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USAID/NAMBIA ENVIRONMENTAL THREATS AND OPPORTUNITIES ASSESSMENT

WITH AN EMPHASIS ON TROPICAL FORESTRY AND
BIODIVERSITY CONSERVATION



November 2010

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COVER PAGE: USAID-supported conservation programs have assisted the "San" people of Namibia in integrating wildlife land-use options into the livelihood, development, and conservation strategies for Namibian communities.
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ACRONYMS

AALS	Affirmative Action Loan Scheme
ART	Anti Retroviral
BCLME	Benguela Current Large Marine Ecosystem
BMC	Basin management committee
CBM	Community-Based Management
CBNRM	Community Based Natural Resource Management
CC	Climate Change
CLRA	Communal Land Reform Act
COPASSA	Conservation Partnerships for Sustainability in Southern Africa
CPP	Country Pilot Partnership
DEA	Directorate of Environmental Affairs
DoF	Directorate of Forestry, MAWF
DRFN	Desert Research Foundation of Namibia
DRWS	Directorate of Rural Water Supply
DRWS	Directorate of Rural Water Supply
DWA	Department of Water Affairs, MAWF
EA	Environment assessment
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EPLs	Exclusive Prospecting Licences
ETOA	Environmental Threats and Opportunities Assessment
FAA	Foreign Assistance Act
GDP	Gross Domestic Product
GEF	Global Environment facility
GIWA	Global International Waters Assessment
GRN	Government of the Republic of Namibia
GTZ	The German Technical Cooperation
HAB	Harmful Algal Bloom
HIV	Human Immunodeficiency Virus
HPI	Human Poverty Index

HRM	Holistic Resource Management
HWC	Human Wildlife Conflict
IBCC	Interim Benguela Current Commission
ICZM	Integrated Coastal Zone Management
IDA	International Development Agency
INP	Indigenous Natural Products
IPD	Indigenous product development
IRDNC	Integrated Rural Development and Nature Conservation
ISLM	Integrated Sustainable Land Management
ITCZ	Inter-Tropical Convergence Zone
IWRMP	Integrated Water Resource Management Plan
LA	Local Authority
LME	Large Marine Ecosystem
LRAC	Land Reform Advisory Commission
LUEB	Land Use and Environmental Board
LUP	Land Use Planning
MAWF	Ministry of Agriculture, Water and Forestry
MAWRD	Ministry of Agriculture, Water and Rural Development
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MDG	Millennium Development Goal
MET	Ministry of Environment and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MLR	Ministry of Lands and Resettlement
MoHSS	Ministry of Health and Social Services
MoLSW	Ministry of Labour and Social Welfare
MoU	Memorandum of Understanding
MPA	Marine Protected Area
MRA	Marine Resources Act
MRLGHRD	Ministry of Regional and Local Government and Housing and Rural Development
NACOMA	Namibia Coastal Management Project
NACSO	Namibian Association of CBNRM Support Organisations
NAPCOD	Namibia's Programme to Combat Desertification
NAU	Namibia Agricultural Union

NCA	Northern Communal Area
NDP	National Development Plan
NGO	Non-Governmental Organisation
NNF	Namibia Nature Foundation
NNFU	Namibia National Farmers Union
NPC	National Planning Commission
NPP	Net Primary Productivity
NSF	National Science Foundation
NWR	Namibia Wildlife Resorts
OKAKOM	Okavango River Basin Commission
OVC	Orphans and Vulnerable children
PA	Protected Area
PAN	Protected Area Network
PEPFAR	President's Emergency Plan for AIDS Relief
POP	Persistent Organic Pollutant
PP	Primary Production
RPRP	Rural Poverty Reduction Programme
SADC	Southern African Development Community
SAIEA	Southern African Institute for Environmental Assessment
SAP	Strategic Action Program
SAREP	Southern Africa Regional Environmental Program
SD	Sustainable Development
SEA	Strategic Environmental Assessment
SLM	Sustainable Land Management
SLR	Sea Level Rise
SPAN	Supporting the Protected Area Network Project
SST	Sea surface temperature
SWOT	Strengths, Weaknesses, Opportunities and Threats
TA	Traditional Authority
TAC	Total Allowable Catch
TB	Tuberculosis
TDA	Transboundary Diagnostic Analysis
TFCA	Transfrontier Conservation Area
UN	United Nations

UNCCD	United Nations Convention on Combating Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USFS	U.S. Forest Service
USG	U.S. Government
USGS	United States Geological Service
WASSP	Water Supply and Sanitation Policy
WPA	Water Point Association
WPC	Water Point Committee
WWF	World Wildlife Fund
Y	Year

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EXECUTIVE SUMMARY

INTRODUCTION

COUNTRY OVERVIEW

Namibia is the 34th largest country in the world and covers approximately 825,000 km². It supports an estimated 2.1 million people, making it the second least populated country on earth. Located in Southern Africa, Namibia's borders include the Atlantic Ocean to the west, Angola and Zambia to the north, Botswana to the east, and South Africa to the south and east.

Namibia's marine environment falls within the Benguela Large Marine Ecosystem (BCLME), which is shared with South Africa and Angola. The cold, highly productive Benguela Current has helped form the low-rainfall Namib Desert, which extends northwards through Namibia and southern Angola.

The Namibian landscape consists of five major geographical areas: the Central Plateau, the Namib Desert, the Great Escarpment, the Bushveld, and the Kalahari Desert. These geographical areas support four major biomes – i.e., the tree and shrub savanna, the Nama Karoo, the Namib Desert, and the Succulent Karoo. These biogeographical areas each contain unique and important biodiversity elements that are critical to Namibia's long-term development goals.

Namibia's scarce surface water, which includes perennial and ephemeral rivers, pans, springs, and seeps is essential to the ecological and economic health of the country. While the larger surface waters support the highest biodiversity (particularly in the northeast) and have the greatest potential to meet people's needs, the smaller and more temporary waters are equally vital sources for the maintenance of wildlife. All rivers in the interior are ephemeral, flowing only after good rains in the catchments.

Surface and groundwater sources in Namibia are virtually fully exploited. While sources and management approaches have been able to ensure a supply of water to most people up to now, that supply has not always been economically, socially or environmentally sustainable.

The combination of poor soils, low and variable rainfall, and high evaporation rates produce rangelands in Namibia of relatively low productivity with correspondingly low carrying capacities for wildlife and livestock. There is a growing trend to diversify livelihoods and to make farming more adapted to Namibia's arid climate. This has brought about a shift from conventional farming with livestock to mixed husbandry with wildlife on both commercial and communal rangelands.

Forests and woodlands cover less than 10% and about 50% of the country respectively. Non-timber products from forests, woodlands, and other wild plants provide valuable resources for local livelihoods.

Important forest and woodland areas include: **the northeastern broad-leafed woodlands**, which support a high diversity of species and animals associated with the trees; **riparian forests** along the banks of the northern perennial rivers, which comprise a great variety of trees and form some of the most biologically diverse habitat in the country; the **ephemeral river woodlands**, which support trees that provide food, shelter, and shade and are important lifelines that cut through the hyperarid parts of the country; and the **mopane woodlands**, which occur in Caprivi and in north-central and northwestern Namibia, where large areas are dominated almost entirely by this species alone.

Namibia is administratively divided into 13 regions with an estimated 37% of the population living in urban areas. The majority of rural population resides in the north of the country.

PURPOSE OF THIS ASSESSMENT

This document analyzes the status of biodiversity and tropical forest conservation in Namibia as legally required by Sections 118 and 119 of the US Foreign Assistance Act (FAA). Its aim is to identify principal problems and their causes, and to provide the USAID Mission with recommendations for biodiversity and tropical forest conservation within a portfolio that is appropriate to Namibia's development needs.

METHODOLOGY

This assessment was conducted by Joe Krueger from the U.S. Forest Service (USFS), with assistance from the Southern Africa Institute for Environment Assessment (SAIEA). It incorporates information gleaned from meetings with 46 key individuals from government institutions, donor agencies, NGOs, the mining industry, conservancies, lodge owners, and tourism operators. The team took two field trips, including site visits to mining operations and adjacent developing areas in the Erongo region as well as to protected areas and areas of high biodiversity in the Caprivi region.

This ETOA includes a review of pertinent legislation, a SWOT (strengths, weaknesses, opportunities and threats) analysis for each of the key natural resources sectors (water, wildlife, rangelands, forestry, and marine environment), and recommendations on how to contribute to the biodiversity conservation needs identified.

THE SUSTAINABILITY OF DEVELOPMENT PROGRAMS IN NAMIBIA

Over the past 20 years, international donors have contributed significantly to sustainable biodiversity conservation practices in Namibia. In 2008, the U.S. Government (USG) shifted its program emphasis away from support to the communal conservancies to implement the PEPFAR (President's Emergency Plan for AIDS Relief) program and assist the government of the Republic of Namibia (GRN) address the AIDS epidemic. More recently, the USG signed a compact with the GRN via the Millennium Challenge Corporation (MCC) that will address necessary actions for sustainable biodiversity conservation. The USG has also recently initiated a program (Southern Africa Regional Environmental Program – SAREP) that is intended to address water sanitation, community tourism, and integrated resource management planning in the Okavango river basin.

The German Technical Cooperation (GTZ) and the German Development Corporation, WWF-UK, and the Global Environmental Facility (GEF) are also conducting projects with environmental components.

The sustainability of development programs has become an issue of concern for Namibia. Based on the annual GDP per capita, Namibia is now classified as an "upper middle income" as opposed to a "poor" country. This classification hides the challenges the country continues to face (including high levels of unemployment and large disparities in income), which have not been adequately addressed during the past 18 years since Independence. It implies that the country no longer requires the same level of support that it did in decades past. Moreover, access to concessional loans of the World Bank's International Development Agency (IDA) is now barred.

SOCIO-ECONOMIC OVERVIEW

The Namibian economy grew by an average of 3.4 % per annum between 1994 and 2002 and continues to depend on the exploitation of renewable and non-renewable natural resources. The economy relies heavily on international trade. The most important exports include: uranium, diamonds, beef, beer, meat, and fish products. The country's wide-open spaces, attractive landscapes, and abundant wildlife provide the mainstay for a strong tourism industry.

In spite of the global economic recession, mining, construction, and infrastructure development in Namibia continues to enjoy increased investment. Furthermore, a "Uranium Rush" is underway in the central Namib area.

DEVELOPMENT POLICY AND CHALLENGES

Namibia's development policy decisions are guided largely by the Vision 2030 document and the Millennium Development Goals (MDGs), which are implemented through five-year National Development Plans (NDPs) and specific sector plans. Agricultural initiatives such as the Green Scheme – initiatives which are expected to boost domestic food production and could offer opportunities for agro-processing activities – are given strong support by government.

Important challenges to Namibia's developmental objectives include *inter alia*: poverty, a predominantly arid environment with limited fresh water resources, low land capability with soils that are easily degraded, fluctuating prices for raw materials, inadequate governance, and growing corruption.

POVERTY AND HIV/AIDS

Although Namibia appears to be making progress towards eradicating extreme income poverty, and access to primary health care and education has improved, recent quantitative analyses of the human poverty index (Human Poverty Index (HPI) – a measure of income, health, and education levels) suggests that human poverty in the country is increasing. Rural areas remain significantly higher than urban areas in all three dimensions of human poverty. An underlying cause of increasing HPI in Namibia is the HIV/AIDS epidemic which has more than offset the positive effects of improvements in the other dimensions of human development.

Poverty in Namibia's rural areas is linked to deforestation and land degradation. The poorest families still use wood fuel, rely on wild foods (particularly during times of drought), and depend heavily on subsistence farming (livestock and unpredictable rain fed crops) for their livelihoods.

LEGISLATIVE AND INSTITUTIONAL FRAMEWORK RELATED TO BIODIVERSITY CONSERVATION

The importance of environmental protection in Namibia is reflected in the Namibian Constitution. There are provisions ensuring the sanctity of the natural environment (95(l)), mechanisms by which the government can investigate misuse of resources (91(c)), and mechanisms for the enforcement of sound management policy.

Although most GRN policies are consistent with the Constitution and Vision 2030's recognition that sustainable utilization of natural resources is essential for the continued advancement of the country, implementation is poor and inconsistent. Despite the country's unsuitable soils, high climatic variability, and vulnerability to climate change (CC), overambitious expectations from the agricultural sector (particularly regarding livestock rearing, rainfed cropping, large-scale irrigation schemes, resettlement, and the role they can play in poverty alleviation and attaining food security) continue to be promoted. Moreover, inadequate recognition of the strategic importance of wildlife-based industries (tourism, venison production, and trophy hunting) undermines Namibia's ability to fully capitalize on its comparative advantages. In addition, the legislative and institutional framework seemingly allows for exploration licenses to be granted wherever a valuable mineral commodity is found, including within gazetted protected areas of high conservation value.

The use of environmental safeguard instruments (including impact assessment) is currently inadequate. Furthermore, high-level decision makers have a poor appreciation of the value of biodiversity and ecosystem services. This sometimes results in conflicting, sectoral agendas, and unrealistic "visions" for Namibia's future.

TERRESTRIAL BIODIVERSITY AND TROPICAL FOREST CONSERVATION IN NAMIBIA: STATUS AND TRENDS

THREATENED TERRESTRIAL HABITATS AND SPECIES

Limited knowledge on the biodiversity of many phyla, and even more limited knowledge on the ecological requirements of many described species, means that any assessment on the status of biodiversity in Namibia remains cursory at best.

In Namibia, the following numbers of species have been described to date: 4,350 vascular plants (17 % endemic), 6,331 insects (24 % endemic), 115 fish (4% endemic), 250 reptiles (24% endemic), 644 birds (14% endemic to Southern Africa, 2% endemic to Namibia), and 217 mammals (12% endemic). Many of these species show unique adaptations to Namibia's largely arid and variable climate and the unusually high levels of endemism make Namibia's wildlife both unique and interesting. Namibia supports the world's largest population of cheetah – a fact alone which makes its biodiversity internationally important.

Known threatened species include African elephant, pangolin, and lesser flamingo. Vulnerable species include lion and blue crane, while African wild dog is endangered and black rhino is considered critically endangered.

Riparian forests, rivers, and other wetlands and the rich biodiversity they support are Namibia's least protected and most threatened habitats

BIODIVERSITY RICH AND ENDEMIC HOTSPOTS

Biodiversity richness is highest in northeastern Namibia which not only receives the most rainfall but also supports perennial rivers, wetlands and varied woodland habitats. The majority of Namibia's endemic species are found in the dry western and northwestern regions. Riparian forests are severely under-protected in Namibia and are highly vulnerable to increasing local and transboundary pollution, increasing rates of water abstraction, invasion by alien species and, most importantly, devegetation.

NAMIBIA'S PROTECTED AREAS NETWORK

National parks cover approximately 17 % of Namibia. The proclamation of most of this land occurred before the value of biodiversity conservation was fully realized and, as a result, these protected areas (PA) are not evenly distributed between the various landscapes, biomes, and vegetation types in the country.

Communal conservancies contribute an additional 132,090 km² to the protected areas network and their establishment has improved opportunities for biodiversity conservation considerably by including previously neglected biomes. In addition to the national parks, these conservancies, together with community forests, private nature reserves, and state concession areas cover approximately 35 % of the country's land base. Thus, Namibia plays a leading role in the world in biodiversity conservation, as the mean average for PA coverage is 12.2 %.

During the past decade, three memoranda of understanding (MoU) have been signed between Namibia and her neighbors. Improved collaboration and co-operation between the signatories of these MoUs has great potential for tourism in and biodiversity conservation within the Southern African Development Community (SADC) – particularly with respect to opening up valuable landscape level biodiversity corridors for the movement of wildlife.

KEY WEAKNESSES AND THREATS

Major concerns pertaining to terrestrial biodiversity conservation in Namibia include:

- Conflicts in land-use, disparate political “Visions” for Namibia’s future, and low status and capacity of both the Ministry of Environment and Tourism (MET) and the Directorate of Forestry (DoF) of the Ministry of Agriculture, Water and Forestry (MWF).
- The absence of adequate Land Use Planning (LUP) threatens biodiversity and conservation efforts throughout Namibia.
- The environment competes with people, livestock, mines, industry, and irrigation for Namibia’s scarce water resources. Human water demand in the country is expected to increase by 230% between 2008 and 2030. The environmental implications on ecosystems and the hydrological cycle are not well considered and political decisions regarding water use are not always consistent with policy directives.
- While woodlands are conserved to some degree inside protected areas, community forests, and conservancies, the controls on wood harvesting, transportation, and selling of wood products is inadequate. As a result, trees are suffering increasing rates of deforestation. The biggest losses of natural woodland have occurred from clearing of land for crop cultivation, cutting of trees for firewood and construction, and the frequent burning of trees as a result of veld fires in the northeast. As people’s livelihoods become more threatened by increasing temperatures and aridification (as predicted in the most recent climate change reports) rural poverty is likely to increase and with it, rates of deforestation and increasingly unsustainable land-use practices and the harvesting of indigenous forest products.
- The carrying capacity of an estimated 26 million hectares of rangelands in central and eastern Namibia has been greatly reduced by bush encroachment – a major form of land degradation. These dense thickets of thorny bush grow in response to the overstocking of cattle, a corresponding loss of perennial grasses and a reduction in the number of browsing ungulates. These human-induced threats are exacerbated by climatic conditions that favor the flowering, seeding, and germination of woody plants – especially during dry periods when water is more accessible to deep-rooted plants, rather than shallow-rooted grasses.
- Namibia is currently experiencing rapid growth in its charcoal industry. Unless adequately monitored, this potentially valuable industry (it can help to combat bush encroachment) is likely to result in the over-exploitation of many valuable tree species.
- Higher temperatures, lower rainfall and higher evaporation rates across Namibia are predicted with climate change. These cumulative impacts will result in increasing aridification across most of the country, lower primary production of rangelands and reduced carrying capacity for wildlife.
- From a biodiversity perspective, the CC impacts on water availability are likely to be severe – especially in western Namibia where trees in ephemeral riverbeds act as linear oases that provide essential fodder and habitats to many species. The decline in surface water (small springs and seeps) in the more arid areas will affect bird and game populations negatively. Reduced inflows into the Etosha Pan may impact on the natural springs around the southern parts of the pan and on the breeding of some important species.
- In addition to the direct impacts of CC on biodiversity, global warming will further exacerbate poverty and household food amongst subsistence farmers – thus placing more pressure on the land and its resources.

- Another potential impact is the CO₂ fertilization effect which is likely to cause an increase in rates of bush encroachment.

KEY STRENGTHS AND OPPORTUNITIES

Despite the low status of MET within the GRN, Namibia’s wildlife sector receives strong NGO and donor support. Furthermore, the development of Community-Based Natural Resource Management (CBNRM) has helped to provide alternative livelihoods for rural communities and, provided that future habitat destruction is minimized in the face of growing foreign and local commercial interests, wildlife-centered enterprises will continue to maintain biodiversity and support some rural communities. Thus, several opportunities for biodiversity conservation exist. These include:

- Strengthening partnerships between the MET, conservancies (especially on communal land adjacent to parks), private landowners, tourism operators, NGOs, private investors, and donor agencies through the formation of multi-stakeholder committees with a joint focus on adopting sustainable and pro-conservation land uses.
- Formalizing links between Etosha and the Skeleton Coast Park via the Kunene conservancies. This could be facilitated by expanding conservation areas and removing fences to provide “safe corridors” to facilitate repopulation of former home ranges and reintroduction of certain species.
- In the northeast (which incorporates the Bwabwata, Mamili, Mudumu and Mahango National Parks, Khaudum Game Park, the Mangetti Game Camp, and Waterberg Plateau Park) the key focus should be on establishing new conservancies (turning the conservation “patchwork” into a “network”) to provide protection for the eastern floodplains in Caprivi, as well as improving ecological linkages within the transfrontier conservation area. By improving the connectivity of current PAs, landscape level corridors will be developed – corridors that will help to meet the challenge of the biomal shifts that are expected to occur as a result of climate change.
- Climate change is expected to have positive as well as negative impacts on Namibia’s wildlife populations. Wildlife in Namibia is well adapted to arid and highly variable climatic conditions. This advantage over domestic livestock should boost the trend amongst freehold farmers – some of whom have already begun to remove fences, develop conservancies, and invest increasingly in consumptive and non-consumptive wildlife-based industries. Under these circumstances there will be increasing demand for wildlife stock from parks and conservancies by freehold farmers. As subsistence farming becomes less viable there will be increasing interest in the development of new communal conservancies and the CBNRM program will need to be expanded upon.
- The extension of ownership rights over some wildlife to rural residents is a welcome improvement in the policy framework, but needs to be extended further. Forestry and non-timber forest and woodland products are beginning to benefit from this. However, the greatest need is for improving the ability of rural residents to better manage their pastures and rangelands.
- There are further opportunities for developing innovative technology in the irrigation, water recycling, and artificial recharge spheres.
- Improving awareness and education regarding Namibia’s water resource challenges and developing price support mechanisms that favor water conservation measures.

- Further opportunities include: integrating game farming within Namibia’s resettlement program; encouraging the role of honorary game wardens and foresters to help the MET and DoF enforce laws and control undesirable practices; building capacity and providing guidance for Namibia’s recently established Woodlands Management Council; supporting Namibia’s bush-to-electricity project (CBEND), which has great potential but will require training and strict control in order to ensure that valuable trees are not harvested together with bush encroachment species; and improving awareness about responsible forestry and sustainable harvesting of woodland products at all levels of society.
- Sustaining robust research and training facilities’ such as the Gobabeb Training and Research Centre is critical to understanding the impacts and potential mitigation measures to combat desertification and climate change impacts throughout Southern Africa.

MARINE BIODIVERSITY AND CONSERVATION IN NAMIBIA: STATUS AND TRENDS

Although biodiversity in Namibia’s marine environment is comparatively low, the dense plankton blooms that characterize the Benguela Current Large Marine Ecosystem (BCLME) provide rich feeding grounds for large populations of fish, crustaceans, sea birds, and marine mammals – many of which are economically valuable.

Namibia has designated three coastal wetlands as Ramsar sites (wetlands of international importance) – the Walvis Bay Lagoon,¹ Sandwich Harbour Lagoon, and the Orange River Mouth which support a high diversity of shorebirds (mostly waders). Other coastal areas/wetlands in Namibia qualify for Ramsar site status (including the Kunene River Mouth, Luderitz lagoon, the Cape Cross Lagoons, and Namibia’s offshore islands) but have not yet been designated this status.

THREATENED SPECIES

Nine of the 15 southern African breeding seabird species that occur in the BCLME region are listed as severely threatened in South Africa’s red data book. Their status reflects, inter-alia, the overexploitation of some fish species – particularly the palagics – within the ecosystem. Endangered avifaunal species include the Damara tern and the Jackass penguin.

WEAKNESSES AND THREATS

There is limited understanding of the physical, chemical, and biological interactions and processes that drive the highly variable and complex BCLME, but there is fragmentary evidence that suggests increasing instability and variability in recent decades – a situation that will further compromise the biodiversity of Namibia’s marine environment.

Despite the creation of an Exclusive Economic Zone (EEZ) and the setting of total allowable catches (TACs) since independence, excessive and uncontrolled overfishing in the past has caused the decline and spatial displacement of many targeted species, alterations to the benthic environment, the decline of many marine predators (birds and marine mammals), the decline of numerous other marine species through by-catch and by-kill, and changes in community structure and ecosystem functioning. Although the Benguela Current Commission has helped to harmonize the management of the BCLME, there remains inadequate capacity (equipment, vessels, expertise), and limited funding for effective marine monitoring.

¹ The Walvis Bay Lagoon consists of lagoon, beach, and intertidal habitats and supports up to 150,000 birds of over 40 species, many of which are migratory waders.

In addition to the overexploitation of certain species, other threats to Namibia's marine and coastal environment include: the petroleum industry, growing pollution, onshore and offshore mining, climate change with its associated Sea Level Rise, sandy beach erosion, and an increase in storm/flooding events. The rapid, poorly planned development of coastal towns is also a concern.

STRENGTHS AND OPPORTUNITIES

The three countries that share the BCLME are attempting to harmonize the management of shared stocks, improve the predictability of extreme events, and address concerns related to increased fishing pressure, harmful algal blooms (HABs), and pollution from ongoing seabed mining and petroleum production. An effort to ensure Integrated Coastal Zone Management (ICZM) poses a tremendous challenge for all stakeholders but does provide an opportunity to help ensure sustainable development along Namibia's coast.

CONCLUSIONS

Namibia has a collection of policies and laws that are largely conducive for biodiversity conservation and sound natural resource management. However, the implementation of these laws and the use of environmental safeguard instruments (including Land Use Planning and Environmental Impact Assessment) are currently inadequate. Consequently, terrestrial habitats and resources (water, forests, and wildlife) are under increasing pressure from a growing population that is experiencing increasing unemployment and the impacts of the HIV/AIDS epidemic. Intensifying development has resulted in increasing concerns with respect to the sustainability of water abstraction, the expansion of large-scale irrigation projects, and increasing coastal zone mining activity.

Land degradation, deforestation, and other threats to biodiversity in Namibia are partially offset by the increasing tendency amongst some freehold farmers to invest in wildlife and remove fences which open up the landscape and allow for more healthy wildlife populations. Furthermore, the development and success of communal conservancies and the growth of the CBNRM movement, particularly in the northwest and northeast, has helped to diversify livelihoods and has placed previously neglected biomes within the protected areas network.

CURRENT USAID ACTIONS THAT ADDRESS THREATS TO BIODIVERSITY AND TROPICAL FOREST

Although the current USAID-Namibia PEPFAR program does not directly address issues associated with biodiversity and tropical forest conservation, the success of this program in helping to reduce the Human Poverty Index in Namibia will have beneficial impacts on biodiversity conservation in the long term.

Ongoing and emerging programs intended to address specific environmental issues include Conservation Partnerships for Sustainability in Southern Africa (COPASSA) and Southern Africa Regional Environmental Program (SAREP). If planned and implemented adequately, the land use planning component of the SAREP program has the potential to address some fundamental conservation issues identified in this assessment as ongoing threats to biodiversity conservation.

