon sinks and the country as a whole is assessed to be a *net carbon sink.*[34] Knowledge on how to reduce emissions of greenhouse gas (especially methane) from livestock is currently limited but could include reducing livestock number, feed conversion or livestock methane vaccine. These options will not be further discussed here. Related to the second largest emitter, the energy sector is facing the challenge to increase supply while at the same time mitigating greenhouse gas emissions. Three technologies are identified as suitable for Botswana: solar, biomass and coal supply technologies. The potential for energy efficiency and demand side management activities have not been fully exploited.[35]

Solar photovoltaic technologies (converting sunlight to electricity) are assessed to be too expensive to be adopted in large scale, and would need government subsidies. The potential for solar thermal installations (solar heat driving high-efficiency generators) is potentially huge.[36] Solar energy is proposed as a good option both for off-grid and grid-connected plants. *Barriers to solar energy* adoption include high investment costs, limited government support and lack of financial sponsors. Biomass options include briquettes, elephant grass, biogas (including sewerage, slaughterhouse, and landfill generation, which are mitigating climate change through collecting methane gas), and bio fuels (such as jetropha); the most advanced of the biomass options appears to be biogas. Most *barriers to biomass* relate to the need for more thorough feasibility assessments, financial constraints and lack of information. Options to develop coal supply technologies include large potentials for coal washing (improve the quality of Botswana's high ash and high sulphur coal) and carbon bed methane (CBM), which can provide fuel for cars, households and power generation and alleviate the power crisis the region is about to face. The *barriers to coal washing* are high costs and lack of potential investors. *Barriers to CBM* are related to undeveloped markets, lack of a resources base and infrastructure for exploitation, distribution, and utilisation of the gas.[37]

*In sum,* solar energy is an accessible and clean energy source and has a great potential, but is still expensive and may require government interventions. Biomass can be positive from a climate change mitigation perspective, by collection and use of methane gas (a strong greenhouse gas). Biogas from landfill gas collection is becoming increasingly popular in the *Clean Development Mechanism* (CDM) arena. Bio fuel production from Jetropha has a great potential and would seemingly only be limited by field size and oil pressing capacity. Lastly, Botswana has a potential to develop its coal reserves. The international company CIC Energy, with exploitation rights of the Mmamabula coal field, is exploring the opportunities to be registered for CDM support to invest in high-efficiency coal combustion technology. Coal washing is estimated to provide the *largest potential* according to the Botswana government. It is stated that in order to realise the CBM potential a *liberalisation of the energy market* would be required.[38] Critical voices are heard, however, over developing fossil fuels instead of investing the money into development of more sustainable, renewable sources of energy.[39]

[34] Govt. of Botswana, 2004; and EU CEP 2006.
[35] Govt. of Botswana, 2004.
[36] By solar thermal installations on 4% of its area Botswana would, according to Wheeler (2008), be capable of producing 10 times Africa's total current electricity output.
[37] Govt. of Botswana, 2004.
[38] Ibid.
[39] Wheeler, 2008.

## 4. What are Key Actors doing to manage the Environmental Problems?

**National development plans**
The central government planning instrument is the National Development Plan (NDP), which is developed every six years and subject to a mid-term review every three years, and the overall long-term vision document, Vision 2016. The Vision 2016 aims at creating a prosperous, productive and innovative nation and re-emphasises the national principles of Democracy, Development, Self-Reliance and Unity. These principles have always underpinned the National Development Plans, but a fifth has recently been added. The fifth principle, *Botho*, refers to the concept of a well mannered, courteous, caring and disciplined people, who realise the potential for both themselves and for their community. The National Development Plan 9 (2003/04-2008/09), the budget and the Vision 2016 highlight the need to diversify the economy. Other priorities are poverty, unemployment and HIV/AIDS. The need to integrate women in the development process is perceived as an issue of social equality and a key element contributing to poverty eradication.

**Key actors**
The Ministry of Wildlife, Environment and Tourism has the main responsibility for environmental management in Botswana. Other important government institutions are the Ministry of Mines, Energy and Water Resources, and the Ministry of Agriculture. Besides government institutions, a number of parastatals (e.g. Water Utilities Corporation responsible for urban water supply and Rural Industries Promotions Company (solar energy and water harvesting)) are involved in environmental activities. Non-governmental organisations (NGOs) and Community-based organisations (CBOs) play a role in service provisions and implementation of projects. There has been a concerted effort to rationalise environmental institutions, which should reduce overlaps, clarify roles and improve their effectiveness.

**Environmental mainstreaming**
The NDP 9 integrates environmental issues into the main sectors.[40] It identifies issues relating to the environment and sustainable development, including the introduction of EIA legislation, the development of management plans for some priority ecosystem areas. It also advocates the inclusion of environmental considerations in the preparation of national accounts, which will reflect that natural resources are assets, like capital stocks. Several sector policies and strategies have been developed to guide government intervention in environmental management, including agriculture, energy, water, wildlife and tourism (see Appendices 2, 3 and 4). Common themes in these policies include: improvement of quality of life, conservation of the environment, diversification of the economy, value addition to natural resources, and job creation. These themes represent various aspects of sustainable development.

**Gaps and overlaps**
The legislation is comprehensive and covers most aspects of the environment. However, in 2006 there was still no legislation regulating the use of persistent organic pollutants or genetically modified organisms (GMO).

[40] Botswana National Development Plan 9. Government of Botswana, 2002. http://www.sarpn.org.za/documents/d0001172/Botswana_NDP9.pdf

There are currently three statutes that deal with Environmental Impact Assessments (EIA) that potentially overlap.[41] An Environmental Management Act was being prepared during 2006 to coordinate and harmonise the different pieces of legislation.

**Other actors**

Donor harmonisation is limited in Botswana, mainly due to the small scale of official development assistance to the country. Coordination takes place at the International Partners Forum. All foreign missions with representation in Botswana are invited to the meetings. Previously a long-time partner in development, Sida is currently giving support to Botswana mainly through regional programmes such as the Regional Water Initiative in Southern Africa based at the Embassy of Sweden in Maputo, and the HIV/AIDS team based at the Embassy of Sweden in Lusaka. Other bilateral donors are the European Commission (EC), UNDP and USAID.

The Southern African Development Community, SADC, has based its headquarters in Gaborone. SADC receives support to environmental management from several donors including the GTZ, Netherlands, and USAID.

## 5. How and to what extent are the Responses to Environmental problems implemented and followed-up?

Regulations have been developed for environmental assessment, drinking water quality, wastewater, water reticulation and urban development. Environmental issues are integrated into development projects through environmental impact assessment (EIA). The EIAs have primarily been performed in the water sector, but have also included agriculture and the road sector. Botswana has adopted Strategic Environmental Assessment (SEA)-type approaches to the development of plans in the water sector, including the development of the National Water Master Plan for the Okavango basin and delta. The Department of Town and Regional Planning intend to incorporate SEA in the development to conform to the Environmental Impact Assessment Act. Many EIA consultants lack experience because of the relatively few EIAs that have been carried out.

A review of all land related laws and policies is underway to formulate a comprehensive land policy, which will promote equitable land distribution and address land use conflicts, land pricing and land rights, as well as strengthen land management. The new policy will establish a conducive environment for both domestic and foreign direct investment, thus contributing to economic diversification and global competitiveness.[42] The government is investigating options to develop its energy sources (see section 3) and has a vision to become a centre of excellence in solar technology.

Non-legislative instruments for environmental management are usually not applied in Botswana. The water sector is an exception, where urban water tariffs are structured in a way that should give incentives to lower water demand. However, Water Demand Management measures could be further encouraged to make water use more efficient and postpone costly supply-side investments.

[41] The Environmental Impact Assessment Act (2005); the Mines and Minerals Act (No. 17 of 1999), and Monuments and Relics Act (No. 12 of 2001).
[42] Minister of Finance and Development Planning, 2007.