ACTIONS NECESSARY TO DECREASE PRESSURES ON BIODIVERSITY AND TROPICAL FORESTS, AND RECOMMENDATIONS TO USAID

- The important communal conservancy component of Namibia's protected areas network will continue to need financial and technical support for the next 15-20 years in order to ensure that its contribution to biodiversity conservation and tropical forest conservation remains sustainable.

- The current SAREP project needs to be carefully planned, supported, and implemented so as to enhance emerging transfrontier efforts to coordinate the management of protected areas and conservancies.
- Integrated land use planning in Namibia is essential to sustainable development. Thus, the lack of clarity regarding responsibilities and the dearth of funds to help facilitate this important environmental tool continues to act as a barrier to sustainable development in the country. It is vitally important that the LUP process in Caprivi (coordinated through SAREP) is carefully coordinated with all appropriate ministries, NGOs, and private investors.
- The land use planning program should consider and be guided by the vision and goals associated with the development of Namibia’s transfrontier protected areas. The land use planning process should strive to link and institutionalize a protected areas network that incorporates existing PAs and conservancies. This planning, which would target the Kunene and Caprivi regions specifically, will help to reduce risks associated with climate change by facilitating the expected biomal shifts and wildlife movements that are expected to occur with the predicted higher temperatures and increasing aridification expected by 2050.
- The targeted areas are also intended to address and complement the transfrontier biodiversity conservation issues. This recommendation is consistent and complementary to one of the objectives of the MET’s Strategic Plan Theme 5 to “develop management partnerships between parks and neighbors to promote compatible land-use and generate economic activity via tourism and resource use.” NDP III also calls for an increased number of management partnerships between parks and neighbors.
- Provide on-the-ground assistance to CBNRM II in the context of providing additional resources to better implement, share, and expand upon CBNRM practices in light of climate change. The CBNRM model should expand to include not only the model of co-management and complex management of protected areas and conservancies but mainstream the integration of best management practices, including prescribed fire, Holistic Resource Management (HRM) measures for livestock, human wildlife conflict management, community forest management, water resource management, and alternative income generation. Supporting the various ministries in capacity building will be necessary in order to support conservancies and private industry to expand CBNRM practices.
- Assist with financial support to ensure that the Gobabeb Desert Research Station is capable of providing quality research in climate change adaptation, biodiversity conservation education programs, desertification mitigation and prevention, mining-related mitigation, and restoration techniques. This initial investment could yield important and strategic partnerships with National Science Foundation (NSF), United States Geological Service (USGS), and U.S. universities involved in climate change research, desertification, and biodiversity conservation in Africa.
- Provide additional support and leverage existing conservancy NGO support for HIV education and prevention. NGOs (Integrated Rural Development and Nature Conservation – IRDNC) supporting conservancies need additional support for “mainstreaming” HIV educational programs into their support function.
- Assist with the development of a forum in which legal assistance and other development partners can assist the development of stronger partnerships between conservancies and existing and future lodge owners. The discussions in the field areas of Caprivi indicated a gap in

understanding the perspectives of conservancies' needs with the understanding of the lodge owners' needs. A forum needs to be established to work through these issues to ensure the gap does not threaten the institutional arrangements of conservancies – for example, lodge owners working around conservancy committees with traditional authorities as the conservancy committees demands are inappropriate or can be marginalized by working with traditional authorities.

- Recommend Peace Corps to bring business/economics/health volunteers to assist conservancy management.
- Provide financial support to government, conservancy members, and private lodge operators to attend a USFS protected area management seminar. WWF-Namibia and IRDNC can assist with identifying appropriate candidates.

I. INTRODUCTION

A. COUNTRY OVERVIEW

Namibia is the 34th largest country in the world and covers approximately 825,000 km². It supports an estimated 2.1 million people, making it the second least populated country on earth. Located in Southern Africa, Namibia's borders include the Atlantic Ocean to the west, Angola and Zambia to the north, Botswana to the east and South Africa to the south and east.

The Namibian landscape consists of five major geographical areas: the Central Plateau, the Namib Desert, the Great Escarpment, the Bushveld, and the Kalahari Desert. These geographical areas support four major biomes – the tree and shrub savanna, the Nama Karoo, the Namib Desert, and the Succulent Karoo. These biogeographical areas each contain unique and important biodiversity elements that are critical to Namibia's long term development goals.

The country is administratively divided into 13 regions with an estimated 37% of the population living in urban areas. The majority of rural population resides in the north of the country.

B. THE PURPOSE OF THIS ASSESSMENT

Section 118 of the Foreign Assistance Act (FAA) of 1961 requires that every USAID country development strategy statement or country plan include an analysis of:

“1) the actions necessary in that country to achieve conservation and sustainable management of tropical forests;” and “2) the extent to which the actions proposed by the agency meet the needs thus identified.”

Section 119 dictates that every country strategic plan developed by USAID shall include: *“1) the actions necessary in that country to conserve biological diversity;” and “2) the extent to which the actions proposed for support by the agency meet the needs thus identified.”*

Hence, the use of the 118/119 report to assist the development of country level plans or strategies is a legal requirement.

This document analyzes the status of biodiversity and tropical forest conservation in Namibia, identifies principal problems and their causes, and provides the USAID mission with recommendations for including biodiversity and tropical forest conservation in a portfolio that is appropriate to Namibia's development needs. It has five objectives:

- Assess the current state of biodiversity conservation and forest management in Namibia
- Identify the root causes of processes and trends that threaten biodiversity and tropical forests
- Identify the immediate causes for the threats to biodiversity and tropical forests
- Identify priority actions necessary to better conserve tropical forests and biological diversity in Namibia
- Provide specific recommendation to USAID/Namibia on how to incorporate actions that will help conserve biodiversity and tropical forests into its strategic priorities given budget and programmatic constraints

C. METHODOLOGY

This assessment was conducted by a team of environmental specialists led by Joe Krueger from the U.S. Forest Service (USFS), with assistance from the Southern Africa Institute for Environment Assessment (SAIEA). It incorporates information gleaned from meetings with 46 key individuals from government institutions, donor agencies, NGOs, the mining industry, conservancies, lodge owners, and tourism operators. The team took two field trips including site visits to mining operations and adjacent developing areas in the Erongo region as well as to protected areas and areas of high biodiversity in the Caprivi region.

This Environmental Threats and Opportunities Assessment (ETOA) focuses on Namibia's land and natural resource use and management, biodiversity, and conservation needs. It includes a review of important legislation, a SWOT (strengths, weaknesses, opportunities, and threats) analysis for each of the key natural resources sectors (water, wildlife, rangelands, forestry, and marine environment), and recommendations to USAID/Namibia on how to contribute to the conservation needs identified. The last ETOA of USAID Namibia was conducted in 2003 and the last update on the 118/119 analysis was done in 2005.

In spite of the global economic recession, mining, construction, and infrastructure development continue to enjoy increased investment and a "Uranium Rush" is underway in the central Namib area. Most natural resource-based development initiatives in Namibia are vulnerable to high environmental variability and climate change. A growing population and the push for more rapid economic growth are placing increasing pressure on the environment and many components of the natural resource base are suffering from unsustainable use.

D. THE SUSTAINABILITY OF THE DEVELOPMENT PROGRAM IN NAMIBIA

Over the past 20 years, international donors have contributed significantly towards sustainable biodiversity conservation practices in Namibia. In 2008, the U.S. Government (USG) shifted their program emphasis away from support to the communal conservancies to implement the PEPFAR (President's Emergency Plan for AIDS Relief) program and assist the Government of the Republic of Namibia (GRN) address the AIDS epidemic. More recently the USG signed a compact with the GRN via the Millennium Challenge Corporation (MCC) that will address necessary actions for sustainable biodiversity conservation. The USG has also recently initiated a program (Southern Africa Regional Environmental Program – SAREP) focused on improved management of shared river basins, strengthened systems to protect biodiversity and ecosystem services, increased access to safe drinking water and sanitation, and strengthened institutional capacity in the context of climate change.

The sustainability of development programs has become a concern for Namibia. Based on the annual GDP per capita (approximately US\$3,000), Namibia is classified by the World Bank and the International Monetary Fund as "upper middle income" as opposed to "poor." This classification hides the challenges the country continues to face (including high levels of unemployment, growing poverty, and large income inequality), which have not been adequately addressed during the past 20 years since Independence. It implies that the country no longer requires the same level of support that it did in decades past. Moreover, access to concessional loans of the World Bank's International Development Agency (IDA) is now barred.

2. SOCIO-ECONOMIC OVERVIEW OF NAMIBIA

An overview of socio-economic trends in Namibia related to key economic constraints/drivers, population growth and distribution, poverty and employment, health, and education are presented in this section.

A. KEY ECONOMIC DRIVERS AND CONSTRAINTS

The Namibian economy, which grew by an average of 3.4 % per annum between 1994 and 2002, continues to depend on the exploitation of renewable and non-renewable natural resources. The economy relies heavily on international trade with imports and exports, each totalling more than half of GDP in value (IPPR 2010). The most important exports include: uranium, diamonds, beef, beer, meat, and fish products. Namibia is the world's fifth largest producer of diamonds (by value) and a leader in the field of offshore diamond mining. The country's wide-open spaces, attractive landscapes, and abundant wildlife provide the mainstay for a strong tourism industry.

A budget review by Schade (2010) provides insight into the current economic state of the country and highlights the fact that domestic developments such as the initiation of production at the Ohorongo cement factory and the Trekkopje uranium mine are expected to buoy the economy in the short to medium term. Economic recovery in Namibia's traditional export markets (particularly diamonds) remains uncertain.

I. NAMIBIA'S DEVELOPMENT GUIDELINES

Namibia's development policy decisions are guided largely by the Vision 2030 document (launched in 2003) and the Millennium Development Goals (MDGs), which are implemented through five-year National Development Plans and specific sector plans.

The Namibian Constitution, Vision 2030, and NDP3 (for the period 2007-2011) are committed, on paper, to maintaining environmental integrity in Namibia. For example, one of the main goals of NDP3 is "... to ensure environmental sustainability by strengthening the management of natural resources and biodiversity." It further acknowledges that "...the activities in all sub-sectors affect ...environmental sustainability." In reality, however, it has been very difficult to achieve most of the sustainable development and environmental goals as laid down in this and other guiding documents. (Discussed in Section 3)

2. NAMIBIA'S ECONOMIC CONSTRAINTS

The main challenges to Namibia's developmental objectives include:

- Namibia's low and variable rainfall
- Limited water resources
- Low land capability with soils that are easily degraded
- Poverty

- The HIV/AIDS epidemic
- Natural disasters (floods in the northern areas and drought)
- Inequitable land ownership and tenure over natural resources
- An education system that inadequately prepares learners for quality tertiary education and/or employment in a competitive global setting
- Uncertain electricity supply
- Rising food and fuel prices
- Fluctuating prices for raw materials
- Inadequate governance and growing corruption²

At the household level, amongst rural Namibians, environmental constraints (frequent droughts, high prevalence of stock diseases, wildlife, human conflict, veld fires, and vector-borne diseases such as malaria) are identified as being the most crucial risk factors.

The loss of biodiversity – which disrupts ecosystem functioning – and the adverse impacts of climate change are additional constraints to economic and social development in Namibia. (See Section 4)

A review of the NDP2 period (2001-2006) as presented in GRN (2008) highlights, *inter alia*:

- Namibia's significant rural-urban disparities in economic growth and employment
- The need for greater integration of service delivery between government agencies and between them and the private sector, civil society organizations, and Namibia's international development partners
- The need for Government to more effectively utilize their limited skilled personnel and implement a comprehensive human resources development plan as a priority
- The need to strengthen and integrate a national monitoring and evaluation system in order to monitor progress on the implementation of laws, development policies, programs, and projects and to evaluate the results and impacts

3. ECONOMIC PERFORMANCE/TRENDS AND ASPIRATIONS PER SECTOR

Although Namibia's primary industries – with the exception of mining and quarrying – performed below target during the NDP 2 period (2001-2006), the GDP grew at 4.7 % per annum. This growth was propelled by performance in the secondary and tertiary industries and high international prices for diamonds and other minerals.

MINING

The mining and quarrying sector recorded a decline in real value added of 1.8 % in 2008 as compared to a growth of 0.5 % in 2007. Both diamond and other mining subsector registered declines of 0.3 % and 8.1 % in 2008 respectively in response to the global financial crises.

² Since Namibia's independence in 1990, incidents of corruption in the public sector have been very visible (IPPR, 2009).

THE URANIUM RUSH

There is renewed interest in Namibia's mineral deposits (in particular uranium), particularly in the southern and coastal desert areas of the country where prospecting and mining have escalated since 2005. There is concern that many of these operations fail to consider the fragility of the Namib and the vulnerability of its unique habitats (SAIEA, 2010). It is clear that improved coordination between the various authorities is essential, so that environmental and social concerns can be addressed with the urgency they require. While there are examples of good practice by some mining companies, the uranium rush may also attract many unethical operators. If governance fails, this will threaten the tourism potential of many attractive areas and result in the irreversible destruction of some unique habitats.

AGRICULTURE

Development/growth in this sector is highly climate-dependant and can vary significantly from year to year. Despite stringent environmental constraints, there are high expectations from the agricultural sector. One of the main strategies of NDP3 is to “... *achieve increased and sustainable economic growth through the promotion of agricultural development-led industrialization.*”

New initiatives such as the Green Scheme and the Dryland Crop Production Programme for the Northern Communal Areas – initiatives which are expected to boost domestic food production and could offer opportunities for agro-processing activities – are given strong government support. Allocations to the small-scale irrigation schemes (including training of farmers) are also steadily increasing (Schade 2010)

The Ministry of Agriculture has a medium-term plan to continue subsidies for fertilizers, pesticides, and/or improved seeds and, while these could play a crucial role in improving short-term agricultural production in the communal areas, this decision is also accompanied by environmental risks, such as the eutrophication and pollution of water and increasing human/wildlife conflict in key wildlife corridors.

Because of good rains, the agriculture and forestry sector registered a growth in real value added of 3.0% in 2008 as compared to a decline of 0.6% recorded in 2007. The increase in the sector is attributed to the livestock subsector, which increased by 6.3%. However, crop farming and forestry recorded slow growth of 0.1% in 2008 as compared to the 3.5% contraction experienced in 2007.

With respect to the agricultural sector, two important land-use trends have emerged:

- Over the past 40 years commercial livestock farmers have moved increasingly towards mixed game/livestock farming and wildlife-based tourism enterprises, which out-perform agriculture in terms of GDP (Turpie et al 2010). Although this trend has helped to maintain biodiversity the wildlife/tourism sector remains constrained by intense livestock interests, which are strongly supported by Government.
- Commercial farming has begun to occur on communal land in northern Namibia and exclusive farms have been, and continue to be, illegally fenced off by individuals in these areas (Fitter, 1996; Mendelssohn and Roberts 1997; Mendelssohn et al, 2002). In the absence of sustainable land-use practices these large private farms will contribute to land degradation.

These trends imply that the impacts of climate change (increasing climatic variability and aridification of rangelands) is likely to have important effects – both positive and negative – on other land-use options in Namibia. (See Section 4)

TOURISM AND WILDLIFE

Tourism in Namibia grew rapidly between 1990 and 2006 (an estimated 14% per annum in the first six years after independence, trailing off to an average of between 5 and 9% per annum thereafter). Comprehensive tourist arrival statistics are now available from the Namibia Tourism Board for 2009. Overall tourist numbers (using the international WTO definition of what constitutes a tourist) rose slightly to 980,173 compared to 931,111 in 2008. The vast majority of these tourists came from Angola and South Africa with increasing numbers from other African countries – in total some 723,760 (about 73%) tourists came from countries in Africa. A total of 206,494 came from European countries with Germany (81,974) and the UK (28,039) the two largest countries of origin by some way.

FISHERIES

The marine fishing and fish-processing-on-board sector has declined in recent years as a result of adverse natural environmental conditions and reduced landings. A decline of 12.3% in 2008 as compared to a decline of 19.0% recorded in 2007 has been recorded.

MANUFACTURING

Namibia's meat processing and onshore fish processing sectors are indirectly linked to environmental (particularly climatic) conditions and, as a result, can fluctuate dramatically from one year to the next. Thus, the real value added by the manufacturing sector declined by 2.6% in 2008 as compared to an increase of 8.5% in 2007. In 2008, meat processing declined by 8% due to a drop in the number of livestock marketed. The 18% decline of onshore fish processing is attributed to an increase in input costs and low landings recorded in pelagic, demersal, and deepwater fisheries.

POPULATION GROWTH AND DISTRIBUTION

In 2008, Namibia's population was estimated at 2 million. The population growth rate – currently at 2.5% per annum – is slowly declining (NPC 2008 a). Sixty percent of the population lives in six northern regions of the country (Figure 1). Approximately 70% of the population live in rural areas.

B. POVERTY AND EMPLOYMENT

I. INCOME AND HUMAN POVERTY IN NAMIBIA

Poverty can be described in terms of income poverty and/or human poverty. Whilst income poverty is presented purely in financial terms, human poverty pertains to life expectancy, educational attainment, and income.

With respect to income poverty alone, an estimated 41% of Namibians could be classified as either poor or severely poor in 2003/2004 (NPC 2006). Furthermore:

- The incidence of poor and severely poor households in rural areas was more than triple the incidence in urban areas.
- The highest incidence of income poverty is found in the Kavango region (home to approximately 7% of Namibia's population) where 56% are poor and 37% are severely poor.
- More than 60% of all poor households in Namibia are found in the combined northern regions of Kavango, Ohangwena, Oshikoto, and Omusati where the majority of people depend on subsistence farming for their livelihood.

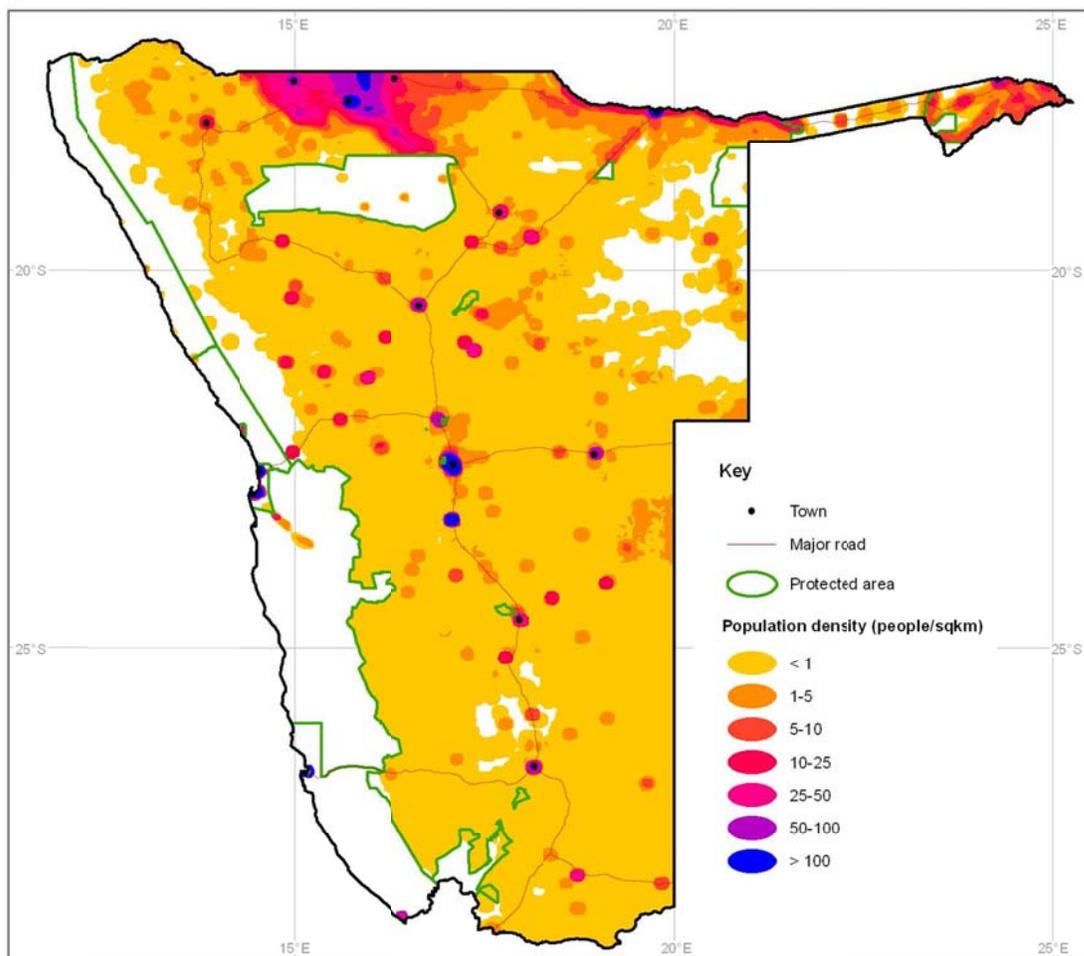


Figure 1: Human population density
(Source: Mendelsohn *et al*/2002)

- Income poverty incidence is lowest in Khomas (home to 14% of Namibia’s population) and Erongo (home to 5% of Namibia’s population), with 6% and 10% poor and 2% and 5% severely poor, respectively.

In 2008, poor and severely poor households were estimated at 28% and 4% respectively (NPC, 2008 a). Although Namibia appears to be making progress towards eradicating extreme income poverty, and access to primary health care and education has improved, recent quantitative analyses of the human poverty index HPI (UNDP 2007) suggest that human poverty levels in Namibia are, in fact, increasing.³

³ Rural areas remain significantly higher than urban areas in all three dimensions of human poverty (50% in Oshikoto, Omusati, and Kavango compared to < 20% in Khomas and Erongo, which both support large urban populations) (UNDP 2007). Since 1991, the HPI has fallen in only five regions. These are Erongo, Otjozondjupa, Omaheke, Kunene and Kavango. In the remaining eight regions the HPI is increasing – a trend that is particularly noticeable in Ohangwena, Omusati, Oshikoto and Kavango (*ibid*).

An underlying cause of increasing HPI in Namibia is the HIV/AIDS epidemic, which has more than offset the positive effects of improvements in the other dimensions of human development.

2. POVERTY AND GENDER INEQUITY IN NAMIBIA

The gender aspect of poverty in Namibia is illustrated by the following findings (NPC 2006; NPC 2008):

- Poverty levels in Namibia are highest among rural households that are female-headed.
- On average, women earn 30% less than men in rural areas and 40% less than men in urban areas.
- Urban areas have a predominance of males between the ages of 15 and 60 when compared to rural areas. As a result, increasing numbers of rural households are headed by women (43% as opposed to 37% in urban areas). This is particularly true in Ohangwena, Oshana, Oshikoto, and Omusati.
- When female- and male-headed households are compared, the former have consumption levels that are almost 5% lower, even when differences in locality, level of education, and number of people in the household are taken into account.

3. UNEMPLOYMENT AND RATES OF URBANIZATION

Unemployment continues to rise, especially in rural areas and among the youth.

The total number of people employed in the economy dropped by 10.8 % between 2000 and 2004, with virtually all the job losses occurring in the rural areas where unemployment in 2004 was 44.7 % (GRN, 2008). Total unemployment in Namibia was reported to have reached 51.2% in 2009.⁴ In 2004, about two-thirds of Namibia's unemployed fell under the most productive age group of 16-45.

Because opportunities for employment, business, and per capita earnings in Namibia are highest in the larger towns, rapid rates of urbanization (estimated at 5 – 6% per annum in 2001 as reported in Mendelsohn *et al.* 2002) continue to draw young, able-bodied people away from rural areas. In 2004, 60% of the population in rural areas was under the age of 20 or over the age of 75 (NPC 2006). About 28% of Namibia's population was urban in 2006 (MoHss 2008) but by 2020 between 75 – 85% are likely to have settled in the larger towns (Mendelsohn *et al.* 2002).

Crime rates and domestic violence (mostly against women and children) – linked to unemployment, poverty and alcohol abuse – has increased over the past two decades (UNDP 2002; GRN 2008).

4. POVERTY AND DEPENDENCE ON NATURAL RESOURCES

Poverty in Namibia's rural areas is linked to deforestation and land degradation. The poorest families still use wood fuel, rely on wild foods (particularly during times of drought), and depend heavily on unpredictable rain-fed crops and livestock for their livelihoods (See Section 4 and Figure 2).

Agriculture still plays a major role as an income generator in Namibia. About 23% of all households get their main source of income from farming and about 27% of the national workforce is in the farming

⁴ The figure of 51.2% is according to the MoLSW's most recent Labour Survey as reported in *Die Republikein* February 8, 2010. Verification of this figure was not possible as copies of this survey are not yet available to the public.

- Infant mortality as well as under-five mortality, which declined noticeably between 1990 and 2000, has been on an upward trend since then – mostly as a result of HIV/ AIDS and inadequate nutrition.
- Maternal mortality has been on the rise since the beginning of the 1990s – also as a result of the HIV/AIDS epidemic.
- Access by urban households to safe drinking water in 2008 was almost 100%, but has slightly decreased. Access by rural households to safe drinking water is increasing and currently stands at 80%.
- Access of urban households to basic sanitation has declined in recent years and stands at 58%. For rural households, access is estimated to be 14%.
- The prevalence of TB has declined since 2004 and current programmes and policies are likely to further contribute to the lowering of TB cases.
- Cases of malaria have declined over the past 15 years to the current ratio of 48 cases per 1,000 people. However, the profile of this disease – as with all other vector-borne diseases – may change with changing climates and prove to become more (or less) problematic in the future.

The HIV/AIDS epidemic is the primary driver of falling life expectancy⁵ in Namibia and is discussed in more detail below.

2. THE HIV/AIDS EPIDEMIC

The 2010 National HIV Sentinel survey of prevalence rates in pregnant women aged 15-49 (MoHSS 2010) reports that:

- National prevalence of the disease in this group of Namibians is estimated at 18.8%.
- There is little difference in HIV prevalence between rural and urban areas, but the disease is concentrated amongst mobile populations (e.g. those linked to the mining industry and at border entry/exit points).
- The incidence of orphans and vulnerable children (OVCs), a major consequence of the HIV/AIDS epidemic, is highest in Namibia's rural areas with the lowest wealth quintiles. The highest incidence of OVCs in Namibia occurs in the Omusati, Oshana, Oshikoto, and Kavango regions which all report between 31 and 37% incidence (MoHSS 2008).
- There has been successful rollout of anti-retroviral treatment (ART) to all 36 hospitals countrywide, with 58,775 people receiving ART in 2005/06 (GRN 2008).
- The number of HIV/AIDS cases in Namibia is expected to increase for several years.

Evidence of the difficult issues surrounding the planning, funding, and treatment of the HIV/AIDS epidemic was seen on several occasions during the two-week mission. Several USAID-funded HIV clinics were being closed as of the end of the fiscal year (September 30, 2010) due to a shift in program strategy, a result of careful coordination and planning between the USG and the Ministry of Health and Social Services (MoHSS). The expectation is that the GRN would assume responsibilities for the

⁵ Life expectancy fell by 11 years (men) and 13 years (women) to 48 and 50 respectively between 1991 and 2001.

treatment and care previously provided by these HIV facilities. Concern was expressed by several individuals with respect to the quality of care and/or lack of diagnoses and treatment that would now be in place. This issue serves as an important reminder to consider if current donor assistance for dealing with HIV/AIDS in Namibia is reduced, which could necessitate the GRN having to take greater financial responsibility for this epidemic with, as a result, fewer resources for conservation.

D. EDUCATION

- In 2006, net primary school enrollment was estimated at 92% – a figure which has increased dramatically since 1990 but has declined since 2003 (NPC, 2008 a) (Figure 3).
- In 2004, more than half of Namibia’s labor force was unskilled and un- or semi-educated (NPC 2006).
- Large differences exist regarding educational attainment between rural and urban populations. Twenty-three percent of the population in rural areas had no formal education compared to 7% in urban areas (ibid).
- A shortage of skilled workers is recognized as one of the key impediments to growth in productivity and accelerating economic growth (GRN 2008).
- Although the literacy rate in 2006 was estimated at 93%⁶, the general competence level of learners in Namibia is considered to be low when compared to other southern and eastern African countries (ibid) (Figure 4). Namibia has invested heavily in the education sector since independence and the sector’s share of the total budget has increased since 2003/04 from 18.3% to the current 22.4% (Schade, 2010).

⁶ In 2005, the adult literacy rate was recorded at 82% for women and 83 % for men. However, this estimate obscures regional differences with some regions recording that 40% of women were able to read and write (GRN 2008).

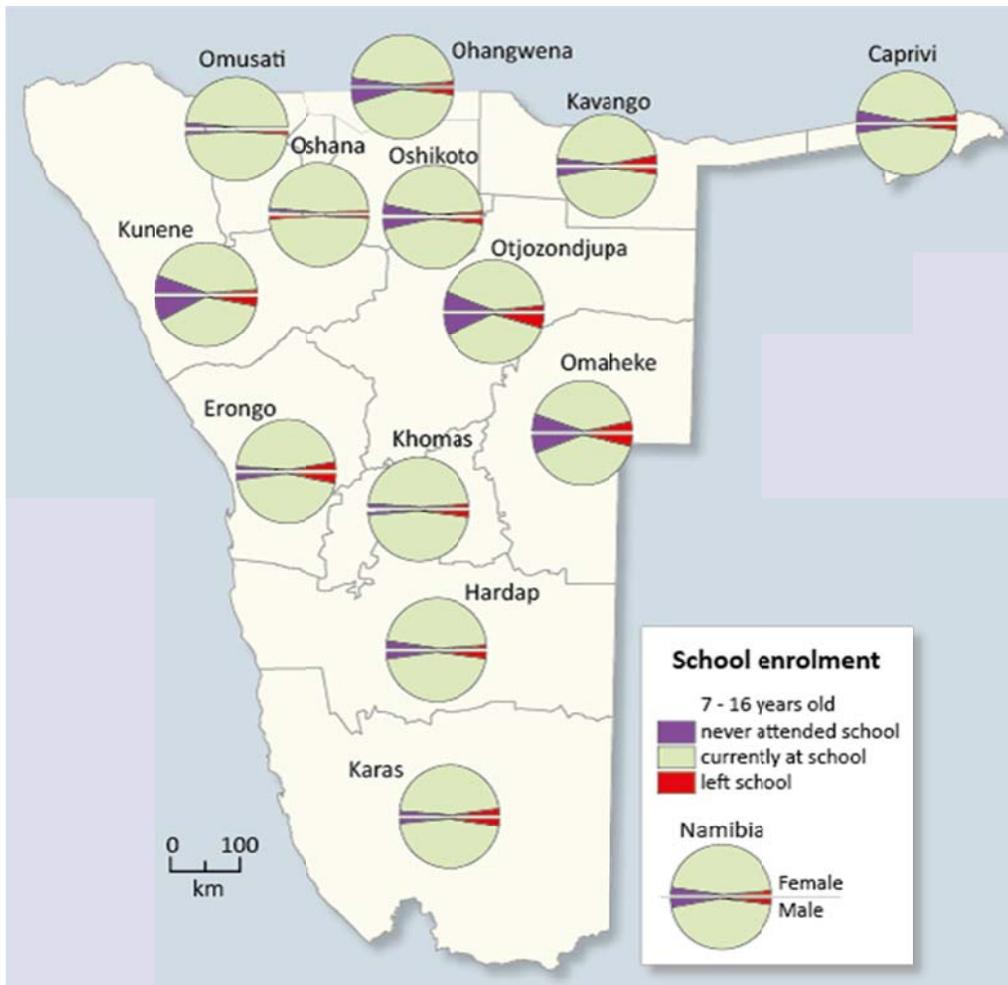


Figure 3: Levels of school enrolment by children aged 7-16 years
 (Source: Mendelsohn 2010)

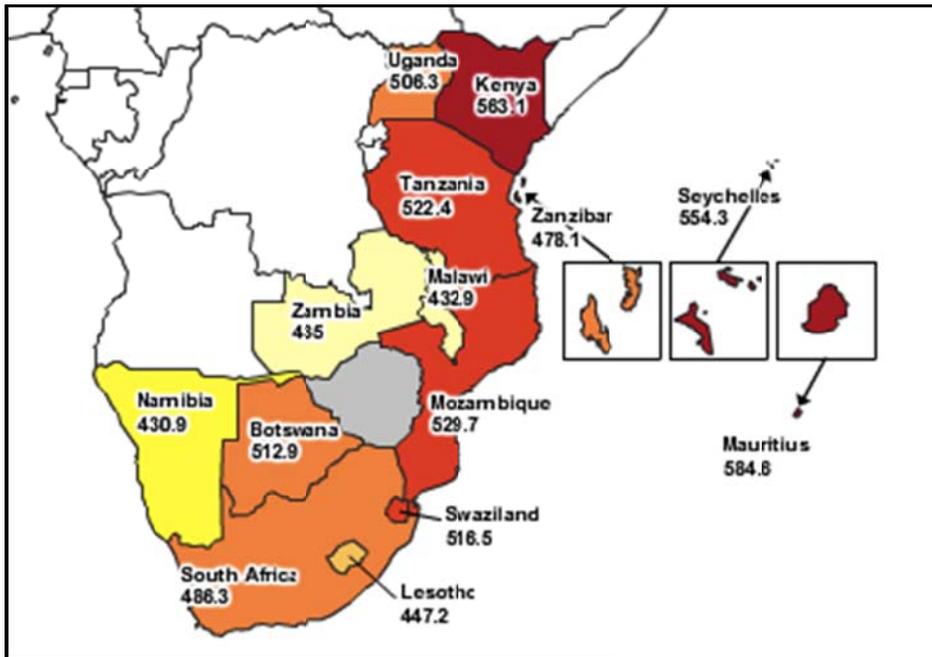


Figure 4: Comparative school performance in SADC countries
 Low scores = low performance
 (Source: SACMEC in SAIEA 2010)

3. THE LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

A. OVERVIEW OF KEY POLICIES AND LAWS (LAND AND NATURAL RESOURCES)

The importance of environmental protection in Namibia is reflected in the Namibian Constitution. There are provisions ensuring the sanctity of the natural environment (95(l)), mechanisms by which the Government can investigate misuse of resources (91(c)) and mechanisms for the enforcement of sound management policy. The Constitution establishes that when the Government acts, it does so on behalf of the people, and that it should act with an effort to ensure both the rule of law and justice for each person. Moreover, Article 18 requires a fair, direct process for persons to challenge agency action.

Since Independence, the Namibian Government has enacted a number of laws and policies intended to protect ecosystems and ensure that development projects avoid or mitigate adverse impacts on the environment. These laws establish clear mandates in some cases, but not in others. Consequently, many gaps remain in the enforceable regulatory structure (SAIEA 2009). Furthermore, Namibia continues to rely on some outdated and ineffective legislation that in some cases is inconsistent with the provisions of article 95(l) of the Namibian Constitution.

The following examples illustrate this:

- Parks are established under the pre-independence Nature Conservation Ordinance of 1975 for the purposes of conservation and tourism by MET, yet the post-independence Policy on Mining in Protected Areas allows prospecting and mining in protected areas under certain circumstances, which undermines tourism objectives and conservation and policies.
- Article 95(l) of the Constitution requires management for sustainability, yet the Department of Water Affairs (DWA) gives permits for groundwater abstraction without knowing, for example, the sustainable yield of the aquifer, because the Water Act of 1956 does not make provision for this (Turpie et al. 2010).
- The Water Act of 1956 ignores the current hydrological reality of Namibia and fails to account for the natural environment's status under the Namibian Constitution since it does not recognize the natural environment as a user of water nor as a provider of essential goods and services.

The policies and laws discussed in this chapter have been placed into clusters (Table 1) and are examined to determine their contribution to sustainable land and natural resources management and biodiversity conservation. More detail in this regard is provided in SAIEA (2009) and Turpie *et al* (2010).

Table 1. Key policies and laws, clustered into Sectoral groups

Sector	Policies and laws
Agriculture	National Agricultural Policy (MAWF, 1995) National Drought Policy and Strategy (MAWF, 1997) Green Scheme Policy (MAWF, 2004 and revised in 2008) National Rangeland Management Policy and Strategy (MAWF, in compilation)
Water	National Water Policy White Paper (MAWF, 2000) Water Supply and Sanitation Policy (MAWF, 1993 and revised in 2008) Water Resources Management Act (2004, Presently Being Revised) Draft IWRM Plan (MAWF 2010)
Forestry, Parks, and Wildlife	Forestry Development Policy (MAWF, 2001) Forest Act (2001) Wildlife Management, Utilisation and Tourism In Communal Areas Policy (MET, 1995) Nature Conservation Ordinance 4 of 1975 and amendment (1996) Promotion of Community-Based Tourism Policy (MET, 1995) Human Wildlife Policy (MET 2009)
Land	National Land Policy (MLR, 1998) National Resettlement Policy (MLR, 2001) Agricultural (Commercial) Land Reform Act (1995) Communal Land Reform Act (2002)
Fisheries	Aquaculture Act 18 Of 2002 Inland Fisheries Act I Of 2003 Marine Resources Act 27 Of 2000
Mining	Minerals Act, 33 of 1992
Environmental Planning	Environmental Assessment Policy (MET, 1995) Environmental Management Act (2007) Land Use Planning Towards Sustainable Development Policy (MET, 1994) Regional Planning And Development Policy (NPC, 1997)

I. AGRICULTURE

The Ministry of Agriculture, Water and Forestry (MAWF) is responsible for promoting agriculture-based production. It consists of a number of Directorates that manage several diverse activities including: agricultural research and training, veterinary services, water provision, Green Scheme management, and dealing with natural disasters such as floods and droughts.

The Drought Policy and Strategy supports sustainable land management but its recommendations are poorly implemented. Timely adaptive responses to drought situations (in terms of reducing livestock numbers in accordance with the carrying capacity at the time) are seldom implemented (SAIEA 2009). Emergency drought relief in the past was responsible for sinking boreholes that were intended to provide temporary relief for farmers, but became permanent fixtures. This encouraged overgrazing of

land that was previously used only seasonally. The Emerging Commercial Farmers Support Programme was started in 2007 to assist new farmers, but there is a marked absence of local level organizations to assist MAWF and development partners to implement this and other programs.

Dryland cropping, particularly of *mabangu* (millet), has led to soil degradation through poor practices, exacerbated by the government-subsidized tractor ploughing services that concentrate on disc harrowing, which compacts the soil and inhibits root growth. The recent Conservation Tillage Project aims to reverse this damage to dryland-cropping soils, improve soil fertility and simultaneously improve *mabangu* yields.

Efforts to improve livestock productivity on communal lands include the Bull Scheme and the recently initiated Five-year Millennium Challenge Account (MCA) programme – which aims, *inter alia*,⁷ to improve livestock quality and rangeland management in the Northern Communal Area (NCAs). Whilst the **Rangeland Policy** recognizes that there is a strong connection between productivity and stability of rangelands and biodiversity, the environmental problems associated with conventional freehold and communal farming and the growing demand for farmland (land clearing, deforestation, overgrazing, soil erosion, bush encroachment) have had, and are likely to continue having, negative impacts on biodiversity.

Whilst **Green Scheme projects** have had a positive (though localized) effect on livelihoods, plans for expanding this sector may be overambitious given Namibia's water limitations, escalating costs, and the need for advanced management and technical skills. Unfortunately, **the revised Green Scheme Policy** has removed the requirement for training to be given to small-scale farmers and weakens the potential for the scheme to attract skilled irrigation farmers and build local capacity in irrigated agriculture. Furthermore, Namibia's soils are highly susceptible to salinization and irrigation demands high input from fertilizers and pesticides.

The **Agriculture Policy** states that subsidies, which distort prices and discourage private sector investment in agriculture, should be discontinued. However, direct subsidization from MAWF in agriculture is actually increasing (e.g. in fertilizers, seeds, tractor ploughing, and weeding services). Such subsidization increases dependence on government services (which are often inefficient) and disempowers local business development.

Overall, poor implementation of the agriculture policy cluster threatens biodiversity conservation and reduces the ability of rural communities to adapt to Namibia's increasing climatic variability.

2. WATER

The Department of Water Affairs (DWA) in MAWF is responsible for allocation of water use permits and administration, while the Directorate of Rural Water Supply (DRWS) handles rural water provision and management. NamWater is responsible for bulk water supply and Local Authorities (LAs) for infrastructure and management in towns. Catchment-based management and planning (through Basin Management Committees –BMCs), now being used by DWA, encourages much-needed integration between sectors.

Institutional aspects are not clearly spelt out in the policies, and strategies for implementation are mostly inadequate. For example, the policies provide for progressive stepped tariffs (i.e. rising block tariffs) and

⁷ Other components of the MCA programme are support to conservancies, improving the management and marketing of indigenous natural products, and support to the education sector.

cross-subsidization in urban areas, which brings equity by assuring a minimum quantity of water for the very poor. However, few towns implement it and capacity at LA level is limited. LAs struggle to manage water infrastructure or other services. A widespread payment arrears by consumers makes water prices unaffordable for the very poor.

DRWS implements the **Water Point Committee (WPC) system**, which is a community-based management strategy for rural water points. At community level, women play a strong role in the Community-Based Management (CBM) of the water supply systems. For the most part, maintenance of water points is the responsibility of the WPC and community, which encourages communities to maintain the equipment properly themselves. This, together with CBM, creates a stronger sense of ownership and encourages sound natural resource management.

Unclear strategies on how to implement the directives of this policy cluster hampers implementation. Political interference undermines the principles of cost recovery and responsible management. There is also concern that insufficient emphasis is given in the revised Water Supply and Sanitation Policy (WASSP) and the revised Integrated Water Resource Management Plan (IWRMP) (2010) regarding maintenance of the basic ecological reserve – particularly in the face of escalating water demand over the next 20 years.

3. FORESTRY AND WILDLIFE

The small Directorate of Forestry (DoF) in MAWF drives the forestry policy. In this sector there is a welcome trend towards community-based management and non-timber benefits from forests.

With respect to wildlife, the **Community-Based Natural Resource Management program** is mainstreamed into MET's operations at both strategic and local levels. Donor interest and NGO support remains strong. In 2007, there were 13 established Community Forests, and by 2009, 50 were either registered or seeking registration (DoF 2009). This rapid growth shows the strong support for the program. Similarly, there were four communal conservancies in 1998, now there are 50 (representing 220,000 members) and a further 25 are being established. Although the equitable sharing of revenues from conservancy enterprises and other governance issues remain a challenge (Long, 2004; Hoole, 2008), concerted efforts are being made to address this.

Human-wildlife conflict – already a problem on land within and adjacent to conservancies – is likely to escalate in the future as a result of the success of the CBNRM programme, and human population growth (Turpie, *et al* 2010). **MET's Human-Wildlife Conflict Policy** (2009) calls for pro-active measures to prevent conflict situations arising, and greater capacity in MET for solving these problems when they occur. Compensation for individuals who suffer losses from wildlife continues to be an issue that lacks sustainable financial arrangements. MET has proposed regulations that could erode some of the landowner incentives in minimizing the potential of human/wildlife conflicts. The payment rates may encourage farmers to plant crops and act as a disincentive to reduce conflict. In addition, the ability of MET staff to be field agents and monitor and report on all the human/wildlife encounters is cause for concern.

Community forest legislation grants control over grazing rights, which can improve range management. Conservancies in Kavango and Caprivi generally set aside riverine areas and wetlands for wildlife, so that crop farming does not occur at the water's edge where it can have negative impacts, and where it would undermine forest preservation). However, many conservancies have commonage areas for livestock, and these are hampered by the "tragedy of the commons" that is typical in many communal areas in Namibia. Recognizing this problem, the CBNRM program is promoting holistic resource management principles to improve the management of livestock and rangelands in conservancy areas.

Overall, land productivity, particularly in areas that are marginal for livestock or crops (most of Namibia), should be improved under conservancy management. This is because conservancy management plans promote the sustainable use of natural resources. To date CBNRM has been successful from a socio-economic and environmental point of view – largely due to NGO support and collaboration.

There is a need to expand the scope of resources that fall under community-based management to include rangelands and fisheries, and to integrate the community-based management of all of these resources much more strongly especially with a focus towards strengthening public/private partnerships.

4. LAND

The Ministry of Lands and Resettlement (MLR) is in charge of land use planning, land allocation, and resettlement. Land administration in communal areas is under the control of Communal Land Boards and Traditional Authorities. Regarding land allocation, the main tasks of the Land Boards is to control the allocation of customary land rights by Chiefs and Traditional Authorities, and to grant rights of leasehold on communal land.

State-led acquisition of land for resettlement has been through the “willing buyer – willing seller” approach but is frustratingly slow, and MLR is considering expropriation of farms in the public interest (MLR 2005). Between 1992 and 2002, 209 commercial farms and an estimated 9,138 people were resettled through the MLR’s resettlement programme (Harring and Odendaal, 2007) and a further 625 farms (incorporating 3,470,000 ha) had been acquired through the Affirmative Action Loan Scheme (LAC 2007). In addition to resettlements on commercial farms, 27,942 people were resettled by the MLR on communal land that has been identified as “underutilized” (*ibid*).

Under the **Communal Land Reform Act (CLRA)**, resettled farmers must be granted leasehold of the land they receive. Yet very few resettlement farmers have been registered, so rights to use this land as collateral for financial support are still mostly absent. Many emerging commercial farmers are unable to develop the agricultural potential of the farms fully due to remoteness, inadequate skills, poor infrastructure, high debt burdens, and other factors (MLR 2005). Also, the size of resettler plots (average 1,500 ha) are too small to be viable and most resettlement farms have very limited options for crops, so that source of livelihood is unavailable. There has been little diversification of livelihoods on resettlement or Affirmative Action Loan Scheme (AALS) farms. Post-settlement support packages are granted on lenient terms to previously disadvantaged emerging farmers yet profitable farming by most beneficiaries is still elusive.

Most resettled farms occur on land that was once freehold and some have reduced land-use options as a result of severe bush encroachment (NPC 2007a; LAC 2007).

Socio-economic problems are rife on many resettlement project farms and resettled communities have repeatedly been described as poor/extremely poor and vulnerable. The problems that have arisen on these farms are well documented in Harring and Odendaal (2007), DRFN (2007), Cloete (2009), and Werner and Odendaal (2010). These include: a lack of governance; ethnic tensions; high levels of food insecurity and a culture of dependency; high levels of alcohol abuse, violence, and crime; no access to electricity or other energy sources (communities depend heavily on wood fuel); limited/no support from the Ministry of Agriculture, Water and Rural Development (MAWRD), and, in many cases, limited access to a reliable water source.

The Land Policy opens the way for communities to have proprietorship over certain renewable natural resources. This includes Water Point Associations managing boreholes, and conservancies and

community forests managing wildlife and forests. By contrast, grazing resources in communal areas have not been granted the same level of proprietorship under the CLRA, so this vitally important component of land management remains unregulated.

Under the CLRA an individual or group cannot exclude others, and influential individuals (who are not necessarily lawful residents) can persuade a Chief to allow them to graze on commonage. Thus communities do not have the right to prevent other people using/fencing off land they might want to set aside for improved management, and there is no incentive to practice SLM. Furthermore, the condition that any resident can keep up to 300 large stock or 1,800 small stock does not make any reference to carrying capacity. With growing numbers of residents, overgrazing is inevitable.

The Resettlement Programme has hampered efforts to reduce land degradation and is not in line with the UN environmental conventions⁸ to which Namibia is a signatory, nor does it help Namibia achieve the Millennium Development Goals.⁹ The resettlement objective “... to give target groups an opportunity...to produce their own food with a view towards self-sufficiency” is in conflict with the Agriculture Policy and NDP3 which have wisely moved away from the goal of food self-sufficiency and strive, rather, for achieving household food security (MAWRD 1995).

Overall, the institutional framework to guide and implement land use planning, land allocation, and resettlement is inadequate and will have severe repercussions on people’s livelihoods and biodiversity conservation in future decades.

5. FISHERIES SECTOR

Namibia’s rights in relation to the marine environment are determined by the Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990 and by the Walvis Bay and Off-Shore Islands Act 1 of 1994. Procedures for determining the inland boundary of the seashore (i.e. the high-water mark) are provided in the Sea-shore Ordinance of 1958. Namibia’s southern boundary with South Africa is disputed and is the subject of international negotiations between the two countries.

⁸ UNFCCC; CBD; UNCCD; The Ramsar Convention

⁹ MLR (2005), during the elaboration of the National Poverty Reduction Action Plan, recognizes that poverty reduction can not be linked to land reform.

Marine fisheries are regulated by the Marine Resources Act (MRA), 27 of 2000 and inland fisheries by the Inland Fisheries Resources Act 1 of 2003, while aquaculture is regulated by the Aquaculture Act of 2002, all of which are administered by the Ministry of Fisheries and Marine Resources (MFMR).

6. ENVIRONMENTAL PLANNING

The Environmental Assessment Policy (1995) has been enacted as the Environmental Management Act (2007), but its regulations are not yet finalized and implementation has not yet formally started. The Policy and the Act are intended to prevent or minimize environmental damage and sustain livelihoods of all impacted parties.

The Directorate of Environmental Affairs (DEA) in the Ministry of Environment and Tourism is responsible for implementing the Environmental Assessment Policy and the Environmental Management Act (EMA) of 2007.

Capacity to guide and review EIAs in the DEA is inadequate but the EMA enables this task to be outsourced (at the proponent's cost) to experts in the private sector if necessary. The pool of environmental consultants in Namibia is small and no certification is required for EIA practitioners.

CONCLUSIONS

Although most GRN policies are consistent with the Constitution and Vision 2030's recognition that sustainable utilization of natural resources is essential for the continued advancement of the country, implementation is poor and inconsistent. Despite the country's unsuitable soils, high climatic variability and vulnerability to climate change, overambitious expectations from the agricultural sector (particularly regarding livestock rearing, rainfed cropping, resettlement, and the role they can play in attaining food security) continues to be promoted. Moreover, inadequate recognition of the strategic importance of wildlife-based industries (tourism, venison production, and trophy hunting) undermines Namibia's ability to fully capitalize on its comparative advantages.

Improved planning and oversight by appropriate ministries is needed to manage the impacts of the mining sector so that they do not threaten the sustainable benefits derived from wildlife-based tourism.

4. OVERVIEW OF NAMIBIA'S BIODIVERSITY AND NATURAL RESOURCES MANAGEMENT SECTORS

A. WILDLIFE AND CONSERVATION

I. BACKGROUND INFORMATION

Namibia's major biomes are depicted in Figure 5.

THE TREE AND SHRUB SAVANNA receives the highest precipitation and is dominated by two vegetation types – i.e., Broad-leafed (in the north east) and Acacia savannas. The sub-humid broad-leafed woodlands represent Namibia's most biodiversity rich area. The central acacia savanna (semi-arid) areas support a moderate to dense cover of shrubs and small trees and suffer from a high prevalence of land degradation (resulting from poor land management) in the form of bush encroachment.

THE NAMA KAROO supports a high level of species endemism (plants, birds, and reptiles). It covers most of the southern and southeastern part of the country and extends northwards in a narrow band along the escarpment – creating a transition zone between semi-arid savanna to the east and hyper-arid desert to the west. This supports highly varied plant assemblages including: shrubby vegetation and grasslands in the north and central western plains, dwarf shrub savanna in the south central areas, and grasslands in the south.

THE NAMIB DESERT is characterized by hyper-aridity, especially along the coast where rainfall is very low (< 50 mm/y). Ocean fog (which penetrates up to 50-100 km inland) moderates the temperature and provides a source of moisture that is utilized by highly adapted plants and animals. High dunes predominate the substrate between Luderitz and Walvis Bay. Vegetation cover on the sandy and gravel plains that occur in areas where the dunes are absent is sparse and confined to lichens and small plants. Ephemeral washes and westward flowing rivers (linear oases) that cut through the desert plains are able to support higher densities of trees and undergrowth and, in some cases, fairly abundant wildlife populations (including elephant, rhino, giraffe, and arid-adapted ungulates). Occasional springs and seeps support birds and wildlife away from the river systems. Trees in the ephemeral rivers are maintained by alluvial aquifers that are susceptible to overabstraction by increasing numbers of upstream boreholes and small farm dams.