Botswana has started to build capacity for the implementation of the UN Framework Convention for Climate Change (UNFCCC), Convention of Biological Diversity (CBD), and Environmental Impact Assessment (EIA). However, the EC has identified some capacity constraints, including: (i) lack of technical skills in specialised areas such as climate change modelling and monitoring of GMO; (ii) lack of specific competencies such as reviewing EIA reports and enforcing adaptive measures; (iii) absence of integrated approaches to environmental management; and (iv) lack of prioritisation of key issues. The overall capacity constraints are enhanced by the HIV/AIDS pandemic. The Department of Water Affairs and the Water Utilities Corporation have developed internal strategies for managing HIV/AIDS. Key features include prevention of infection, support to individuals who are affected of infected, dissemination of information to reduce the stigma associated with the disease and mainstreaming of HIV/AIDS into their business process.

Botswana is supporting the Kimberley Process (KP).[43] Botswana has strongly supported UN resolutions condemning conflict diamonds. Botswana is often mentioned as a 'shining example' of when high-value minerals have become a 'blessing' rather than a 'resource curse': Botswana's diamond wealth has, due to its democratic, consensual and transparent processes, been used to fuel one of the fastest rates of economic growth in the developing world instead of fuelling conflicts. Its performance, until the onset of the AIDS pandemic, equalled that of the Far East Asian tigers.[44]

However, there are some human rights related issues that darken the 'shining example' a bit: the Botswana government wanted to evict the indigenous Basarwa (San) people of the Kalahari Desert in order to protect wildlife. However, it was suggested that the mineral resources the Kalahari is believed to possess, including diamonds and possible uranium, was the reason for cutting water and other essential services for the Basarwa in 2002. In December 2006, at the end of the longest and most expensive court proceeding in Botswana's history, the High Court ruled that the state had wrongfully evicted the people from their home and that they could return.

Ongoing projects related to the environment, supported by the international cooperating partners, are in the areas of wildlife conservation and management, capacity assessment and development, energy, climate change, rangeland and biodiversity management, environmental law and water resource management. Sida is supporting various regional water resources management programmes in Southern Africa relevant to Botswana including co-financing of the newly inaugurated Secretariat for the Permanent Okavango River Basin Water Commission, OKACOM, which is based in Maun; the community development project 'Every River has its People' for the Okavango river basin; and development of a joint integrated water management strategy for the Zambezi river basin, all in which Botswana takes an active part. Sida was also supporting the outreach component of the Okavango Delta Management Plan, and plans to support a Water Demand Management project open for all countries in the SADC region.

## 6. Implications for Sida

Due to sound macro-economic policy and prudent use of its diamond revenues, Botswana has been developing from a low-income to a middle-income country in a few decades. However,

[43] The Kimberley process is an international diamond certification scheme designed to eliminate the trade in conflict diamonds.
[44] Lal, 2003; and Stiglitz, 2004.

excessive dependence on its mining sector and the HIV/AIDS pandemic threatens human development and economic growth. Efforts to diversify the economy have so far not been successful. Poverty is still widespread and income inequality is big. Infrastructure, such as roads and (rural) electrification is in need of investments.

Botswana faces several challenges in effectively managing the environment, and climate change is expected to further aggravate the situation. Environmental protection and environmental management is both a means to sustainable development and an end in itself. Increased water demand in combination with anticipated lower precipitation due to climate change, will reduce water availability with a negative impact on economic sectors and food security. The provision of water supply is costly due to the fact that Botswana has few surface water sources, and there is a need for greater understanding of groundwater recharge, its quality, distribution and quantity. Historically, the development and management of human settlements has largely been orderly due to physical planning. However, new pressure in urban areas has resulted in higher occupancy rates. There are also instances of self-allocation of land due to increased scarcity and unaffordability. Botswana is currently exploring different options for future sources of energy, to meet a growing demand for energy and electricity at household levels as well as for transportation and industrial development. When developing a "new" energy sector there are great opportunities to do it in a sustainable manner, using the opportunity to draw on international assistance to develop renewable sources in accordance with the Bali conference on climate change.

Below are some tentative areas and issues for Sida to consider in the process of developing a selective cooperating strategy for Botswana. As the desk study has been very brief, the issues below are by no means comprehensive.

### 6.1 Issues for Sida to consider related to climate change

*Strategic development and planning*

- Today's decisions and investments in energy, industry, infrastructure, rural land use, etc. will largely determine the $CO_2$-emissions of tomorrow. Improved spatial planning can both reduce future emissions and reduce vulnerability to climate change. Promoting inclusion of environmental and climate change aspects in spatial planning is therefore important and could be considered by Sida.

- Well functioning institutions responsible for environmental protection and environmental management is crucial for sustainable development. Strategic Environmental Assessment (SEA) is a way to improve environmental management, and is also a good decision-making tool generating transparent information.
    - Sida could consider support to strengthen environmental management institutions through twinning arrangements with Swedish municipalities or regions (regional authorities).
    - The Sida-financed International Training Programme on SEA might be relevant for Botswana stakeholders.

- Botswana is currently developing a land policy. It might be worth examining if support to a sound land tenure policy would be of interest to Botswana. It would benefit tenure security and investments, equitable land distribution and address land-use conflicts, land pricing and land rights, as well as strengthen land management. Improved land

management practices will – in turn – facilitate sustainable climate change adaptation especially at local levels.

*Water*

- A growing demand for water needs to be matched with the possibility of decreased availability. Implementing better water demand management, rain water harvesting, and groundwater management in Botswana would benefit the economy (by postponing expensive supply-side investments), poverty reduction, as well as water availability and facilitate climate change adaptation.
    - Interested Swedish actors could be the new regional water authorities.

*Energy*

- Botswana is currently investigating its domestic energy sources to meet the long-standing and pressing demands for a minimum level of modern energy services for the majority of the poor. Sida might want to consider supporting the efforts to develop a sustainable energy sector, by exploring new opportunities and overcoming some of the barriers identified including a need for feasibility studies, financial constraints and awareness raising (see section 3). Biogas (especially landfill methane-gas collection) is becoming increasingly interesting as it has a potential for supplying energy as well as being (potentially) eligible for CDM funding through its mitigation measures. Elephant grass and jetropha are other areas where Botswana has a potential that is yet to be explored.

- Rural electrification is generally correlating to both poverty alleviation and easing of gender imbalances. Improved household economies will reduce households' vulnerability to stresses including climate change related impacts. It might be interesting to investigate if there is any potential to support actors interested in aspects of solar energy or reduction of energy transmission losses.

- In order to realise the potential of coal based methane in Botswana, the government states that there might be a need to liberalise the energy market to allow entrance for other actors that might provide CBM based energy services. A state's ability to put in place effective and responsive frameworks for investments in clean energy comes down to fundamental questions of governance. There is an emerging recognition that when it comes to basic service delivery, governance matters are more important than ownership.
    - Sweden has already liberalised its energy market, and sharing these experiences might be interesting for both parties. Sida may want to consider supporting governance aspects of the possible future energy market liberalisation, perhaps through the Swedish energy authority.
    - Swedish energy companies might be interested in the Botswana energy market.

*Modelling and information*

- Capacity for climate change modelling and understanding of the results is identified as a capacity need in Botswana. This may give more accurate indications of future impacts from climate change and be useful when planning both adaptation and mitigation measures. It may be beneficial to work with climate change modelling and other related issues on a regional scale, perhaps under the SADC umbrella (SADC countries already have a meteorological cooperation including data-sharing and performing analyses).

- In order to improve the living conditions of the poor, provision of environmental information and awareness raising, early warning, extension services, etc. could be beneficial, for example through radio services. This would also potentially improve land use management, agricultural practices enhancing both climate change mitigation and local adaptation capacity, through information sharing, awareness raising and education.

### 6.2 Other issues for Sida to consider

- Sweden has a well developed system for Fair trade and environmental labelling. It might be worthwhile investigating if it is possible to extend Fair trade/labelling to existing community development programmes, such as the "Every River has its People", where communities produce crafts from locally available materials.

- In order to maximise benefits from its mineral wealth, Botswana may be interested in developing its knowledge and information and improve management and negotiation skills.

- Development of eco-tourism would enable increased income while sustaining the environment, and could be a good way to decrease the dependency of the mineral sector and develop the service sector. Eco-tourism should preferably be combined with community-based natural resources management and income sharing, including local actors.