THE SUCCULENT KAROO (the lower Orange river basin) supports an abundant and distinct succulent vegetation – largely dependent on highly variable winter rainfall. Plant endemism is extremely high in this zone. The vegetation structure (referred to as dwarf shrubland) shows great variety in response to the variable landscapes (mountains, inselbergs, gypsum, and sand plains), varying degrees of fog penetration, and wind patterns.

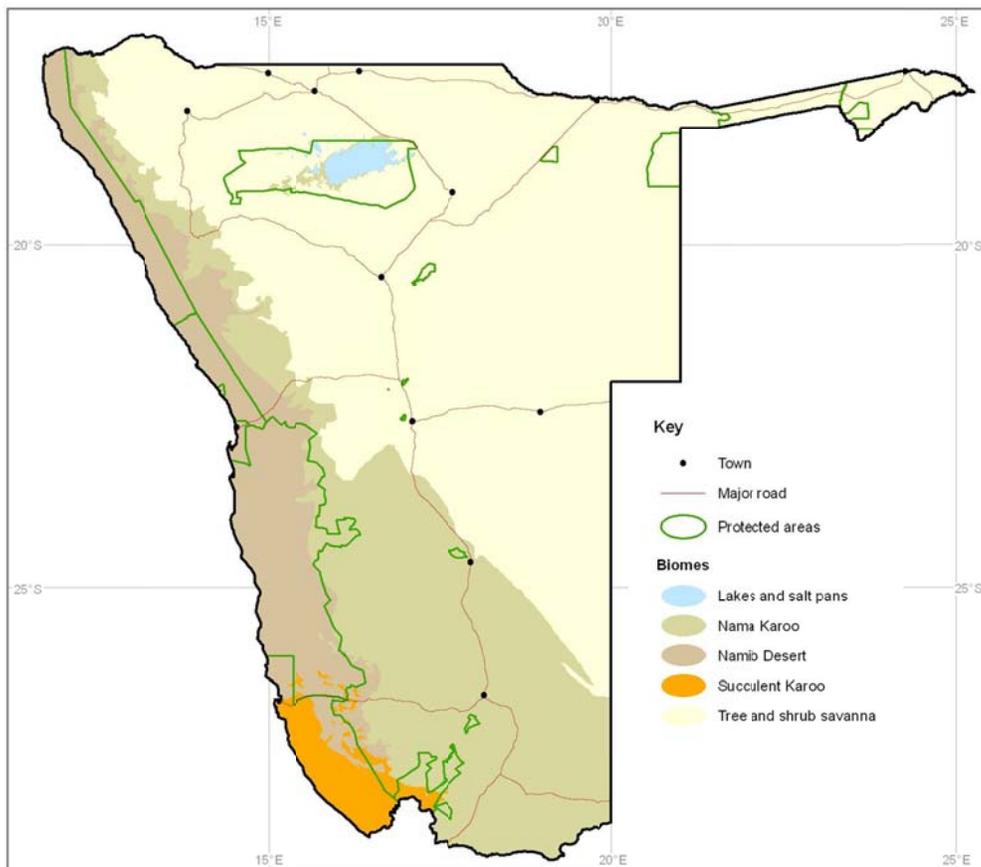


Figure 5: Namibia's major biomes
 (Source: Mendelsohn *et al.* 2002)

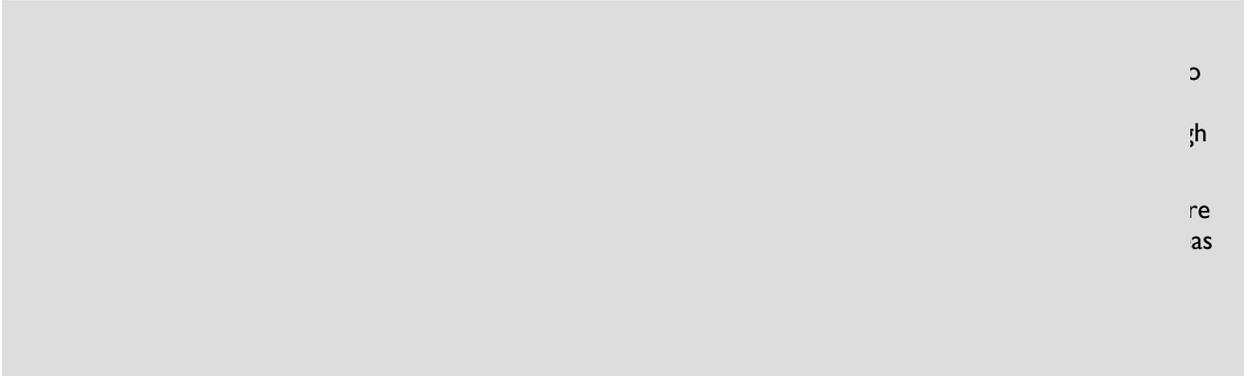
Current rates of global biodiversity loss are well documented; nevertheless, it must be noted that one of the biggest constraints to reducing these losses is inadequate knowledge. There are an estimated 5-10 million species of plants and animals on Earth. Of these, only 15% to 30% are known to science. Our limited knowledge on the biodiversity of many phyla, and our even more limited knowledge on the ecological requirements of many described species, means that any assessment on the impacts on Namibia's biodiversity remains cursory at best.

In Namibia, the following numbers of species have been described to date: 4,350 vascular plants (17 % endemic), 6,331 insects (24% endemic), 115 fish (4% endemic), 250 reptiles (24% endemic), 644 birds (14% endemic to Southern Africa; 2% endemic to Namibia), and 217 mammals (12% endemic) . Many of these species show unique adaptations to Namibia's largely arid and variable climate.

High levels of endemism make Namibia's wildlife unique and interesting. The fact that this country hosts the world's largest remaining population of cheetah is of global importance.

Known threatened species include African elephant, pangolin, and lesser flamingo. Vulnerable species include lion and blue crane, while African wild dog is endangered and black rhino is considered critically endangered.

Riparian forests, rivers and other wetlands and the rich biodiversity they support are Namibia's least protected and most threatened habitats.



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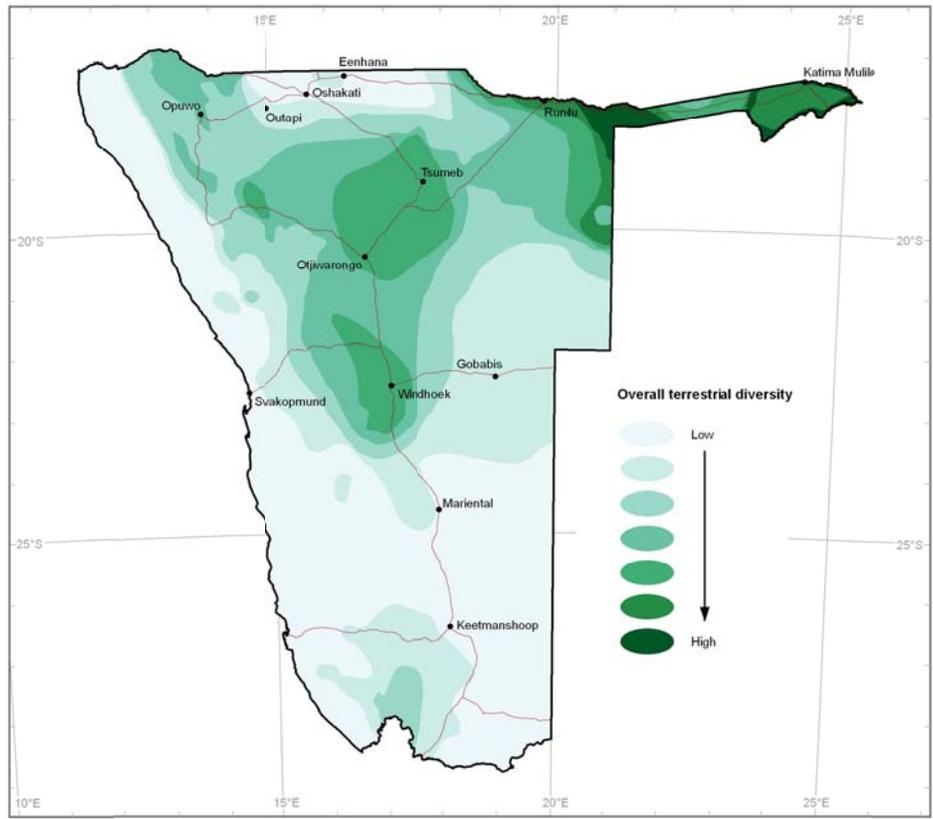


Figure 6: Total biological diversity in Namibia
(Source: Mendelsohn et al. 2002)

The State-owned parks cover approximately 16.6% of the country. The proclamation of most of this land occurred before the value of biodiversity conservation was fully realized and, as a result, these protected areas are not evenly distributed between the various landscapes, biomes, and vegetation types in the country. Thus, while the Namib Desert and Succulent Karoo biomes have 75% and 90%

respectively of their areas protected by the State, the Nama Karoo, Acacia Savanna, and Broad-leafed Savanna biomes have just 5%, 4.5%, and 7.9% respectively of their areas in national parks (Barnard *et al* 1998).

Riparian forests are severely under-protected in Namibia and are highly vulnerable to increasing local and transboundary pollution, increasing water abstraction and devegetation.

The State-owned protected areas do not comprise the only conservation areas in Namibia. Figure 7 and Table 2 illustrate the extent of the country’s various protected areas, which incorporates large tracts of private and communal land.

Table 2: The proportional composition (% of total conservation network area) of protected areas and ownership types making-up the Namibian conservation network
(Source: Turpie *et al.* 2010)

PA Category	Ownership				
	Emerging	Gazetted	Private	State	Total
Commercial conservancy	0	0	13.5	0	13.5
Communal conservancy	10	35.8	0	0	45.8
Community forest	0	1.1	0	0	1.1
Private nature reserve	0	0	1	0	1
Protected area	0.3	36.5	0	0	36.8
State concession area	0	0	0	1.8	1.8
Total	10.3	73.4	14.4	1.8	100

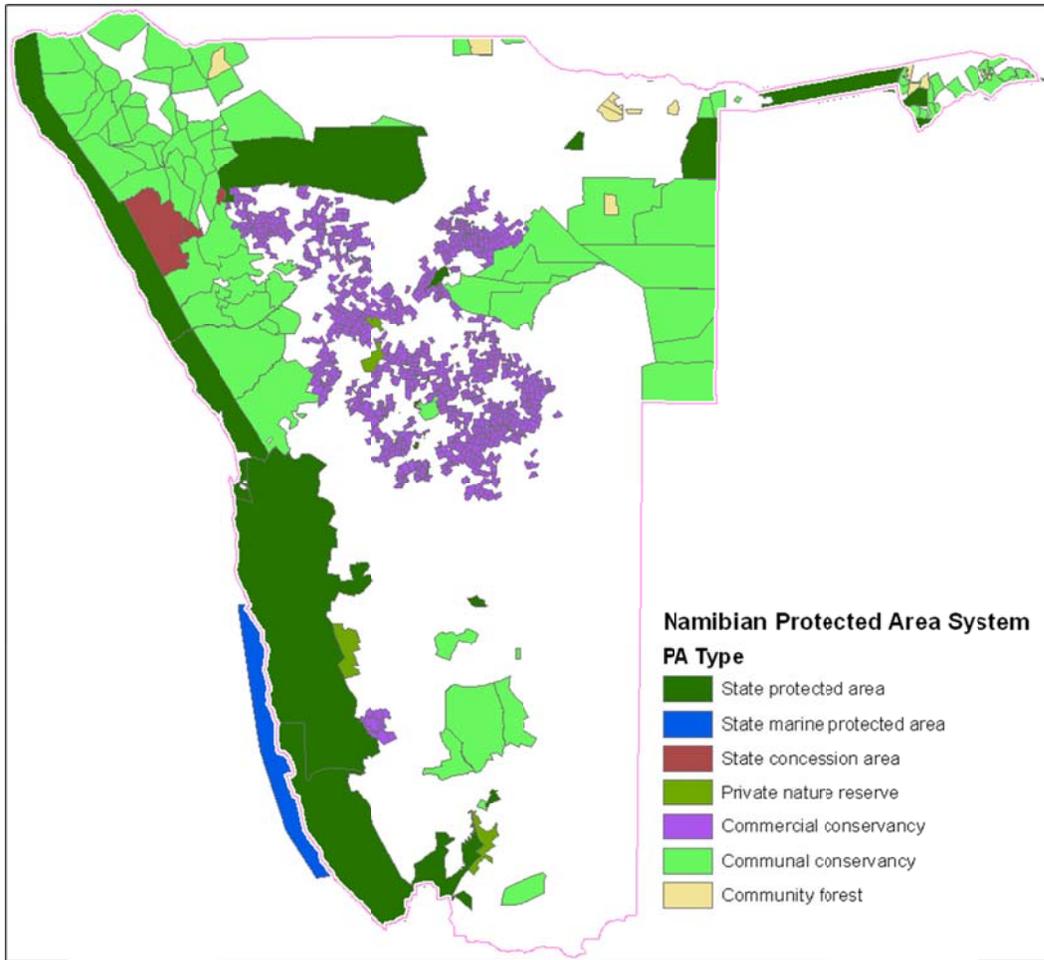


Figure 7: Namibia's Protected Areas
(Source: Turpie *et al*/2010)

COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT IN NAMIBIA

After independence, the GRN established legal and policy frameworks, which entitled freehold farms, communal conservancies, and community forests to acquire rights over some wildlife species, trees, and non-timber products. This created an opportunity for the custodians of these resources (individuals and/or communal conservancies) to become involved in land-use management, tourism, forestry, and indigenous product development (IPD) activities. Since 1998, 59 communal conservancies have been registered throughout Namibia – covering 132,090 km² and involving more than 176,000 community members (NACSO, 2009).

Community forests conserve local natural resources and promote sustainable harvesting and income. In 2007, the 13 community forests earned almost N\$500 000, mainly from the sale of firewood, timber, and poles for construction, thatching grass, and tubers of the INP, *Harpogophytum* sp (Devil's Claw) (SAIEA, 2009).

Conservancies obtain income from trophy hunting, tourism, lodge levies, and employment in tourism establishments, all of which bring significant community benefits and earned N\$39 million in 2007 (NACSO 2010). The program is expanding to include indigenous plant products, conservation tillage projects, and holistic resource management. The platform provided by conservancies allows for the

development of business skills and the expansion of enterprises – all of which help to promote economic development in remote rural areas.

Whilst benefits from conservancies may be modest at the household level (Hoole, 2008; Long, 2004) and governance issues remain a challenge (Odendaal, LAC, *personal communication*), the CBNRM programme helps to diversify livelihood options for communities, especially in arid areas where farming is marginal.

The development of communal conservancies and CBNRM has resulted in:

- Improved wildlife custodianship and an increase in wildlife populations on large tracts of communal land. Game numbers have increased particularly in Kunene, Erongo and Caprivi.
- Improved levels of conservation management in biomes previously neglected by the proclaimed parks (most specifically the Nama Karoo, the Acacia Savanna and broad leafed Savanna).
- Opportunities for improved livelihoods in rural areas as a result of direct revenues from joint venture tourism, sustainable wildlife uses and other enterprises, generated through the conservancies.

TRANSBOUNDARY CONSERVATION

During the past decade three memoranda of understanding have been signed between Namibia and her neighbors (Table 3). Improved collaboration and cooperation between the signatories of these MoUs has great potential for tourism in and biodiversity conservation within SADC – particularly with respect to opening up valuable landscape level biodiversity corridors for the movement of wildlife.

Table 3: Namibia's Trans-frontier Conservation Areas (TFCAs) (www.sadc.org)

TFCA description	COUNTRIES INVOLVED	STATUS
Ai-Ais/Richtersveld Transfrontier Park <i>Important area for arid-adapted and succulent Karoo endemic species</i>	Namibia and South Africa	MoU signed 17 August 2001 Treaty signed 1 August 2003
Iona-Skeleton Coast TFCA <i>Important area for facilitating north-south movement of arid-adapted large mammals and some marine species (e.g. green turtles). The Kunene river is an important habitat for birds.</i>	Angola and Namibia	MoU signed 1 August 2003
Kavango-Zambezi TFCA <i>Biodiversity rich broad-leafed savanna woodland area; essential for elephant and other large game (particularly woodland and wetland species) survival and migration</i>	Angola, Botswana, Namibia, Zambia and Zimbabwe	MoU signed 15 July 2010

2. SWOT OVERVIEW

Strengths	<ul style="list-style-type: none"> Extensive protective areas Conducive policies and laws Historically strong NGO and donor support Committed community and private sector involvement CBNRM considered successful Wildlife has advantages (economic and environmental over livestock) Attractive landscapes, wide open spaces and good game viewing opportunities: high tourism value Innovative vision for transboundary conservation Management of wildlife in the hands of a cross-sector of society (NGOs, private sector, communities) and the State.
Weaknesses	<ul style="list-style-type: none"> Disparate political “Visions” for Namibia’s future with conservation given low status/inadequate recognition of the value of wildlife/tourism sector at high political level MET politically weak Inadequate capacity within the MET and Conservancies High degree of external donor support necessary State Parks not placed strategically for the maximum protection of all biomes, biodiversity, and endemic species Inadequate control over poaching
Opportunities	<ul style="list-style-type: none"> Climate change Turning Namibia’s PA patchwork into a PA landscape level network Improved land use planning Improving EIA guide and review capacity and practice Building on the current CBNRM program Integrating land reform with wildlife and conservation The creation of honorary game wardens
Threats	<ul style="list-style-type: none"> Climate change Sustainable financing for conservancies and human wildlife conflicts Inadequate research capacity Mining related environmental and social effects Habitat loss through land degradation Insecure tenure over some natural resources Lack of adequate Land Use Planning

3. ANALYSIS OF MAJOR WEAKNESSES AND THREATS

THREAT: CONFLICTS IN LAND-USE, DISPARATE POLITICAL “VISIONS” FOR NAMIBIA’S FUTURE, AND LOW STATUS OF MET

One of the most important challenges that faces CBNRM and conservation efforts in Namibia is that wildlife and tourism are not sufficiently acknowledged as key development sectors by many high-level decision makers. This results in widely disparate “visions” and conflicting land-uses as reflected in the policy review (Section 3). Conflicts in land-use – even within national parks where mining activities and agricultural activities¹⁰ do occur – are usually not challenged by MET.

THREAT: CLIMATE CHANGE

The expected impacts of climate change on biodiversity conservation, protected areas, and the CBNRM program (as reported in Turpie *et al* 2010 and NACSO 2010) include:

¹⁰ Examples include the ongoing mining activities in the Namib Park, Skeleton Coast Park, and many examples of negligence in Caprivi, including the establishment of a prison farm at Bagani, various irrigation and agriculture schemes in Bwabwata Park, the development of a military camp in the Kwando Triangle, and grazing of livestock in Mamili and Bwabwata Parks. In all cases, these activities are contrary to the management plans that the MET drew up for the parks.

- Increasing aridification and a gradual shift in hyper-arid desert and arid shrubland eastwards.
- A reduction in ground cover and reduced Net Primary Productivity (NPP) throughout much of the country by 2050 (exacerbated by 2080). This will result in reduced carrying capacity for wildlife.
- Out of more than 800 plant species that were modeled by Midgely *et al* (2005), at least 7% are estimated to shift their distribution range out of Namibia entirely with 52% of species showing range contractions.¹¹
- Plant assemblages on the western escarpment (which separates the arid desert from the semi-arid savannas) will be particularly vulnerable to CC. This area is an important center of endemism which does not extend significantly into the national parks network, but occurs almost predominantly on communal lands in the Kunene and Erongo regions.
- The south and southwestern parts of the country are predicted to experience the greatest increase in total plant species numbers (arid-adapted species) as well as the lowest proportion of species loss, whereas much greater species losses are expected to be experienced in the central, northern, and biodiversity rich eastern areas (Midgley *et al.* 2005).
- Declining surface water (small springs, seeps etc.), which will affect wildlife presence in many of the northwestern areas.
- Reduced groundwater recharge, lower water tables and threats to the ecological water reserve and valuable ephemeral river habitats.

The expected responses of some game species are presented below. A more detailed description is presented in Turpie *et al* (2010):

- Reduced carrying capacity will lead to a decline of 11-22% in the numbers of the main grazing species across the country.
- A slight decline in the range of springbok, gemsbok in extreme western areas with minor expansions into the northeast.
- A notable decline in Burchell's zebra in western areas can be expected as well as a gradual decline of desert dwelling giraffe and black rhino with declining wooded ephemeral river habitat and higher temperatures in the western areas.
- Blue wildebeest, impala, red hartebeest, and giraffe ranges remain largely unaffected – although giraffe may decline throughout Namibia as a result of fewer large trees.
- Valuable woodland ungulates (e.g. Roan and Sable) will no longer prosper in Etosha/Waterberg but will still be able to survive in Bwabwata park, Mudumu Park, and the adjacent conservancies (although may require extra fodder in dry years).
- Elephant distribution may not be affected but these animals will exert increasing pressure on habitats (especially in the arid northwest) which will become self-limiting for this (and other) species.

¹¹ Earlier studies (Turpie *et al*, 2002) suggest a complete loss of the unique *succulent Karoo biome* as a result of reduced winter rainfall by 2050. These authors also state that the *Nama Karoo biome* will also contract radically.

- Increasing incidents of human-wildlife conflict¹² and increased poaching, pressure on PAs as rural food security is increasingly compromised.

In order to respond to the biomal shifts that will accompany climate change, wildlife populations must be able to migrate. This demands landscape level corridors and improved connectivity between Namibia's various protected areas. (See Recommendations Section 6)

THREAT: HABITAT LOSS THROUGH LAND DEGRADATION

Historically, nomadic pastoralist societies in the more arid areas of the country adjusted to Namibia's naturally high climatic variability by moving seasonally with their livestock – an activity that helped prevent land degradation and soil erosion. As a result of population expansion and the erection of fences, traditional agricultural methods are either no longer viable (as in the case of nomadic pastoralism) or have become increasingly unsustainable (as in the case of slash and burn cultivation¹³). Furthermore, commercial farmland has been severely overstocked and suffers from bush encroachment.

Soil salinization (caused by poorly managed irrigation schemes) is another form of land degradation that threatens habitats. In addition, irrigation schemes demand the use of polluting pesticides and fertilizers. Little information is available on the extent of soil erosion and salinization in Namibia, although irrigated soils, in the Stampriet and Hardap areas as well as in the Swakop River and Orange River valleys, show signs of salinization – particularly around Aussenkehr (Orange River valley), where it is reported that this type of land degradation is extensive (R. Roeis, MAWRD, 2002 *pers. comm.*)

Human-induced changes to the natural fire regime. High intensity fires play a major role in maintaining open savannas. However, increasing numbers of human-induced fires in Caprivi have begun to result in losses of large trees, organic matter, and soil nutrients. This exposed soil is particularly susceptible to erosion (Mendelsohn and Roberts 1997).

Deforestation. Most deforestation in Namibia results from land clearing for agriculture and wood remains the primary energy source for a large proportion of the population, particularly in the NCAs (Figure 1). If it occurs along rivers, deforestation impacts heavily on the healthy functioning of wetland ecosystems and is a major cause of soil erosion, declining water quality and flood control.

THREAT: LACK OF SECURE TENURE OVER NATURAL RESOURCES

Although rural communities have been afforded limited user rights over some natural resources through the establishment of conservancies and water-point committees, communities still do not have property rights over land itself. The absence of appropriate tenure over land in the communal areas is believed to be a major cause of the lack of effective systems of local resource management (Dewdney 1996; Jones, 2004).

¹² A wide range of traditional methods are used to deter "problem animals" and conservancy, NGO and MET staff are committed to trying to assist farmers in the protection of their crops and livestock (Mulonga *et al* 2003). The IRDNC has set up a direct financial compensation scheme (HACCS) to help individual households that suffer losses due to wild animals.

¹³ In 1996 a total of 1719 km² had been cleared in Caprivi, an activity that has increased at a rate of about 4.1% each year since 1943 (Mendelsohn and Roberts 1997). Today, due to increasing population pressure, more farmers clear bigger areas of woodland and grassland and are forced to reduce the fallow period considerably. Consequently, the cycle of woodland regrowth and soil regeneration is broken and the centuries old traditional practice of slash and burn cultivation has become unsustainable, causing excessive loss of soil nutrients and increased rates of deforestation.

THREAT: POORLY PLANNED RESETTLEMENT PROGRAMS

The environmental impacts of resettlement have not been taken into account by the Government's resettlement programme, nor has the capability of the land been matched to appropriate land uses. (Discussed in the policy review, Section 3)

THREAT: THE ABSENCE OF ADEQUATE LAND USE PLANNING

Ad hoc sectoral approaches to land use are inefficient and ultimately result in the corrosion of natural capital, land degradation, and biodiversity loss. Successful land use planning is a vital management tool essential to achieve sustainable and equitable natural resource utilization, but it demands inter-sectoral cooperation and coordination and the integration of policies, plans, programs, and projects.

4. STRENGTHS/OPPORTUNITIES

OPPORTUNITY: CLIMATE CHANGE

Climate change is expected to have positive as well as negative impacts on Namibia's wildlife populations (Turpie *et al* 2010). These are summarized as follows:

- The general aridification scenario expected for Namibia will result in some positive plant species shifts. Midgely *et al* (2005) showed that 41% of 800 plant species modeled (the arid-adapted varieties) are likely to show range expansions across the country. Some of these plants will have value for INP development e.g. *Commiphora* species which produce more resin during drought years.
- Conditions in Caprivi will improve for some game species (e.g. White Rhino) and there will be a possible increase in wetland and floodplain species due to higher rainfall in the catchment areas of the northern perennial rivers (although riparian forests are likely to have been reduced considerably by 2050 due to insufficient protection/increasing abstraction/pollution from more ambitious irrigation schemes/flood control measures).
- Wildlife in Namibia is well adapted to arid and highly variable climatic conditions. This advantage over domestic livestock should boost the trend amongst freehold farmers – some of whom have already begun to remove fences, develop conservancies, and invest increasingly in consumptive and non-consumptive wildlife based industries. Under these circumstances there will be increasing demand for wildlife stock from parks and conservancies by freehold farmers.
- As subsistence farming becomes less viable there will be increasing interest in the development of new communal conservancies. However, not all land in Namibia's rural areas is suitable for enterprises that focus on tourism activities, and the CBNRM program will need to expand into other areas. (See Recommendations, Section 6)
- There could be increasing demand by farmers in communal areas for wider devolution of rights over natural resources (e.g. over grazing/rangelands).

OTHER OPPORTUNITIES

These include: Establishing a linked protected areas network and developing landscape -level wildlife corridors, integrating wildlife and resettlement, and encouraging the role of honorary game wardens. (See Section 6: Recommendations) In addition, sustaining robust research and training facilities, such as the Gobabeb Training and Research Centre, are critical to understanding the ongoing effects and potential mitigation measures from climate change in Southern Africa.

5. CONCLUSIONS

Although Namibia's wildlife sector has low status within the Government, it receives strong NGO and donor support. The development of CBNRM has helped to provide alternative livelihoods for rural communities and, provided that future habitat destruction is minimized in the face of growing foreign and local commercial interests, wildlife-centered enterprises will continue to maintain biodiversity and support some rural communities.

B. COASTAL AND MARINE ENVIRONMENT

I. BACKGROUND INFORMATION

Namibia's marine environment falls within the Benguela Large Marine Ecosystem, which stretches northwards from the Cape of Good Hope in South Africa to Cabinda in Angola.

The cold, productive Benguela Current comprises an equatorward flow of cool water in the South Atlantic gyre, with dynamic wind-driven upwelling close inshore at certain active upwelling sites. This has helped form the low-rainfall Namib Desert, which extends northwards through Namibia and southern Angola.

Namibian waters have a high nutrient supply to the upper layers. This supports dense plankton blooms and a large biomass of fish, crustaceans, sea birds, and marine mammals. Historically, the BCLME presented favorable conditions for a rich production of economically valuable species. Occasional harmful algal blooms (HABs) develop, which independently, or in combination with low-oxygen water, can cause mass mortalities of fish, shellfish, marine mammals, seabirds, and other animals. Although HABs are natural phenomena, their incidence appears to be increasing in frequency and intensity worldwide (Joyce, 2004).

There is limited understanding of the physical, chemical and biological interactions and processes that drive the highly variable and complex BCLME. However, there is fragmentary but important evidence that suggests increasing instability and variability within this large marine ecosystem.

Of the 1,600 km long **coast** of Namibia, only 5% is rocky. The rest is comprised of sandy beaches with minor rocky outcrops (Molloy, 1990). Perennial river input is only via the Orange and Kunene. Ten westward flowing ephemeral rivers, between Walvis Bay in the south and the Kunene in the north, are dry for most of the year but seasonally can carry water and silt to the sea.

Namibia has designated three **coastal wetlands** as Ramsar sites (wetlands of international importance), i.e. the Walvis Bay Lagoon,¹⁴ Sandwich Harbour Lagoon, and the Orange River Mouth, which support a high diversity of shorebirds (mostly waders). Other coastal areas/wetlands in Namibia qualify for Ramsar site status (including the Kunene River Mouth, Luderitz Lagoon, the Cape Cross Lagoons, and Namibia's offshore islands) but the GRN has hesitated on submitting these sites for designation. In addition to these naturally occurring wetlands, the Swakopmund Saltworks, a manmade system of shallow evaporation ponds, also qualifies as a wetland of international importance. This site, used for commercial salt production and oyster farming, supports thousands of waders and seabirds.

¹⁴ The Walvis Bay Lagoon consists of lagoon, beach, and intertidal habitats and supports up to 150,000 birds of over 40 species, many of which are migratory waders.

Nine of the 15 southern African **breeding seabird species** that occur in the BCLME region are listed as regionally threatened in South Africa’s red data book (Cooper *et al* 2002). Threats include oil pollution, fisheries interactions (mainly long-liners), habitat alteration and loss, predation by seals, and human disturbance from tourism and recreation.

Well-documented **endangered avifaunal species** include the Damara tern and the Jackass penguin. Damara terns are near endemic and occur in a very limited range. The breeding range of jackass penguins is limited by the availability of offshore islands and predator-free mainland sites. In Namibia, this species is listed as vulnerable although the rate of population decline has been so rapid (>30% reduction since the late 1970s) it could be classified as endangered.

MANAGEMENT OF THE BCLME

In the past there was an absence of inter-agency (or inter-ministerial) frameworks for management of the marine environment and its resources and scant regard for sustainability.

In 1998, the Global Environmental Facility approved support for an ecosystem-based project, with a focus on sustainable management. The three BCLME countries prepared a Transboundary Diagnostic Analysis (TDA) and a Strategic Action Program (SAP), which reviewed the existing knowledge of the status of the Large Marine Ecosystem (LME). They established an Interim Benguela Current Commission (IBCC) to strengthen regional cooperation and address the gaps in current knowledge. The priorities addressed are increased fishing pressure, HABs and pollution from ongoing seabed mining and petroleum production.

Currently, the three countries that share the BCLME are attempting to harmonize the management of shared stocks and improve the predictability of extreme events. Obstacles include: inadequate capacity (equipment, vessels, expertise), and limited funding for marine monitoring.

2. SWOT OVERVIEW

Strengths	<ul style="list-style-type: none"> Natural richness of the BCLME Natural beauty of the coastline Establishment of the EEZ, improved management and the setting of TACs since Independence Dedicated legislation and institutions The Benguela Commission and improved transboundary agreements with South Africa and Angola
Weaknesses	<ul style="list-style-type: none"> Overexploitation, collapse of stocks (Pelagic collapse pre-independence; Deep sea stocks post-independence) Inadequate capacity (vessels, equipment, expertise) Limited funding Poor management (including by-catch and by-kill)
Opportunities	<ul style="list-style-type: none"> Develop ecosystem based management through the Benguela Commission ICZM of the coastal areas which accommodates all stakeholders and ensures that impacts are minimized Sustainable mariculture Sustainable (eco) tourism
Threats	<ul style="list-style-type: none"> Overexploitation High climate driven variability of the BCLME Foreign vessels and illegal fishing within Namibia’s EEZ The petroleum industry Growing pollution Unplanned Coastal Development Onshore and offshore mining Climate Change

	Catchments issues Recreational activities Alien Invasive organisms Mariculture
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3. ANALYSIS OF MAJOR WEAKNESSES AND THREATS

MAJOR THREAT I. OVEREXPLOITATION OF LIVING MARINE RESOURCES

Namibia’s pre-independence decline and spatial displacement of targeted fish species is well documented. Hampton *et al* (c.1999) report that total catches in the BCLME declined from a peak of more than 3 million tonnes in 1968 to levels of < 1 million tonnes per year in the 1990s. Although management of Namibia’s fisheries improved considerably after Independence.¹⁵ Global International Waters Assessment (GIWA) (2005) predicts a worsening of the current unsustainable exploitation in the smaller and less valuable fisheries by 2020.

The overexploitation of commercially valuable marine resources (Figure 8) during the 1960s and ’70s caused several environmental impacts. These combine to constitute the most serious threat to Namibia’s marine habitats and biodiversity, which include:

- The decline and spatial displacement of targeted species¹⁶ through overutilization
- Alterations to the benthic environment
- The decline of numerous marine species through by-catch and by-kill while targeting certain species
- Changes in community structure and ecosystem functioning
- Changes to gene pools

¹⁵ After Independence, a 200-mile EEZ was established, TACs (quotas) for major species were introduced, quota fees were levied to capture rent, and quota allocations and subsidies were introduced to promote Namibian ownership.

¹⁶ Populations that have suffered the most dramatic declines include: pelagics (pilchards, sardines), west coast rock lobster, all line fisheries species (snoek, albacore and big eye tuna), the targeted recreational and artisanal fishery species (silver kob, west coast steenbras, copper sharks), the entire deep-sea catch (orange roughy, alfonsino, boarfish, oreo dory, and cardinal fish) (Hampton, et al circa 1998; Kirchner, 1998; Holtzhausen & Kirchner, 1998).

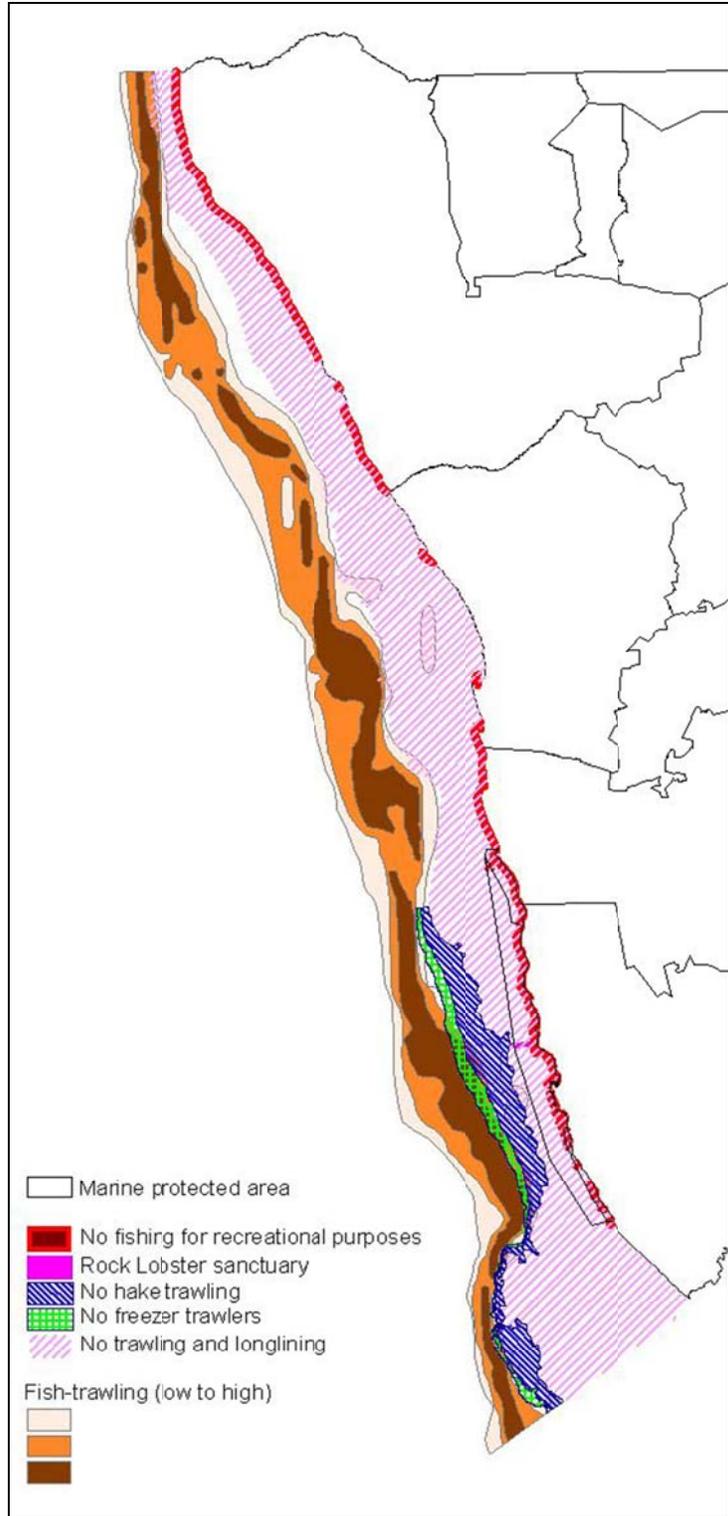


Figure 8: Main fishing areas and restricted zones
 (Source: Mendelsohn 2011 in prep)

All of these impacts (except the first) have received little attention and there is almost no baseline data to assess their regional and local effects. The following observations provide some insight into the ecosystem health of the BCLME:

- In response to the loss in pelagic fish there have been dramatic declines in seals, African (Jackass) penguins, and several seabird species (including cape gannets and Cape cormorant) populations since in the mid-1970s. (Vaz-Velho *et al* 2006).
- Southern Right Whales were reduced from an estimated 20 000 individuals to 35 in the 1930s. They have now recovered to about 3,000 individuals (Lombard and Strauss, 2004).
- Severe exploitation of particular species associated with kelp beds (e.g. rock lobster and abalone) has led to changes in community structure within the Kelp forests. It is likely that harvesting of kelp for alginates will increase in the future both in Namibia and South Africa. It is uncertain at this stage what the long-term impacts of kelp harvesting will be.
- Sink (2004) reports that bottom (demersal) trawling in the BCLME is capable of destroying/altering valuable shelf slope and seamount habitats and thus affecting the survival of many endemic species. In South Africa, there is concern that all trawlable grounds on the west coast have already been damaged (*ibid*). In Namibia the demersal fishery which targets Cape and deep-water hakes has been active along most of the coastline for several decades.
- Large losses, through bycatch and incidental mortality of non-target species (by-kill), occurs with all commercial fisheries. The world's fishing industries are reported to be responsible for the incidental mortality of between 18 and 40 million tonnes of marine life (including sharks, fish, sea birds, turtles, marine mammals, and innumerable other organisms) – an amount that equals an estimated one-third of the global catch (Holmes, 1998). Trawl fishing in Namibia which targets only one or two specific species has the greatest bycatch. Changing markets have caused some bycatch species to become valuable – e.g. kingklip, monkfish and west coast sole, which are caught as bycatch with the demersal hake fishery. Because they are not officially targeted species, there are no quotas set for their harvesting and there is no strategic approach for their sustainable management.
- Roux *et al.* (2006) report that several seabird species¹⁷ are susceptible to bycatch by long line fisheries. The survival of several of these species is severely threatened – in particular, the Cape gannet which breeds in Namibian and South African waters but relies on areas in southern Angola for overwintering. The most damaging fishery for seabirds is the pelagic tuna fishery, which has high bycatch rates and poor compliance with mitigation measures (Ryan *et al.* 2002).
- Fisheries management has only recently begun to take ecosystem impacts into account in the southern parts of the BCLME (Sink, 2004). One major impact in this regard is the alteration of community structure and ecosystem functioning as a result of overexploitation of one or two key species. For example, the dramatic decline in the population of pelagics has resulted in other species filling that niche. Squid (calamari) and jellyfish (which has no economic value and has few natural predators) are two species that appear to have dramatically increased in numbers in the BCLME in recent years.

¹⁷ These include: black-browed albatross, yellow-nosed albatross, grey-headed albatross, white-chinned petrels, other petrels and shearwaters, and the endemic Cape gannets.

MAJOR THREAT 2. ONSHORE AND OFFSHORE MINING

The diamond mining industry has been active in Namibia for just over 100 years. Since the mid-1990s the main thrust of diamond mining operations has moved from the land into coastal waters and beyond, into deep sea areas. Offshore concessions extend the full length of the Namibian coastline, from the Orange River in the south to the Kunene River in the north.

The desert and coastal parks are littered with abandoned mines, some dating back to early 1900s. Figure 9 depicts current (2010) mining activities along Namibia's coast. However, it should be noted that there are a large number of Exclusive Prospecting Licences (EPLs) that have recently been awarded in both the marine and coastal environments – including within national Parks (Peter Tarr, SAIEA, *pers. Comm.*). The uranium rush will likely result in at least six large uranium mines by 2020. As many as 11 large mines will be established if the uranium price and demand increase significantly within the next few years (SAIEA, 2010).

Smith (2006) reports that the cumulative effects (over time and space) of individual on-shore, near-shore, and sub-tidal mining activities (specifically pertaining to diamonds) within the BCLME may be severe. Impacts include:

- The discharge of tailings of several million tons of sediments at some sites (e.g. Elizabeth Bay and Oranjemund).¹⁸
- The construction of large seawalls to prevent flooding. These are constantly eroded and require continual replenishment with large volumes of sand.
- Both seawall construction and tailings discharges contribute heavily to alteration of sub-tidal and inter-tidal habitats as a result of: smothering by on the sea-bed, increased turbidity causing reduced sunlight penetration and reduced growth of marine vegetation, decreased efficiency of filter feeders, clogging of fish gills, and other effects.
- Sub-tidal mining occurs up to 3 km offshore and causes damage to important offshore ecosystems (particularly kelp beds) and negatively impacts upon rock lobster populations.
- Long-term diamond mining activity has been responsible for a dramatic reduction in shorebird biodiversity and density (from 220 birds/km to 41 birds/km) (Simmons (2005).

Threats posed by nearshore coastal diamond mining in Namibia will increase as terrestrial diamond sources become depleted and operators increasingly target the marine deposits.

¹⁸ In Namibia, the policy is to discharge tailings directly into the marine environment. It is estimated that mining operations in the vicinity of the Orange River were responsible for approximately 404 million tons of sediment input to the coastline between 1968 and 2005 (Smith 2006). This volume is of the same order of magnitude as that discharged naturally by the Orange River over the same period.

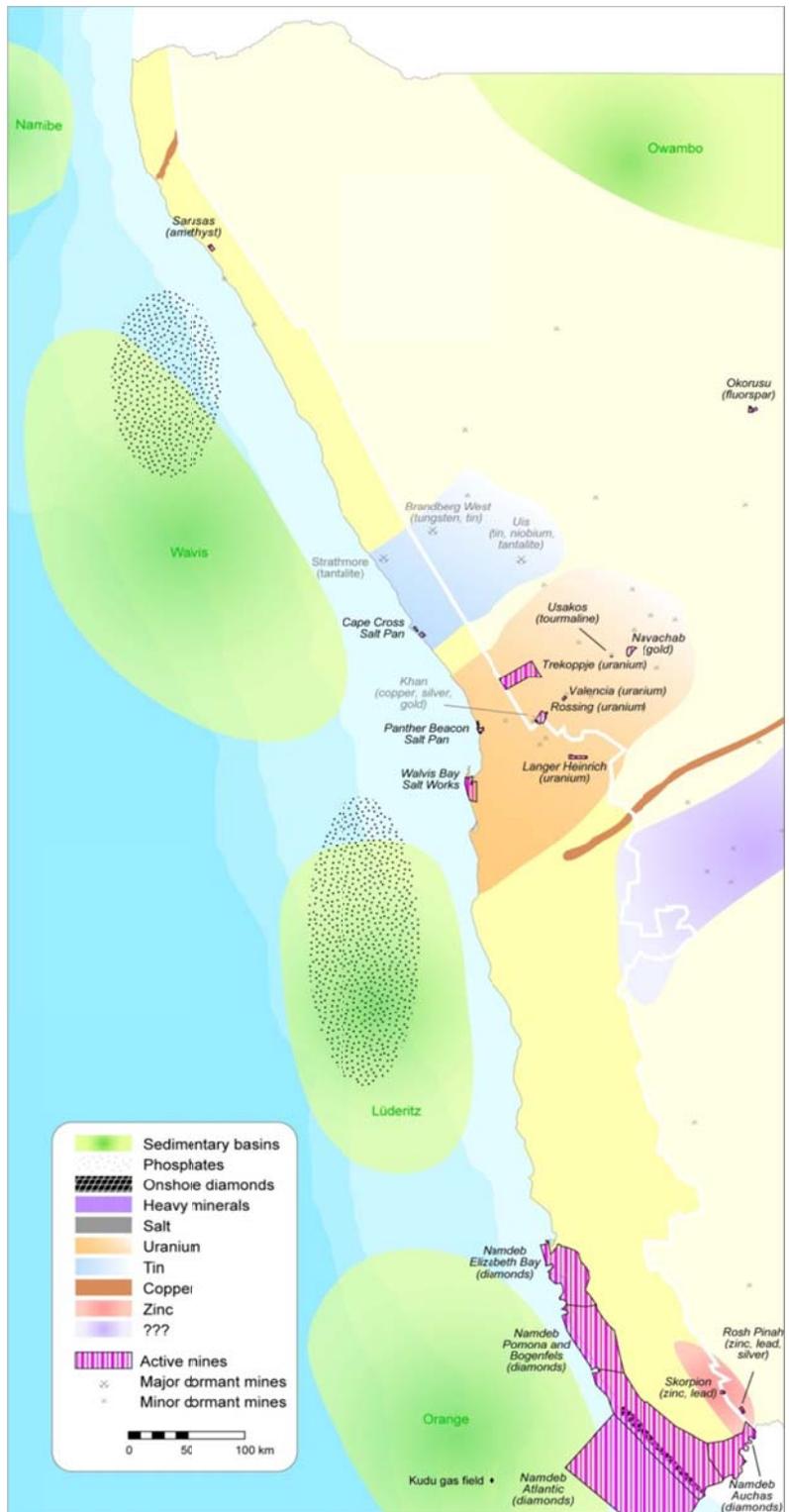


Figure 9: Mines and mineral deposits in the coastal and marine environment (Source: Mendelsohn in prep)

Deep-sea mining and diamond dredging off the coast of Namibia can occur at depths of 100m. Sediment and gravel (which make up about 75% of the sediments that are pumped from the seabed to the mining vessel) are discharged overboard, generating extensive sediment plumes at a rate of 100 tonnes/hour (O’Toole, 1997). Turbidity clouds can be transported both vertically and horizontally over long distances by currents and are considered to be responsible for several threats to marine biota, including a reduction of dissolved oxygen to lethal levels (Smith 2006). Marine sediments reintroduced into the water column characteristically contain high concentrations of organic material and/or cysts of HAB species, which usually originate from an anoxic environment and, as a consequence, have a high oxygen demand. HAB cysts released into the environment can trigger new harmful algal blooms.

MAJOR THREAT 3. UNPLANNED COASTAL DEVELOPMENT

Human settlement and development along the Namibian coast is currently confined to five principal nodes: Henties Bay, Swakopmund, Walvis Bay, Lüderitz, and Oranjemund. Future growth is probable in terms of new harbors (e.g. Cape Fria), mariculture, offshore diamond mining, phosphorite mining, diatomite mining, and oil drilling activities.

The uranium “rush” currently being experienced in the Namib Desert is expected to have dramatic impacts on the growth of some coastal towns (particularly Swakopmund).

While low impact, high quality eco-tourism is encouraged, unregulated mass tourism poses a threat to biodiversity and certain habitats of coastal Namibia. The rapid development of informal townships with inadequate sanitation and waste management services poses a localized threat to the coastal areas.

The cumulative impacts of coastal development demand strict control as they pose a major threat to many components of the marine environment. These include:

- Pollution
- Transformation of the supratidal environment
- Alteration of dune movement
- Negative impacts on estuaries

MAJOR THREAT 4. POLLUTION

Pollution enters the BCLME from many different sources in all three countries. The accumulation and combination of the different types of pollution is likely to cause several cumulative and/or synergistic impacts throughout the BCLME for many decades to come (Taljaard, 2006).

Sources of marine pollution in the BCLME include:

- Waste originating from land-based sources, which accounts for about 44% of marine pollution in the LME and includes: sewage effluent discharges, industrial effluent discharges from fish factories as well as pesticide and fertilizer run-off, stormwater run-off, mining return flows, and contaminated groundwater seepage.

Seawater quality in the environs of Walvis Bay and Lüderitz is poor due to fish factory effluents, minor oil spills, high organic levels, and heavy metals in the bottom sediments.

- Maritime transportation, offshore exploration and production activities which include accidental and deliberate oil spills, dumping of ship garbage, and the draining of ballast waters. Plastics are reported as a major source of pollution in the BCLME – with large numbers of animals (including seven species of marine mammals, 36 species of seabirds, two species of turtles and seven species of fish) recorded as either being susceptible to ingesting and/or becoming entangled in plastics (Ryan 1996).

MAJOR THREAT 5. CLIMATE CHANGE

Limited understanding of atmospheric/oceanic forcing on the marine biosphere restricts our ability to predict with any degree of certainty the manifold, interactive effects of climate change on marine ecological complexity. Nevertheless, some general statements can be made relating to the direct impacts of: *sea level rise (SLR)*, *enhanced concentrations of atmospheric CO₂*, and *increases in sea and air temperatures* on Namibia's coastal zones and marine ecology as a result of CC.

It is predicted with a high degree of certainty that sea surface temperature (SST) and SLR will continue well into the future.¹⁹ The expected social and coastal zone impacts are summarized as follows: -

- SLR on Namibia's coastal zones and settlements include biogeophysical effects such as: increasing rates of coastal erosion; increased flooding, inundation, and displacement of lowlands; impairment of water quality into freshwater aquifers and estuaries due to increased salt intrusion; reduced protection from extreme storm and flood events (more extreme high-tide events) (IPPC, 2007).
- The cumulative impacts of higher temperature, lower rainfall, and higher evaporation rates across Namibia will result in increasing aridification of the country. Of major concern for all coastal settlements and most of their economic drivers will be the provision of water in future decades – a situation that could, to one degree or another, be further impacted by the salt-water intrusion of coastal aquifers as a result of SLR.

With respect to marine biodiversity, the ecological functioning of the BCLME, and the future of Namibia's marine fisheries sector, the impacts of SLR, higher SST, increased atmospheric CO₂, and changes to the wind regimes could be extreme, predicted impacts include:

- Increasing climatic variability of the BCLME.
- Higher temperatures throughout the water column²⁰ will affect the growth rates, reproduction, and metabolic processes of many marine species. Species distributions and community composition will be affected and predator-prey interactions will be disrupted (Peters and Lovejoy 1992).
- Increasing CO₂ is causing the oceans to become more acidic. As a result, marine calcification rates are declining. This affects growth and reproduction rates of organisms that use calcium carbonate to construct their shells and skeletons (including calcareous phytoplankton and rock lobsters).

¹⁹ Global Sea level rose by an average rate of 1.8 mm/year during the years 1961-2003 (IPCC, 2007). Research conducted in southern Africa from 1959 – 1990 show trends in SLR that are comparable to global trends (Hughes *et al* 1991; Hughes *et al*, 1992) Sea levels are expected to rise by 21 to 48 cm (above 2003 levels) by 2050 under the A1B emissions scenario.

²⁰ Observations since 1961 show that the oceans have been absorbing more than 80% of the heat added to the climate system, and that ocean temperatures have increased to depths of at least 3000 m (IPCC, 2007).