Building capacity in some of the above mentioned areas could enable Botswana to export its knowledge to other countries in the region, e.g. through consultancy services.

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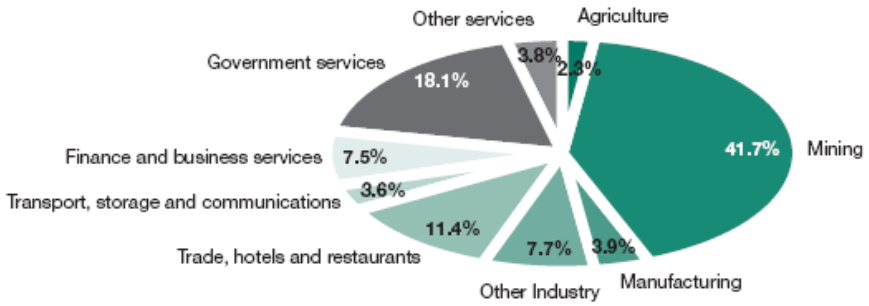
## Appendix 1: Botswana GDP by sector in 2004/2005

Figure 2 - **GDP by Sector in 2004/05** (percentage)



## Appendix 2: National environmental policies in Botswana

| *POLICY* | *POLICY OBJECTIVES* |
|---|---|
| National Policy on Resource Conservation and Development, 1990 | ▪ Increase the effectiveness with which natural resources are used and managed and to reduce harmful impacts; and integrate the work of stakeholders in order to improve the development of natural resources through conservation. |
| National Policy on Agricultural Development, 1991 | ▪ Improve food security through sustainable methods of production, and increase employment and incomes in the sector through diversification. |
| National Master Plan for Arable Agriculture and Dairy Development, 2002 | ▪ Improve and ensure sustainable performance of the agriculture sector. |
| National Settlement Policy, 1998 | ▪ Rationalise the distribution and development of settlements thereby achieve spatially balanced development across the country. |
| Housing Policy, 1999 | ▪ Facilitate the provision of decent and affordable housing for all within a safe and sanitary environment. |
| Draft National Energy Policy, 2006 | ▪ Facilitate economic efficiency; improve access and affordability of energy services; ensure environmental sustainability; ensure security of supply and diversified supply sources; facilitate gender equity; and, improve governance in the energy sector. |
| Game Ranching Policy for Botswana, 2002 | ▪ Support economic diversification in rural areas and increase economic returns from wildlife resources outside protected areas including by increasing the participation of Batswana. |
| Revised National Policy for Rural Development, 2002 | ▪ Reduce poverty; provide opportunities for income generation and involvement in economic activities; create employment; and, enhance popular participation in the development planning and implementation processes, as a basis for broad-based, balanced and sustainable development. |
| The Tourism Policy, 1990 | ▪ Promotes low-volume, high value tourism that benefits rural areas and involves a larger number of citizens. |
| National Water Master Plan,1992 | ▪ Guide the development of the water sector by estimating water until 2020; determining the availability and development potential of resources to meet the identified demand; determining the optimum water resources development programmes and policies, and identify the associated financial, institutional, and legal requirements, as well as the likely social and environmental impacts. |
| Wildlife Conservation Policy, 1986 | ▪ Provide a framework for the conservation and sustainable utilisation of wildlife by realising the full potential of the wildlife resource, developing a commercial wildlife industry in order to create economic opportunities, jobs and incomes, and increasing the supply of game meat for commercial, subsistence and nutritional purposes. |
| Strategy for Waste Management, 1998 | ▪ Minimise and reduce wastes in industry, commerce and households; maximise environmentally-sound waste reuse and recycling, and promote environmentally sound waste collection, treatment and disposal. |
| Wastewater and Sanitation Management Policy, 2003 | ▪ Assess the status of sanitation and wastewater in Botswana and propose improved mananagement. |