- Increases in frequency and intensity of upwelling events will affect the nutrient and larval supply to the coast, which, in turn, will strongly influence the current coastal community structures.
- There are likely to be latitudinal shifts in ecologically (and in some cases, economically) important keystone species.
- The distribution and populations of the vast flocks of palaeartic and resident sea and shorebirds that frequent Namibia's coastal zone are also likely to be affected by alterations to their food supply – including intertidal organisms, mudflat invertebrates, and fish.
- Impacts on many land breeding seabirds and mammals are likely to be dramatic. Species such as the Jackass penguin (already endangered) are susceptible to heat stress during hot, humid, and windless conditions.
- SLR will cause sandy beach erosion and sedimentation changes that could threaten some coastal habitats – particularly lagoons and other important coastal wetlands. The Walvis Bay Lagoon and the vast numbers of avifauna it supports during the summer months is the most at risk from these impacts.
- Namibia's offshore islands will be severely threatened by increased inundation and vulnerability to storm events as a consequence of SLR. Species that are most likely to be affected include: the African penguin; Cape gannet; Cape, bank and crowned cormorants; Hartlaub's gull; and African black oystercatchers.

THREAT 6. CATCHMENT ISSUES

Coastal areas are strongly influenced by the rivers that bring water, sediments, nutrients, and pollutants to the coast. The ecological functioning of many estuaries in the three countries that share the BCLME region have been destroyed by alteration and reduction of flow in the catchments (Sink 2004).

Over-abstraction of fresh water, construction of water supply reservoirs, and inter-basin water transfer schemes result in reduced river flow, desiccation, increased salinities, and changes in estuarine mouth dynamics. This has serious consequences for coastal processes and fisheries and threatens biodiversity in both estuarine and marine habitats. Poor catchment management and siltation threaten marine biota over large areas. Siltation can impact negatively on phytoplankton and benthic algal communities.

Although the influence on the BCLME by Namibia's transboundary perennial rivers (the Orange and the Kunene) is minimal when compared to rivers in Angola and South Africa their drainage basins do include a large part of the southern African hinterland. The Orange, in particular, is a conveyor of polluting substances that originate from agricultural and industrial activities upstream in Lesotho and South Africa.

THREAT 7. NON-EXTRACTIVE RECREATIONAL ACTIVITIES

Non-extractive coastal recreational activities in Namibia are concentrated around the Central Namib – between Sandwich Harbor and the Ugab River mouth. The population of people living in this coastal area (particularly the towns of Walvis Bay and Swakopmund) is expected to double during the 20-year period between 2001 and 2021 (Mendelsohn *et al.* 2002) and tourism to this area is likely to continue to increase.

The beaches, sand dunes, and gravel plains within this area are popular with offroad 4x4 drivers, and scrambler/quad bikers who are present in high numbers during holiday periods. These land-based recreational activities leave unsightly scars on the desert gravel plains (which can last for over 70 years), can impact on beach communities, and threaten ground nesting bird species such as the Damara tern.

Fossicking (exploring of intertidal shores and pools), an activity, which can impact negatively on shore organisms in the intertidal and shallow sub-photic zones, is also likely to increase. Efforts to zone the coastal areas for multiple land use by NACOMA aim to control these growing problems.

Marine eco-tours in search of marine mammals (dolphins, whales, and seals) and sea and shore birds are increasing in popularity. Disturbance to seabird breeding colonies by poorly managed tourism enterprises can cause a reduction in breeding success, nest desertion by adults, a loss of eggs to predators, and even full-scale colony abandonment (de Villiers & Cooper, 2002). Birds most affected to date have been Cape gannets, African penguins, bank cormorants, swift terns, and Hautlaub's gulls (Crawford *et al.* 1995b).

THREAT 8. ALIEN INVASIVE ORGANISMS

No invasive alien marine plants have yet been recorded in Namibia, but with the expanding development of aquaculture and mariculture, care must be taken to avoid introducing potentially invasive faunal species. Another source of alien organisms is via the ballast waters of ships. Areas of shallow and/or sheltered seas such as the Lüderitz and Walvis Bay lagoons are particularly vulnerable to invasions.

THREAT 9. MARICULTURE

Mariculture on an industrial scale is capable of posing several threats to marine and coastal biological diversity and their associated habitats. In Namibia these threats include²¹:

- Threats posed by excess nutrients and antibiotics in mariculture wastes
- The release of exotic species or genotypes which can displace local and indigenous species
- The transmission of diseases to wild stocks, and displacement of local and indigenous species

Namibia currently produces modest commercial quantities of Pacific oysters, European oysters, and Black mussels.

4. KEY OPPORTUNITIES

The key opportunities within the Marine and coastal environments include the development of Integrated Coastal Zone Management, sustainable mariculture, and ecotourism. These are discussed in more detail under recommendations. (See Section 6)

5. CONCLUSIONS

Despite improvements in management, the depletion of Namibia's marine resources is of considerable concern. Past overexploitation of pelagic fish resulted in the large-scale damage to an important middle trophic layer within the ecosystem. This has resulted in partial and irreversible ecosystem collapse – affecting the biodiversity and abundance of top predators (fish, birds, and mammals) and disrupting ecosystem functioning.

After overexploitation, onshore and offshore mining activities are considered the most important threat to biodiversity but, in the future decades, climate change (and increasing environmental variability) and pollution are likely to have a growing impact. Marine pollution from a variety of onshore and offshore sources is growing in both complexity and intensity globally (Tarr 2007).

²¹ <http://www.oceansatlas.org/unatlas/uses/uneptextsph/settleph/2560aqua.html>

Catchment issues (mainly pollution and reduced in-flows from the Orange/Senqu Rivers), recreational activities (including off road driving and cetacean watching boat trips), coastal development, alien invasive species, and mariculture follow in impact magnitude.

Development of the coastline is currently inadequately planned and controlled. Very often seemingly arbitrary decisions are taken – often driven by the promise of short-term economic benefit. There are many conflicting interests relating to coastal zone management in Namibia – most notably between biodiversity conservation efforts, eco-tourism (current and future), and the mining industry. In spite of concerns about rapid uncontrolled growth in tourism, this sector is regarded as being key to the sustainable development of the coast. Similarly, fishing, mariculture, and mining all need to be accommodated in order to promote the required multi-sector economic base.

A key to addressing the above and other concerns is adopting a common vision for the development of the coast through ICZM and the implementation of carefully considered and well-designed strategies and safeguards. These must result from multi-stakeholder collaboration and consensus. The MET's NACOMA project aims to achieve this through the coastal zone SEA and White Paper.

C. FRESH WATER RESOURCES

I. BACKGROUND INFORMATION

RAINFALL AND WATER RESOURCES

Namibia has low and variable rainfall, averaging less than 20 mm annually along the west coast (the Namib Desert) to just over 600 mm in the north-east (Figure 10, Mendelsohn *et al.* 2002). Rainfall occurs mainly as summer thunderstorms, while the southwestern corner receives winter rains. Annual evaporation rates are extremely high, between 2,600 mm and 3,700 mm per annum, leading to a very high water deficit. These figures classify Namibia as hyper-arid in the west to sub-humid in the northeast, and periodic droughts are a natural occurrence.

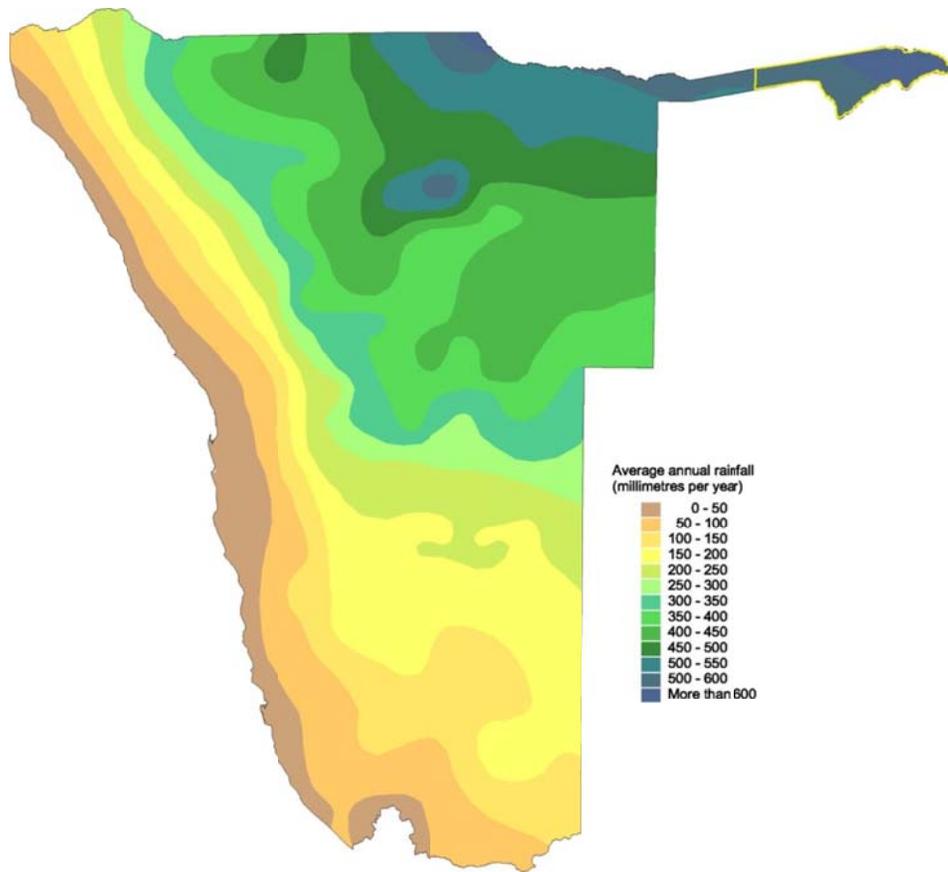


Figure 10: Annual average rainfall in Namibia
 (Source: Mendelsohn et al 2002)

Namibia has very little surface water, particularly in the interior of the country (Figure 11). Perennial rivers are limited to the northern and southern borders and the north-eastern corner. The five perennial rivers – Orange, Kunene, Okavango, Kwando, and Zambezi – are shared with neighboring countries. Thirty-eight percent of the water used in Namibia is supplied by these rivers, but most of the country does not have access to these relatively strong sources due to the long distances involved (Heyns et al 1998).

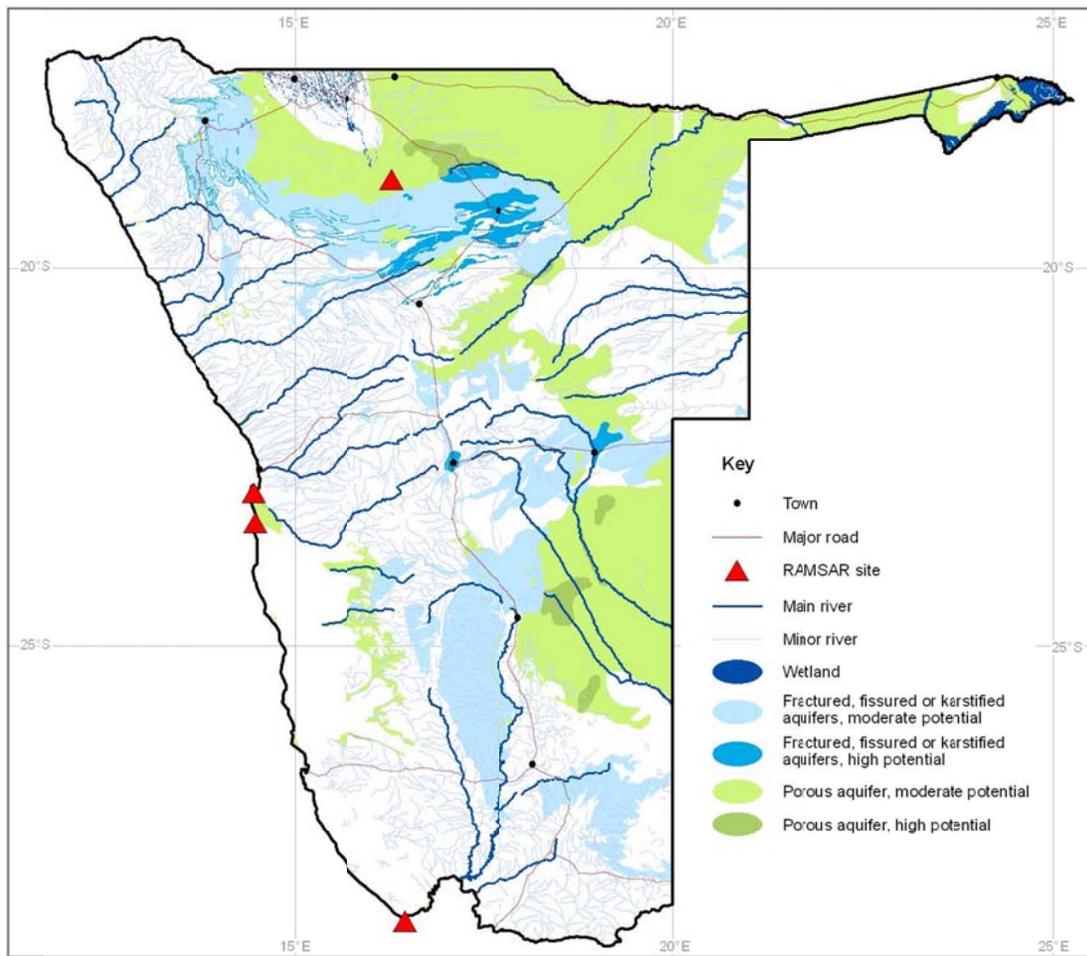


Figure 11. Surface and groundwater sources in Namibia
 (Source: Mendelsohn et al 2002)

The rivers in the interior are ephemeral, flowing only after good rains in the catchments. Most of these are west-flowing and cross or enter into the Namib, serving as life-giving linear oases in the desert. The Fish River and its many tributaries flow southward into the Orange River, while relatively weak flows occur in the southeast-flowing Nossob.

The main surface water storage dams are situated on some of these ephemeral rivers (Figure 12). The largest is Hardap Dam on the Fish River, which supplies the town of Mariental and irrigation farms in the vicinity. The Swakoppoort and Von Bach Dams on the Swakop River and the Omatako Dam supply the Windhoek and Okahandja urban centres. Three other relatively smaller dams supply the towns of Gobabis, Rehoboth, and Keetmanshoop. Approximately 20% of the water used in Namibia is supplied from the seven dams described.

Most of the water used in Namibia comes from underground. Important aquifers are the Omaruru Delta and Kuiseb Delta Aquifers, which supply the Erongo coastal towns; the Karstveld aquifer supplying irrigation, mines and towns around the centres of Tsumeb, Otavi and Grootfontein; the Koichab pan which supplies Lüderitz; and the large Stampriet artesian aquifer, which irrigates fruit and vegetable crops. All the ephemeral rivers also contain alluvial (riverbed) aquifers. There are

approximately 32,000 boreholes in the country. In certain parts of the country, the quality of the groundwater is too poor (brackish or containing other salts) for human consumption.

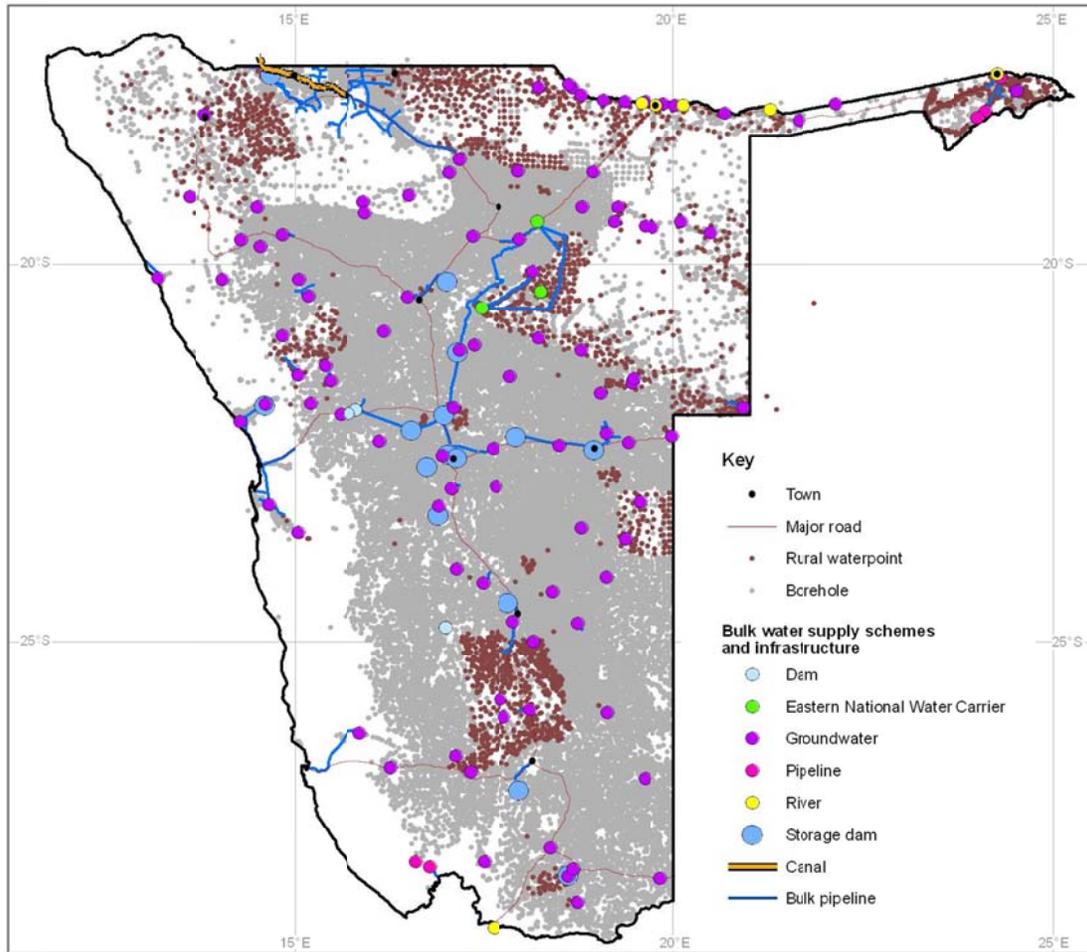


Figure 12. Water supply infrastructure in Namibia
(Source: IWRM 2010)

has

WETLANDS AS ECOSYSTEM SERVICE PROVIDERS

Namibia’s rivers, pans, and other wetlands are mostly rare and temporary, making them and the aquatic life they support very precious. Although many are dry most of the time, they are essential to the ecological and economic health of Namibia.

While the larger surface waters have the greatest potential for people’s needs, the smaller and more temporary waters are equally vital sources for small communities, rural populations, their livestock and

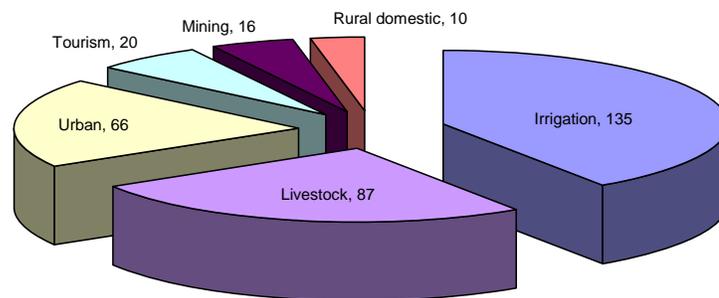
small irrigation projects. Wetlands provide many products apart from water: trees and their fruits and wood, reeds, fish, and the potential to attract tourists. Their reedbeds and sand floors help to purify water, and are important in recharging aquifers and controlling floods. All of these functions help to provide a healthy environment, and to support local people.

Many interesting and unique animals are associated with Namibia's wetlands. For instance, the Karstveld lakes contain endemic fish, a certain species is known only from ephemeral rainwater pools in Caprivi, ephemeral pans come alive with shrimps and aquatic invertebrates when they fill with rainwater, and they host many species of water-associated birds including many migrants from the northern hemisphere. Their significance for biodiversity is enormous.

Certain wetlands are recognized and protected under the UN Convention on Wetlands of International Importance, known as the Ramsar Convention (Figure 11).

WATER CONSUMPTION

People and livestock compete with mines, industry, and irrigation for Namibia's scarce water resources (IWRM 2010). The agricultural sector (livestock and irrigation) is the largest consumer of water by far (66%), followed by the urban sector (20%). The irrigation sector presents the greatest opportunity for improved water use efficiency and water demand management.



**Figure 13. Total water demand by sector 2008: 334 Mm³/a
(Source: IWRM 2010)**

FUTURE DEMAND

Water consumption in Namibia is expected to increase steeply in future, as shown by the projections for water demand in Table 4 (IWRM 2010). By 2030, only 20 years hence, total demand is predicted to be more than double what it is now.

Table 4: Present and projected water consumption per sector from 2008 to 2030 (IWRM 2010)

Sector	2008	2020	2030
Irrigation	135	335	497
Livestock	87	87	87
Urban	66	91	117
Tourism	20	32	39
Mining	16	18	20
Rural domestic	10	11	11
Total	334	574	771

How will this demand be met? Proposals and activities currently underway include the following:

- Desalination of sea water (presently being led by uranium mines in Erongo Region)
- Use of purified sewage effluent for irrigation of parks, golf courses and sports grounds, and reclamation of water from wastewater effluents (practiced in some of the bigger towns)
- Recycling of water used in industrial and mining processes (e.g. Rössing uranium mine water conservation program)
- Water banking in aquifers (purposely pumping water into aquifers where the water is not lost to evaporation, currently practiced in Windhoek)
- Artificial recharge enhancement of aquifers (practiced at Model Dam, where surface water is trapped and led to infiltration basins)
- Mixing of potable water with brackish water to improve quality
- Water demand management through conservation of water by reducing unit consumption and wastage, mostly achieved through pricing incentives
- Dry sanitation (not well accepted socially, but potentially a significant water conservation strategy)

The rise in amount of water demanded for irrigation is considered to be unrealistic.

WATER MANAGEMENT

There are a number of water service providers with different responsibilities that are involved in water and sanitation infrastructure planning and development. These entities are:

- NamWater (a parastatal organization), responsible for bulk water supply
- Department of Water Affairs and Forestry (in the Ministry of Agriculture, Water and Forestry) responsible for resource management and rural water supply
- Regional Authorities (in the Ministry of Regional and Local Government and Housing and Rural Development - MRLGHRD), responsible for small scale water supply to rural communities

- Local Authorities (also in MRLGHRD), some responsible for water supply, water reticulation, and sanitation while others are just responsible for water reticulation and sanitation, but all in urban areas
- The private sector, responsible for water supply in agriculture, mining and tourism

2. SWOT OVERVIEW OF THE WATER SECTOR

Strengths	<p>Infrastructure for water supply is good</p> <p>Community-based management approach is well established</p> <p>River basin commissions are established</p>
Weaknesses	<p>Aridity, climate variability, and drought unpreparedness</p> <p>Water legislation is in limbo</p> <p>Inadequate capacity in both GRN and Local Authorities</p> <p>Environmental requirements of river systems poorly considered</p> <p>Land use in catchments degrades runoff, water quantity, and quality</p> <p>Pricing support mechanisms favor unsustainable water extraction in mining sector</p>
Opportunities	<p>Technology innovations in the irrigation, water recycling and artificial recharge spheres</p> <p>Desalination</p> <p>Awareness and education</p> <p>Price support mechanisms that favour water conservation measures</p>
Threats	<p>Perennial rivers all shared with other countries</p> <p>Land use in catchments</p> <p>Industrial growth, especially mining</p> <p>Politically driven decisions often don't conform with policy or they contradict other policies</p> <p>Climate change</p>

3. ANALYSIS OF MAJOR WEAKNESSES AND THREATS

MAJOR THREAT 1. ARIDITY AND DROUGHT UNPREPAREDNESS

Namibia's arid climate and the natural variability in rainfall and runoff of rivers places almost all agricultural production at risk. The Drought Policy and Strategy (1995) emphasizes drought preparedness, for example, by diversifying livelihoods so that there is not heavy dependence on livestock and subsistence crops, farming with arid-adapted products (e.g. indigenous crops and resilient livestock), creating conditions where people can reduce numbers of stock without financial losses, and improving early detection. While some of these are established or taking root, livestock marketing improvement is very slow and early warning systems are not functional. Most importantly, drought relief is inappropriately provided (too frequently, provision of assistance is corrupt) and creates an expectation of and reliance on government support rather than encouraging resilience.

MAJOR THREAT 2. POOR MANAGEMENT FROM WEAK CAPACITY AND UNRESOLVED LEGISLATION

The draft IWRM plan (2010) recognizes that management capacity in the water sector is weak: monitoring of volumes of water abstracted, used, stored, and available is inadequate; pollution prevention is inadequate; information is poorly distributed to other parties such as Local Authorities; demand management and water conservation measures are poorly understood and not implemented; and alternative sanitation technologies are not taken seriously. All of these issues impact significantly on existing and future water provision to people, and on the environmental sustainability of Namibia's very limited water resources.

Part of the problem lies in the long period in which water legislation has been in limbo, with the IWRM Plan being in formulation for over three years and the Water Resources Management Act not promulgated so there has been a legislative gap for many years.

MAJOR THREAT 3. LINKS BETWEEN WATER SUPPLY, ACTIVITIES ON LAND, AND ENVIRONMENTAL IMPACTS ARE NOT ADEQUATELY CONSIDERED

The reservation of water to provide for ecological requirements is not adequately considered in the provision of water. For example, water abstraction for government-led Green Scheme irrigation projects is assumed without environmental assessments (notably on the Okavango and Orange Rivers). Also, return flows of contaminated waters (from fertilizers, pesticides) is not monitored or regulated.

Many farming activities on land affect the quality and quantity of water that becomes available for use. Uses of land that results in overgrazing and soil erosion cause increased siltation into dams. Also, contamination of boreholes from livestock is common, particularly nitrate pollution from cattle kraals.

Water supply and pricing for mining operations in the Erongo Region from NAMWATER currently favors the extraction from underground aquifers rather than the development of desalination plants. This regulatory scheme is likely to threaten municipal water supply to Namibia's growing coastal settlements in future decades.

MAJOR THREAT 4. POLLUTION

There is a significant threat to water resources from polluting human activities, including sanitation, medical waste, mining, and industry.