## Appendix 3: National environmental legislation in Botswana

| *LAW* | *RELEVANT PROVISIONS* |
|---|---|
| Water Act, 1968 | ▪ Defines water use rights and servitude. |
| Wildlife Conservation and National Parks Act, 1992 | ▪ Conservation and management of wildlife and implementation of international conventions for the protection of fauna, management of national parks and game reserves to which Botswana subscribes. |
| Agricultural Resources Conservation Act, 1974 | ▪ Makes provision for the conservation and improvement of agricultural resources and establishes the Agricultural Resources Board whose functions include to issue conservation orders and stock control orders. |
| Herbage Preservation (Prevention of Fires) Act, 1978 | ▪ Prevention and control of bush fires and other fires. |
| Tourism Act, 992 | ▪ Regulates the tourism industry to promote its sustainable development. |
| Forest Act, 1968 | ▪ Provides for the protection of forests and forest produce and the establishment of forest reserves. |
| Environmental Impact Assessment Act, 2005 | ▪ Provides for environmental assessment to be done for projects and policies. |
| Monuments and Relics Act, 2001 | ▪ Enables the protection, preservation and declaration of artefacts, monuments and heritage areas and provides for archaeological impact assessment. |
| Mines and Minerals Act, 1999 | ▪ Provides for environmental impact assessment of mining projects. |
| Waste Management Act, 1998 | ▪ Provides for the efficient management of waste, as well as the implementation of the Basel Convention. |
| Town and Country Planning Act, 1980 | ▪ Provides for the orderly development of land. |
| Atmospheric Pollution Prevention Act, | ▪ Governs air pollution and provides for the declaration of "controlled areas". |
| Agrochemicals Act, 1999 | ▪ Regulates the registration and licensing of agrochemicals, controls their importation, manufacture, distribution, use and disposal and limits pollution of the environment. |
| Tribal Land Act, 1970 | ▪ Defines Tribal Land and establishes Land Boards to administer it. |
| State Land Act, 1966 | ▪ Defines State land and provides for its disposal |

## Appendix 4. International environmental conventions

| *NAME OF CONVENTION* | *DATE OF SIGNATURE / RATIFICATION / ACCESSION* | *OVERALL OBJECTIVES* |
|---|---|---|
| UN Convention on Biological Diversity | Ratified 12 October 1995 | ▪ Conservation of biological diversity, sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources. |
| UN Convention to Combat Desertification and Drought, 1994 | Ratified 11 September 1996 | ▪ To combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa. |
| Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973 | Accession 14 November 1977 | ▪ The protection of endangered species prominent in international trade through appropriate control measures and monitoring the status of such species. |
| Convention on Wetlands of International Importance especially and Waterfowl Habitat (Ramsar Convention), 1971 | Accession 12 November 1997 | ▪ To stem the loss and to promote wise use of wetlands. |
| Montreal Protocol on substances that Deplete the Ozone Layer, 1987 | Ratified 4 December 1991 | ▪ Ensuring measures to protect the ozone layer. |
| Basel Convention on the Trans-boundary Movement of Hazardous Wastes and their Disposal, 1989 | Accession 20 May 1998 | ▪ Reduce transboundary movements of wastes; minimise the amount and toxicity of wastes generated and ensure their environmentally sound management; and assist least developed countries in environmentally sound management of the hazardous and other wastes. |
| UN Framework Convention on Climate Change | 27 January 1994 | ▪ To stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. |
| Kyoto Protocol | Accession 8 August 2003 | ▪ Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases, or engage in emissions trading if they maintain or increase emissions of these gases. |
| Vienna Convention for the Protection of the Ozone Layer, 1985 | Accession 4 December 1991 | ▪ Protect human health and the environment against adverse effects from activities which modify the ozone layer. |
| Cartagena protocol on Biosafety to the Convention on Biological Diversity, 2000 | Ratified 11 June 2002 | ▪ Ensure an adequate level of protection in the safe transfer, handling and use of living modified organisms that may have an adverse effect on the conservation and sustainable use of biodiversity. |
| Convention on Persistent Organic Pollutants, 2001 | Accession 28 October 2002 | ▪ Protect human health and the environment from persistent organic pollutants. |
| Convention for the Protection of World Cultural and Natural Heritage, 1972 | Acceptance 23 February 1999 | ▪ Establish an effective system of collective protection of the cultural and natural heritage of outstanding universal value. |