Most of the country's wastewater treatment plants are overloaded and there are major blockages in sanitation, both in rural and urban areas (IWRM 2010). The high rate of urbanization has created a major strain on the capacity to treat wastewater to an acceptable standard. Microbiological hazards are not monitored in most water distribution systems, so preventative management is not likely. Development of water safety plans, including warning and consultation with consumers if water does not comply with basic health parameters, is needed to avoid outbreaks of water-borne diseases.

While waste pollution is a growing (both in abundance and complexity) global problem, Namibia's very low industrial activity means that, although it has accumulating problem with litter (particularly plastic waste) – especially in and around the urban centers – it has (comparatively) low levels of dangerous chemical pollution. Medical waste was identified as a problem in all towns as long ago as 1996 [Tarr, J. (1997). *Desktop survey on waste management in Namibia 1996-1997*.

Groundwater contamination can result from toxic substances and radioactivity that are involved in mining and their chemical treatment plants. Namibia has many abandoned mines that are causing contamination, such as lead around Tsumeb, and copper around Oamites and Otjihase, while there are also concerns about existing mines e.g. arsenic in the wastewater runoff from Rosh Pinah lead-zinc. Without proper controls and law enforcement of pollution legislation, these practices are still continuing.

MAJOR THREAT 5. POLITICAL DECISIONS ARE NOT ALWAYS CONSISTENT WITH POLICY DIRECTIVES

Water is a political issue. The issue of payment for water frequently comes up, and politicians (especially in the run-up to elections) are known to make statements which directly contradict government policy. Thus, expectations are raised, yet it is not in the interest of sustainable development that water be provided randomly.

MAJOR THREAT 6. CLIMATE CHANGE

Based on the expected climate scenarios for Namibia it is predicted with a fair degree of certainty that Namibia will experience a 10% decrease in rainfall in the northern and southern regions, and a 20% decrease in the central part of the country (from current values) by 2050 (Turpie *et al* 2010). This situation will worsen with possible rainfall reductions of 20% and 30% respectively by 2080. Despite these predictions there is a fairly high possibility that eastern Caprivi will receive more rain, as this (currently) sub-humid area lies on the edge of the Inter-Tropical Convergence Zone (ITCZ) which, under most scenarios, will become wetter in future decades.

Increasing temperatures and evapotranspiration, together with the likelihood of lower and more variable precipitation throughout most of Namibia, will have severe impacts on runoff, streamflow, and hydrology in the country. Consequently, the following constraints which currently challenge national and regional water resources and which threaten the ecological reserves and essential goods and services provided by Namibia's wetland systems, are likely to be severely exacerbated by 2050.

- Reduced rates of aquifer recharge and lowering of the water table across most of the country. Literature quoted by Dirx *et al* (2008) suggests that groundwater recharge may suffer a reduction of 30-70% by 2050 -2060.
- Increasing water scarcity in central and southern Namibia.
- Declining surface water (natural springs, seeps etc) and higher rates of evaporation from dams.
- Escalating financial costs of supplying adequate water for agriculture, mining, and domestic use.
- There may be a drive to increase the numbers of emergency boreholes in remote rural areas, which will (as it has done in the past) encourage the settlement of previously nomadic populations. This, in turn, will increase rates of land degradation.
- An increase in transboundary issues with upstream users (including Angola and Zambia in the case of the northern perennial rivers, and South Africa and Lesotho in the case of the Orange/Senqu basin), and downstream users (Botswana in the case of the Okavango basin).
- Increasing water demand and water pollution by a growing, rapidly urbanizing population and more ambitious irrigation schemes. Water demand for irrigation is expected to increase dramatically throughout southern Africa as a result of climate change and, as a direct result of higher temperatures and evaporative demand, virtually all irrigated lands in southern Africa will require between 10%- 30% more water applications per annum (Schultze, 2005 (b)).

From a biodiversity perspective, the impacts of CC on water availability are likely to be severe – especially in western Namibia, where ephemeral rivers and the trees they support act as linear oases that provide essential fodder and habitats for many species. The decline in surface water (small springs and seeps) in the more arid areas will affect bird and game populations negatively. Reduced inflows into the Etosha Pan may impact on the natural springs around the southern parts of the pan and on the breeding of some important species (including Greater and Lesser Flamingo).

4. OPPORTUNITIES

Opportunities are available regarding technological innovations in the irrigation, water recycling, and artificial recharge spheres, waste management including incinerators, desalinization development, and continued efforts regarding awareness and education, at all levels of society regarding Namibia's limited water resources.

5. CONCLUSIONS

Despite Namibia’s aridity and unfavorable circumstances with respect to rainfall, surface, and groundwater resources, the country has been able to meet the growing demand for water to sustain development. The draft IWRM Plan (MAWF 2010) concludes that Namibia still does have sufficient water to meet the goals of 2030. However, the environmental implications of this increased demand on the affected ecosystems and the hydrological cycle have not been well considered, and many existing environmental problems are going to increase in severity as the demand rises.

The most important issue in integrated water resource management is the human element itself, since if you have well skilled managers (from local level all the way up to the highest decision makers) then the problems can be addressed. Thus the critical shortage of skills in this sector is of great concern.

D. RANGELAND RESOURCES

I. BACKGROUND INFORMATION

VITAL STATISTICS

More land is used for agriculture than any other activity in Namibia: about 64 million hectares or 78% of the country is used for farming (Mendelsohn 2006). Of this, ranching of cattle and small stock, combined with small-scale cereal production on (the communal) part of the area, accounts for almost all of the land, and less than 1% is for intensive (irrigated crop) agriculture. Protected areas and private game farms also depend on productivity from their rangelands, so it can be said that almost all agricultural production relies on this broad category: rangelands.

**Table 5: Estimated numbers of humans and livestock
(Source: Mendelsohn, 2006)**

Animals	Population
People	2.1 million
Goats	2.4 million
Sheep	2.4 million
Cattle	2.3 million
Wildlife	2.1 million +

Despite the high proportions of farmland and households living on farms, agriculture contributes a low and declining percentage of Namibia’s GDP. The whole agricultural sector made up only 4% of GDP in 2007 (Ndishishi 2007), of which just less than two-thirds came from meat products. This is in stark comparison to the agricultural sector’s contribution of 16% in 1976 (Werner and Odendaal 2010). Livestock in 2007 contributed 76% of the overall agricultural output, 70% coming from the freehold areas and the remaining 6% from communal areas.

TYPES OF LAND TENURE – COMMUNAL AND FREEHOLD

A major determinant of the kind of farming activity which happens on rangeland is land tenure (Figure 14). Freehold or “commercial” farms (totaling 43% of the country) are privately owned and mostly farm livestock for marketing, locally, to South Africa or overseas. Communal land (36% of the land) is theoretically for “open access farming” – where grazing, soils, and other natural resources are owned by the state and available for use by local people, under the control of Traditional Authorities. (It is important to stress “theoretical” because about 4% is used privately and much of the remaining 32% is

fenced off informally and illegally, so that many people's freedom of access to rangeland resources has become severely constrained [Mendelsohn 2006, Werner & Odendaal 2010]).

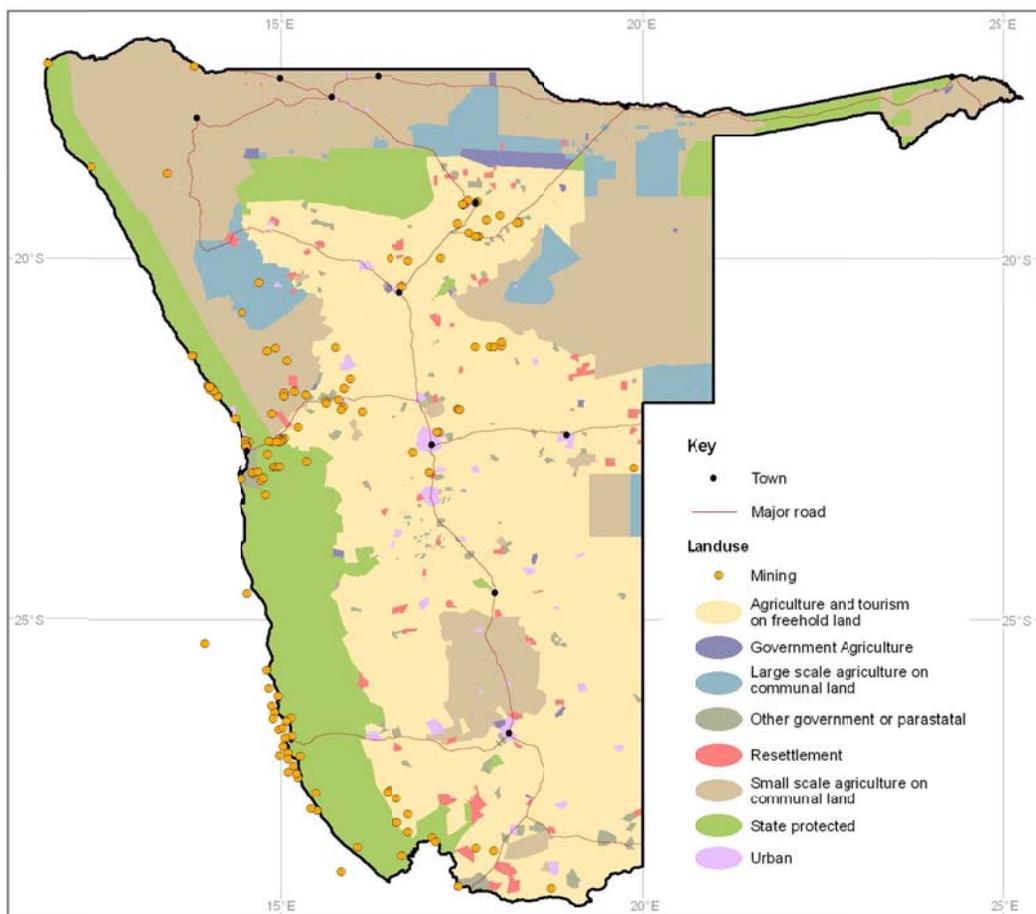


Figure 14: Land tenure and land use in Namibia
(Source: Mendelsohn 2006)

All livestock production is based on extensive systems, breeding, and rearing of stock, based on the productivity of natural rangeland. On freehold land in the northern half of the country, cattle are mainly kept on fenced farms averaging 15,000 ha each, to produce beef. Stocking rates are kept at around the most biologically productive carrying capacity (approx 10-15 ha/large stock unit). In the south and west (between the 100 and 350 mm isohyets), sheep produce mutton, karakul pelts, and some wool, and goats produce meat.

On communal land, livestock are kept unfenced in common property systems around villages to produce meat, milk, transport, and as a store of wealth. They are also kept at cattle posts away from villages for the production of beef and as wealth. As mentioned earlier, private production has begun to happen on communal land too. In the south, small-scale production of sheep and goats, also for mutton, pelts and goat meat, take place on common property or partly fenced properties.

RESOURCES NEEDED FOR PRODUCTIVE RANGELANDS

Rainfall and groundwater. Rangeland productivity depends directly on rainfall, which drives grass and browse production. More rain leads to more forage, higher stocking rates, faster livestock growth and production, and higher yields of meat for cattle, sheep, and goat farmers. Variability is very high and rainfall is unpredictable from year to year, so that stock farming is risky business. Farmers need to continually assess how many animals their pastures can support, and should theoretically track pasture conditions with livestock numbers.

Degradation of rangelands is due to continued overstocking by farmers who optimistically increase livestock numbers during good years, and are reluctant to reduce numbers in the more common below-average years.

Water is obviously a prerequisite for keeping stock, and this is mostly provided by privately owned and managed boreholes on freehold land. Rural water schemes in communal areas provide piped or borehole water through government programs, which are subsequently handed over and managed by community-based Water Point Associations.

Drought is defined in the National Drought Policy and Strategy (MAWRD 1995) as those years in which an area receives the least amount of rain that occurs with a statistical probability of 1 out of 14 years, i.e. 7.1% of the time. So, in eastern Caprivi the annual totals in this category are less than 350 mm, while in Windhoek they are less than about 150 mm. An event of this nature is supposed to trigger Drought Relief from Government but it has a slow onset and the definition is difficult to apply rigorously. This leads to drought relief being provided more often than the Policy suggests (annually in many cases), and relief becoming a political tool rather than a provision of assistance when genuinely needed.

Soil. Namibia has very poor soils. Soils derived from rocky substrates in the south, central, and western regions are generally shallow, have little moisture retention, and support relatively sparse vegetation. Exceptions are along the thin lines of ephemeral river courses where vegetation is taller and denser. The northern and eastern parts of the country are dominated by Kalahari sands which are extremely poor in nutrients, do not hold moisture for long, and are low in organic matter.

Vegetation. Cattle are predominantly grazers and do best in areas where pastures are most abundant, in the northern half of the county but excluding the very dry west. However, while they produce more meat per hectare, the amount of available fodder is more variable as it is more closely dependent on rainfall. The southern and western parts of the country offer little in the way of grass fodder, and these areas are better suited for sheep and goats, also because dwarf shrubs are available over longer periods than grasses.

The combination of soils, rainfall, and vegetation produce rangelands of relatively low productivity, and carrying capacities are accordingly low (Figure 15).

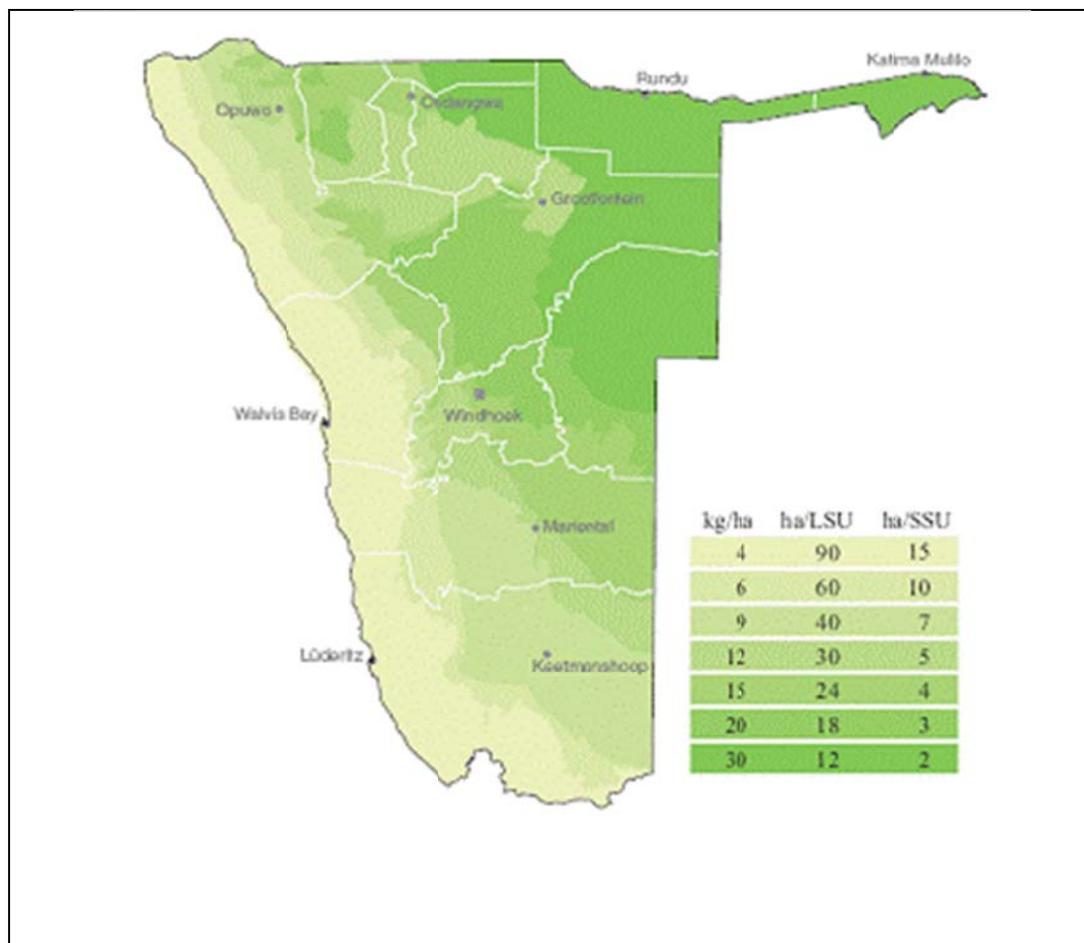


Figure15: Average carrying capacity on Namibia's rangelands
 LSU / SSU = large / small stock unit
 (Source: Mendelsohn 2006)

A further factor which reduces carrying capacity is bush encroachment. Large areas of central and eastern Namibia are covered with thorny bush (Figure16) which grows densely in response to conditions of high stocking rates, loss of the grasses, a reduction in the frequency of fires, reduction in the numbers of browsing animals, and climatic conditions favoring flowering, seeding, and germination of woody plants, followed by drier periods when water is more accessible to deeper-rooted plants and less to shallow-rooted grasses (Mendelsohn and el Obeid 2005). It is most severe in the 300-500 mm rainfall belt, particularly on calcareous soils in the Tsumeb-Grootfontein areas, where the number of small woody trees and bushes can exceed 10,000 per hectare.

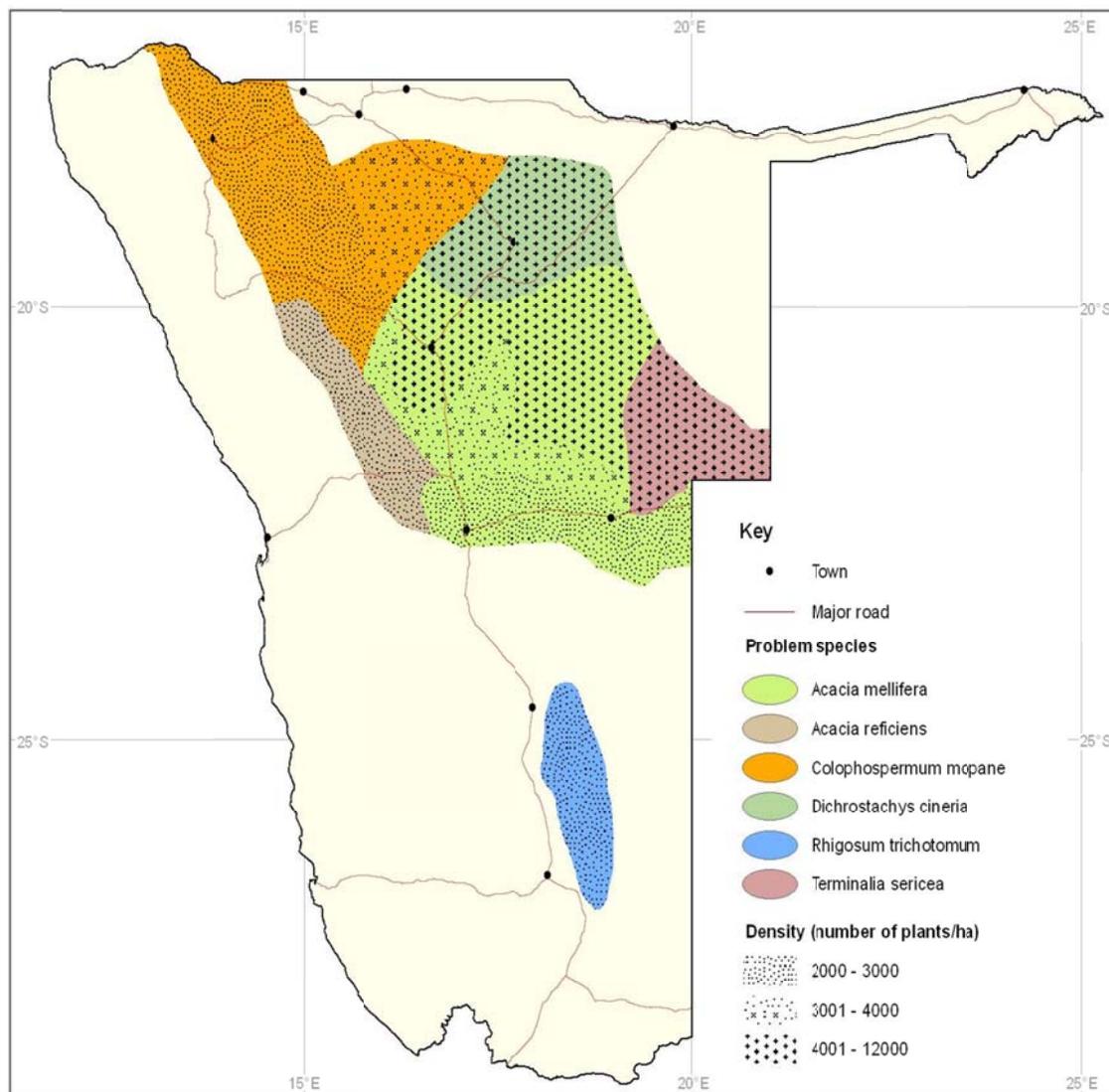


Figure 16: Bush encroachment in Namibia
 (Source: after Bester 1996)

ANIMAL DISEASES

Veterinary diseases of livestock play a very significant role in the distribution and productivity of Namibia's livestock and wildlife.

Foot and Mouth Disease and Contagious Bovine Pleuropneumonia are only found north of the Veterinary Cordon Fence (Red Line), and are the reason for its existence. EU and other foreign country's regulations on these diseases are very strict, and Namibia must comply with strict veterinary standards of disease control to be able to export to them. While there are other notifiable diseases (e.g. Rift Valley Fever in sheep and Lumpy Skin Disease in cattle) which break out occasionally, these are not implicated in the arguments for and against moving the Red Line further north to facilitate more marketing of livestock in the country.

VALUE OF RANGELAND PRODUCTS

Livestock products include meat (e.g. excellent quality beef, mutton, and venison) and meat products (such as smoked meats, sausages), dairy products, and tanning and leather processing from cattle and wildlife, and karakul pelts.

Relatively much less marketing of livestock products happens in the communal areas, where livestock (especially cattle) remain a cultural status of wealth. However, the Red Line also profoundly limits marketing opportunities, since only disease-free animals can be slaughtered commercially and they must be quarantined for three weeks to achieve this status if originating from north of the Red Line. This effectively prevents any significant marketing from communal lands. MAWF is currently assessing the feasibility of moving the Red Line northwards to open up marketing opportunities.

There are also some indigenous products which are beginning to be commercially marketed, that derive from rangelands. These include the plant devil's claw (medicinal properties in the roots) and some tree products which are described under Forestry.

Rangeland products have conventionally been thought of in terms of livestock, but the trend to diversify livelihoods and to make farming more adapted to an arid climate has brought a growing shift to farming with wildlife and tourists. The strong growth of CBNRM and tourism are part of the realization that Namibia has a competitive advantage in getting economic benefits from wildlife and landscapes. There is much greater mixing of wildlife with livestock on both commercial and communal rangelands, as described in the wildlife section above.

2. SWOT OVERVIEW FOR RANGELANDS

Strengths	<ul style="list-style-type: none"> Strong export market Culture of value-adding Mixing of wildlife and livestock is a growing trend especially on commercial farms Framework of policies, laws and institutions is strong (although compliance is weak) Emerging Holistic Resource Management models
Weaknesses	<ul style="list-style-type: none"> Arid climate and poor soils, making rangelands vulnerable to degradation History of inappropriate subsidization and extension services Politicization of the land issue Unrealistic expectations from land Inadequate policy implementation Marketing constraints Bush encroachment Borehole development resulting in overgrazing and resultant loss of biodiversity
Opportunities	<ul style="list-style-type: none"> Potential for mixing of wildlife with livestock Realigning the land reform strategy Moving the Red Line There is a niche market for beef and venison which is not yet fully tapped
Threats	<ul style="list-style-type: none"> Transboundary livestock diseases Climate change Support for Holistic Resource Management

3. ANALYSIS OF MAJOR WEAKNESSES AND THREATS

MAJOR THREAT 1. INAPPROPRIATE SUBSIDIZATION, UNREALISTIC EXPECTATIONS, AND POLITICIZATION OF LAND

Little can be changed in the climate and soil situation, so the challenge is to adapt rangeland practices to suit them. Subsidization in pre-Independence times (focused on white commercial farmers) and which are being continued under the present regime (focused on black communal and commercial farmers) lie at the root of overstocking, bush encroachment, and declining rangeland productivity.

Politicization of the land issue goes hand in hand with unrealistic expectations from land. Under the Land Reform Program, resettlement farms are expected to help poor and emerging farmers become productive, but the conditions in which such group and individual resettlement farmers are placed – small parcels of land, with little follow-on support for infrastructure and management needs – has led to most of these being failures (Werner & Odendaal 2010).

MAJOR THREAT 2. RANGELAND POLICY FAILURE

The extension of ownership rights over wildlife to rural residents is a welcome improvement in the policy framework, but needs to be extended further. Forestry and non-timber forest and woodland products are beginning to benefit from this now. However, the greatest need is for improving the ability of rural residents to manage their pastures and rangelands better.

At the moment, rangelands in communal areas “belong to everyone, and are managed by no-one.” Illegal privatization of rangelands is not prevented or controlled, even though the National Land Policy called a moratorium on this practice in 1995. The Land Policy promised to resolve the issue of tenure rights over rangeland, but this has not yet occurred and it continues to be a root cause of declining productivity of communal rangelands.

MAJOR THREAT 3. MARKETING CONSTRAINTS

The Red Line effectively separates Namibia into a southern section where marketing for international export is possible and facilitated, and a northern section where veterinary restrictions are so tight that marketing is negligible. As shown above, only 6% of Namibia’s agricultural output comes from the communal areas, most of which lie north of the Red Line.

While moving the Red Line to the northern border of Namibia (hand-in-hand with careful implementation of veterinary controls) will remove the main obstacle to improved marketing, it is not certain whether cattle marketing will dramatically increase. Cultural values attached to cattle ownership also make people reluctant to sell their livestock.

MAJOR THREAT 4. TRANSBOUNDARY LIVESTOCK DISEASES

The main threat of livestock diseases jeopardizing the meat export market originate in Namibia’s northern neighbours, notably Angola and Zambia. Foot and Mouth Disease and Contagious Bovine Pleuropneumonia are both found in these countries, and it is very difficult to prevent movements of cattle from those countries into Namibia when the international boundary is only a cut line through the bush. Significantly, Namibia also experienced a recent outbreak of Rift Valley Fever in the south, which probably originated from South Africa. While veterinary controls on livestock are very strict, especially with regard to moving animals and monitoring of herd health at local level, the risks of diseases being brought in illegally and causing an outbreak are very high.

MAJOR THREAT 5. BUSH ENCROACHMENT

It is estimated that 26 million hectares of rangeland is encroached with bush, at current prices leading to economic losses estimated at N\$1.2 billion per year. Bush encroachment is therefore one of the most serious and costly forms of habitat degradation in Namibia.

The Government recognizes that bush encroachment is causing a severe drain on rangeland productivity, but has not yet implemented measures to actively combat it. This is left up to individual farmers, who must carry the high cost of bush thinning. For many (especially on relatively small farms), it is unaffordable. Activities such as harvesting wood for charcoal production, firewood and fencing stakes, are helping farmers to derive financial benefits from encroacher wood so that the cost of clearing is offset.

MAJOR THREAT 6. CLIMATE CHANGE

The expected increasing temperatures, lower and more variable precipitation, higher rates of evaporation, and reduced soil moisture suggest that vegetation in Namibia will show a noticeable shift in spatial dominance from Grassy Savanna to Desert and Arid Shrubland by 2080. The following important implications for agriculture and rangelands are expected:

- Arid vegetation types will increase in cover by about 20% by 2050, and up to 43% by 2080 in the absence of a CO₂ fertilization effect.²² With CO₂ fertilization modelled, the expansion by 2080 is reduced from 43% to just under 30% (Midgely *et al* 2005).
- There will be a reduction in ground cover and reduced Net Primary Productivity throughout much of the country by 2050 (exacerbated by 2080).
- Rising atmospheric CO₂ could increase primary productivity in certain plants. This suggests that bush encroachment in some regions may intensify.
- A steady decline in rain-fed crop production will occur until this activity becomes no longer viable except in eastern Kavango and Caprivi.
- Much higher irrigation water demands, increased use of fertilizers and pesticides – the latter in response to increased pestilence and disease.
- Fewer but more intense rainfall episodes will result in increased rates of erosion. They will also have negative impacts on seed germination.
- Namibia's long-term carrying capacity for large livestock is already exceeded in many places and under climate change predictions a mean loss of 28% of livestock revenue below 2009 estimates can be expected by 2050 (Brown 2009).
- The productive area for large stock in Namibia will shrink towards the east and north and it is estimated that cattle numbers could decline to about 76% of present numbers by 2050 and 51% of present numbers by 2080 (*ibid*). Cattle will probably be replaced by small stock, which is better suited to arid conditions. The productive area for small stock will retreat from the west and expand towards the north and east. Despite an overall increase in productive range the numbers

²² While there is considerable uncertainty pertaining to the CO₂ fertilization effect on plants, higher CO₂ could enhance the reduced dominance of Grassy Savanna by 2080 (by exacerbating the increase in C3-dominated vegetation types, Woody Savanna, Mixed Grassland, and C3 Grassland/Shrubland) (Midgely, 2005)

of small stock are predicted to decline by 16% and 25% by 2050 and 2080 respectively (Turpie *et al 2010*)

Most farmers in Namibia's communal areas are poor. As they have limited options for other livelihood strategies, the impacts of climate change will be highly significant at the household level in these areas.

4. CONCLUSIONS

In spite of poor soil and unfavorable climatic conditions, rural Namibians continue to rely disproportionately on rangelands for their survival. In September 2010, President Pohamba stated that the Government remains convinced that agriculture will “*drive the economy and help Namibia become an industrialised country by 2030.*” This widely held view requires intervention at both policy and general awareness levels. Whilst ongoing support is needed for the rural poor who have few options other than farming (livestock and/or subsistence crops), Namibia needs to pursue land use practices that are more strategically aligned to the country's comparative advantages. The concept of integrated land use needs to be emphasized in order to dispel the perception that wildlife and stock-farming are mutually exclusive and thus in conflict with each other. By publicizing pilot projects where wildlife, livestock, and tourism occur successfully in the same area, high-level decision makers may realize that policies, plans, and programs need greater alignment and institutions need to be less sectoral.

E. FORESTRY RESOURCES

I. BACKGROUND INFORMATION

Forests – defined by the FAO as areas covered by trees with a canopy cover of more than 10% and higher than 5 m – are extremely scarce in Namibia. Woodlands are more open habitats, but still with conspicuous reasonably tall trees. By these definitions, forests cover less than 10% of the country (in the eastern and northern parts of the country) and woodlands cover about 50%, leaving areas of shrubland and desert in the driest western and southern parts (Figure 17). Timber from local trees is consequently not an abundant natural resource, but it is widely recognized that non-timber products from forests, woodlands, and in fact, all plants are very valuable resources for local livelihoods. Thus, the focus here is on forests and woodlands and their products, with some discussion of other indigenous plant products.

The distribution of forests and woodlands is determined mainly by climate and soils. Water availability in Namibia generally is very low, with prolonged periods of rain and moisture occurring as very rare events, and only very restricted habitats (such as riverbeds) providing significant soil moisture. Additionally, high rates of evaporation make for very low humidity most of the time and the dry air drives high rates of transpiration from plants. Generally speaking, trees in Namibia are sparsely distributed, small in size, and have slow rates of growth. Species that are least tolerant of water shortages are confined to north-eastern Namibia and to water courses.

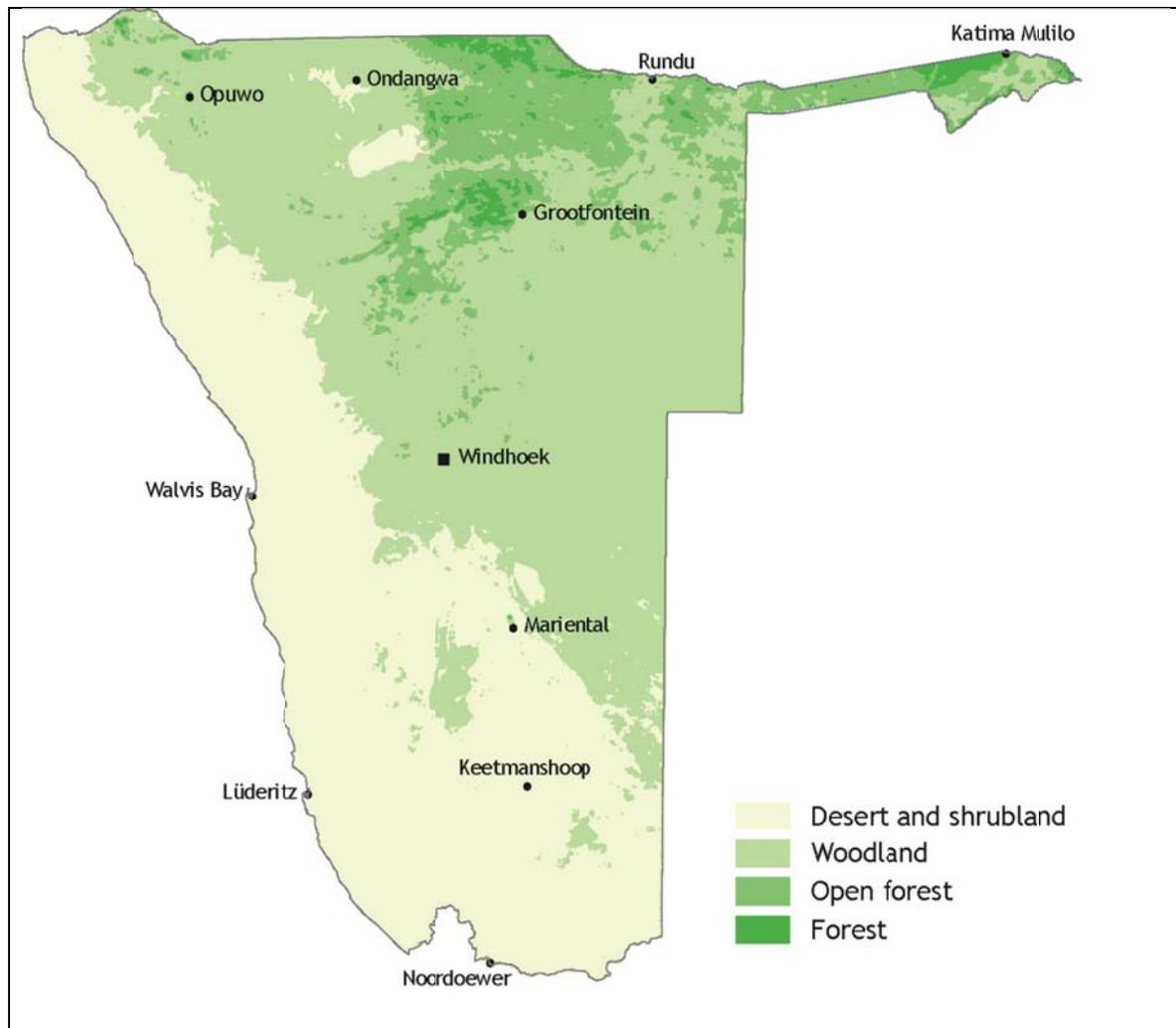


Figure 17. Distribution of forests and woodlands in Namibia.
 (Source: Mendelsohn & el Obeid 2006)

Fire is a third major factor affecting the distribution and abundance of trees. Its most important effect is in limiting the growth of young trees and in killing older and larger ones, keeping woodlands more open and savanna-like. Fires are more prevalent in higher rainfall areas since grass cover is needed as fuel. The other impact of fires is on the species composition, as some species are more vulnerable to fires than others, and their numbers are greatly reduced in areas where fires are frequent. A high percentage of Namibia’s northeast burns every year: in a five-year period, 43% of Caprivi and 34% of Kavango burnt each year (Mendelsohn & el Obeid 2005). The central parts of the country burn much less frequently, depending on the amount of grass fuel (largely determined by the previous season’s rainfall), while fires hardly ever occur in the southern and western areas where there is not the grass to sustain them.

IMPORTANT FOREST AND WOODLAND AREAS

The significant forests and woodlands are:

- **Northeastern broad-leaved woodlands** harbor the greatest resources of wood and timber in the country, and support a high diversity of species and animals associated with the trees. Dominant and characteristic species are *Burkea Africana*, kaa, Zambezi teak, silver-leaf terminalia, camelthorn, and several *Combretum* species. The woodlands lie on Kalahari sands and are thinly populated, and they contain most of Namibia's good quality timber.
- **Riparian forests** line the banks of perennial rivers. They are relatively sparse and species-poor in the dry west, but along the east-flowing rivers they comprise a great variety of trees and form some of the most biologically diverse habitat in the country. Especially noteworthy are small patches along the Okavango River (much reduced from their former extent), on the Kwando, and a few spots along the Zambezi.
- **Ephemeral river woodlands** form ribbons of trees along river courses. The trees provide food, shelter and shade and are important lifelines running through dry surroundings. A few "forests" occurring as patches of many old and tall camelthorn trees are noteworthy, on the Oanob and Tsumis Rivers and, with more sparse concentrations, in a few places in the Namib Desert.
- **Mopane woodlands** occur in Caprivi and in north-central and northwestern Namibia, where large areas are dominated almost entirely by this species alone.

Other hot-spots of abundance and diversity include:

- The dolomite hills of the Karstveld, near Otavi, Grootfontein, and Tsumeb
- The north-western highlands which have a high proportion of plants endemic to Namibia

There are very few formal tree plantations in Namibia, and the ones that have been attempted have produced very poor yields.

Namibia has few invasive trees, mainly because of its arid climate and poor soils. Most alien plants grow in riverbeds where the soils are deeper and richer in nutrients, more water is available, and seeds are distributed by river water flows. *Prosopis* trees (mesquite) are probably the most important alien, and are abundant along only a few rivers. While they may displace other trees, they also provide valuable fuel wood, shade and fodder.

PROTECTION OF FOREST AND WOODLAND RESOURCES

Many of the key areas listed above are found in Namibia's formally protected areas, or are now coming under community-based management through the establishment of conservancies and community forests. Parts of the broadleaved woodlands and riparian forests in the north-east are in the Khaudom, Bwabwata, and eastern Caprivi parks, and community forests are showing steady growth in that area. The west-flowing ephemeral rivers go through the protected areas of the Namib along the coast, and, more importantly, their upper catchments are increasingly in areas that have become or are emerging as communal conservancies.

Mopane woodlands in the north-central parts of Namibia coincide with the country's highest rural population density areas and deforestation is severe. Large areas consist of mopane shrubland, where larger trees have been cut and the remaining stems have coppiced but continual cutting does not allow them to grow tall again.

While woodlands are therefore conserved to a certain degree inside protected areas, community forests and conservancies, the controls on wood harvesting, transportation, and selling of wood products is

inadequate. About 50 species of plants are protected under forestry or nature conservation legislation, but the law enforcement to give teeth to the legislation is poor.

FOREST, WOODLAND, AND PLANT PRODUCTS

Forests and woodlands are important to people for many reasons. They yield wood for construction, furniture, and firewood, and they support many other animals that are valuable components of the natural environment. Trees and these associated plants and animals also provide food, pleasure, and other products used medicinally or for cultural activities.

Firewood is the largest use of all wood in Namibia, making up about two-thirds of all wood consumed (Mendelsohn and el Obeid 2005). About 10% of this is sold commercially, while the remainder is collected locally, usually close to rural homes and mostly for domestic cooking. Wood is used for cooking by nine out of 10 rural households, whereas only 20% of urban homes use wood as the main cooking fuel.

Household construction and fencing is the next biggest use of wood, and most of the consumption is in northern Namibia. While styles are changing, there is still status attached to a homestead comprising complexes of rooms and palisades made from large mopane and silver terminalia poles. The use of wood for construction and fencing is declining quite rapidly, and being replaced by modern building materials, which are cheaper and readily available.

Relatively little timber (planks) used in construction originates in Namibia. Cutting of kiaat, Zambezi teak, and a few other species does occur and is regulated within community forests and by government issuing of permits.

Charcoal production is a growing industry and is mostly produced from encroacher bush. The industry is worth about N\$ 75-100 million (in 2004) and continues to grow, with 200-300 farming operations involved in this activity. Estimates on the amount of charcoal produced in Namibia vary from 50,000 to 90,000 tonnes per year (NPCS 2010), all of which is sold commercially, either locally or exported to SA and Europe.

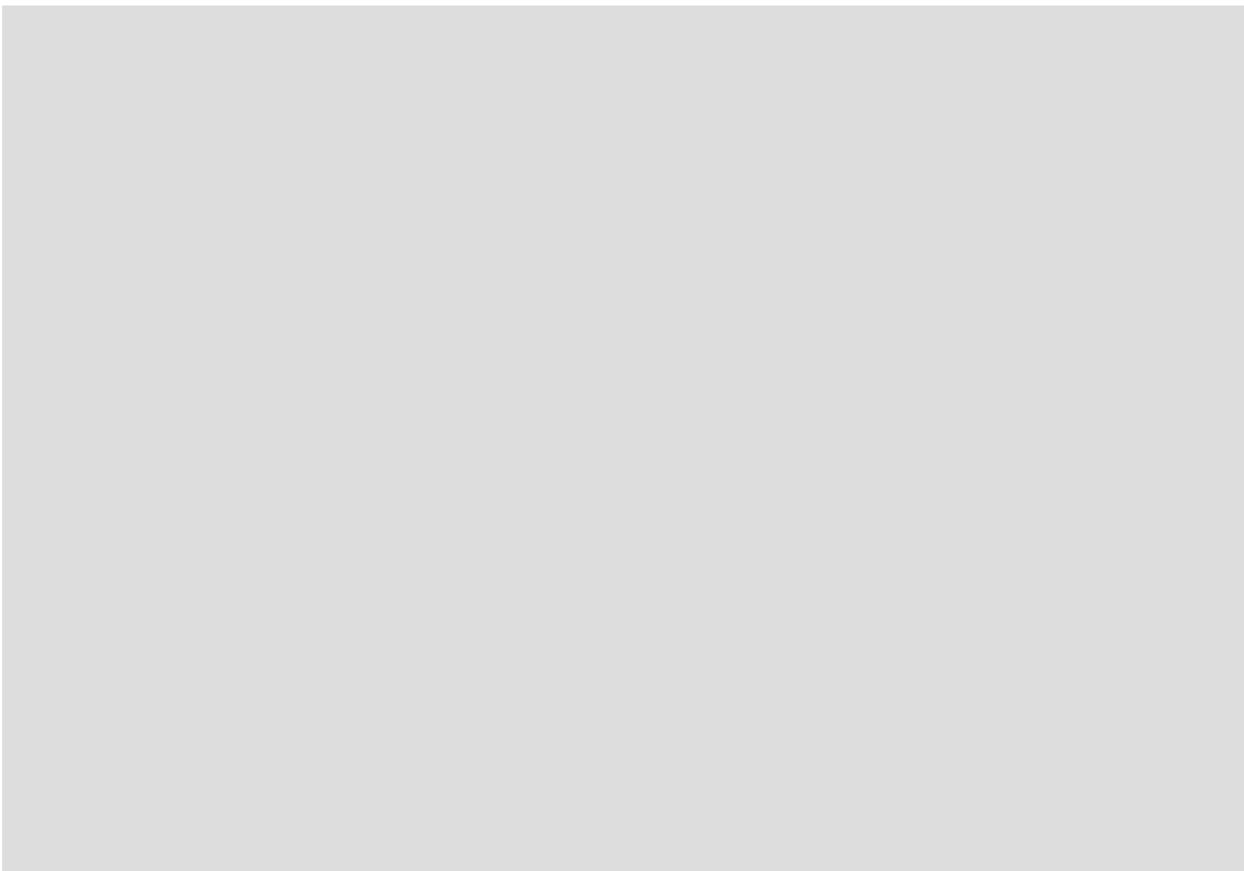
While harvesting for charcoal is promoted as a method to clear encroacher bush, it is thought that harvesting is also preferentially cutting down valuable and protected (non-encroacher) larger trees since they yield more wood. The extent of this impact is not known. Additional uses of encroacher bush, such as for generating electricity using bush fuel, are being investigated, and these are likely to increase the levels of cutting of non-encroacher species.

Crafts and carvings probably provide the highest returns for all uses of wood in Namibia (Mendelsohn & el Obeid 2005). The amount of wood cut for these purposes is estimated at less than 1% of all Namibia's wood consumption, but there is no public information to evaluate how sustainable are the harvesting rates.

Plant foods are among the most important non-timber forest products, and several tree species are being investigated for commercial production of nuts, fruits and oils. Medicinal products are also receiving attention. See discussion of indigenous natural products in box below.

VALUE OF FOREST, WOODLAND, AND PLANT PRODUCTS

The use of plant resources takes place mostly on communal land and to a lesser extent on freehold land. Nearly all rural households harvest wood for fuel, poles for building, and non-timber wild plant products for food, medicines, and making crafts. The charcoal industry is developing entirely on freehold land.



Natural resource values deriving from wild plants estimated in 2009 amounted to N\$1,686 million, from which almost 80% was on communal land (Turpie et al 2010). The direct contribution was estimated by Mendelsohn & el Obeid (2005) as about 3% of the gross national product, and does not include other indirect values such as carbon sinks, contributions to biodiversity and ecological processes etc. They conclude that “forests and woodlands are indeed rich assets.”

2. SWOT OVERVIEW FOR FORESTS AND FOREST PRODUCTS

Strengths	Most forests are in protected areas Community-based management is well accepted and growing Framework of policies, laws and institutions is strong
Weaknesses	Skills and capacity in Directorate of Forestry are limited Poor law enforcement Harvesting possibly at unsustainable rates e.g. for planks, carvings
Opportunities	Forestry can integrate more thoroughly with CBNRM Namibia Woodlands Management Council is potentially very useful but not yet formally established Honorary Foresters have potential for valuable role in law enforcement Bush-to-electricity (e.g. CBEND) has great potential Awareness of and education about forestry and woodland products will increase their priority for conservation

Threats	<p>Population growth and poverty increases pressure on firewood resource and to clear land for crops, which both drive deforestation</p> <p>Fire is another major cause of losses of woodland</p> <p>Charcoal industry is possibly also driving over-exploitation of valuable species</p> <p>Climate change will cause CO₂ fertilisation, increase rate of bush encroachment</p>
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3. ANALYSIS OF MAJOR WEAKNESSES AND THREATS

MAJOR THREAT 1. DEFORESTATION

It is one of the ironies of Namibia that much of the wooded areas of the north suffer from excessive use of wood and deforestation, while the central areas are heavily encroached with woody growth.

The biggest losses of large areas of woodlands and forests have occurred from clearing of land for crop cultivation, cutting of trees for firewood and construction, and the frequent burning and killing of trees by veld fires in the northeast. Most rural “farmers” rely heavily on off-farm incomes derived mostly from employment in towns and remittances, and it is this component of livelihoods that offers the greatest opportunity for relieving pressure on natural resources in rural areas. Secondly, the issue of runaway fires that burn large areas of northeastern Namibia almost annually, needs to be addressed.

MAJOR THREAT 2. OVER-EXPLOITATION OF NON-ENCROACHER TREES DURING ACTIVITIES TO COMBAT BUSH ENCROACHMENT

The charcoal industry and bush-to-electricity projects generate employment and income while combating bush encroachment, and are worthwhile economic activities. However, there is also an element of illegal cutting of non-encroacher trees, those which are valuable as fodder and/or legally protected, which is occurring, and is likely to increase as bush harvesting enterprises grow. At the same time, there is inadequate law enforcement from the Directorate of Forestry to monitor and/or prevent such activities.

This issue might be addressed through the establishment of the Namibia Woodlands Council, which could support the Directorate of Forestry in its administration and permitting, and make DoF staff available for field work and law enforcement. The concept of “Honorary Foresters” – members of the public who are granted some authority to monitor bush cutting and prevent illegal cutting of the wrong trees – also deserves attention.

MAJOR THREAT 3. CLIMATE CHANGE

An overview of expected climate scenarios for Namibia is provided in Annex C.

As a result of these predictions, most of Namibia’s tree and shrub savannah biome (comprised of Broad-leaved and Acacia savanna) will experience a gradual aridification in future decades. It is generally accepted that there will be a shift from grassy savanna to more arid shrubland in response to more frequent and intense droughts and the predicted 10% - 20 % drop in annual precipitation (in Turpie *et al.* 2010)

In the eastern part of Caprivi the response of the broad-leaved savanna to climate change is less predictable than the more western areas. This area, which straddles the edge of the high rainfall ITCZ, although subject to high variability, receives the highest rainfall in Namibia (> 600mm) and consequently supports the greatest abundance and diversity of plants and animals found in the country. It is characterized by diverse woodland with varying bush and grass undergrowth. The diversity and richness of the broad-leaved forests in this area is further enhanced by several large river systems (Zambezi-Chobe-Linyanti, Kwando, Okavango) which flow through the area creating a landscape of wetlands, floodplains, and riparian forests. Future precipitation in the Angolan highlands and Zambia (which fall well within the ITCZ) is predicted to increase in response to climate change (de Wit & Stankiewicz 2006).

Thus, streamflows in the northern perennial rivers, could experience a 10 – 15% increase in water volume by 2050 – with floods becoming more frequent and of greater magnitude. In theory these circumstances will favor riparian forests and the rich diversity of wetland species (Turpie *et al.* 2010).

However, an increase in river flows does not mean that riparian forest destruction will decline. In reality this will continue to occur as populations in the NCAs expand. Furthermore, increasing river flows are likely to result in more hydropower and irrigation schemes in Caprivi as well as the construction of flood control measures that will have a highly detrimental impact on the floodplains, biodiversity, ecological reserve and natural functioning of these river systems (NACSO 2010).

Other responses by forests to climate change include the decline in large trees found in westward flowing ephemeral rivers (linear oases) due to lower water tables, increasing elephant damage, and increasing upstream abstraction. In addition, there could be an increase in bush encroachment species in some areas – in response to poor land management and higher concentrations of atmospheric carbon dioxide (Turpie *et al.* 2010).

As people’s livelihoods become more threatened by difficult climatic conditions, rural poverty is likely to increase and with it rates of deforestation and increasingly unsustainable harvesting of indigenous forest products. Some commercially valuable INPs may benefit from climate change in Namibia (see box).

4. KEY OPPORTUNITIES

There is potentially great synergy between conservancies and community forests, but at the moment they are proclaimed and governed under separate legislation, so that custodianship over trees is not granted to conservancies, while custodianship over wildlife is not granted to community forests, even though the areas invariably contain both. This situation should be urgently resolved so that rural communities can benefit from all the natural resources that conservancies and community forests contain.

Establishment of the Namibia Woodlands Management Council and a system of “Honorary Foresters” are seen as being potentially valuable in supporting the Directorate of Forestry’s capacity to manage woodland and forest resources better.

There is a need to broaden perspectives on the value of woodland resources, especially in developing more commercial values and recognizing indirect benefits. The more Namibia does to preserve forests and woodlands, the greater its options in the future.

5. CONCLUSIONS

Namibia may not appear to be well endowed with forestry and woodland resources, yet this sector makes a surprisingly large contribution to the country’s economic development through the value of wood, food, and medicinal products.

Namibia should offer greater protection to forest and woodland habitats, promote the importance of these habitats, and increase the benefits derived from them through community-based management and commercial schemes.

Trees and woodland products should form an important part of Namibia’s adaptation strategy to future climate change, especially as rangeland resources come under increasing pressure and ways to diversify livelihoods are sought.

5. CONCLUSIONS

Despite some shortfalls in the Land Sector, Namibia has a suite of policies and laws that are largely conducive for biodiversity conservation and sound natural resource management. The implementation of these laws, however, and the use of environmental safeguard instruments (including impact assessment), is currently inadequate. Furthermore, there are sometimes conflicting, sectoral agendas, and unrealistic “visions” for Namibia’s future.

Terrestrial habitats and resources (water, forests, and wildlife) are under increasing pressure from a growing population that is experiencing increasing unemployment, poverty (especially in the rural areas) and the impacts of the HIV/AIDS epidemic. Land degradation, deforestation, the overstocking of domestic animals and the illegal fencing-off of private “farms” on communal land, are all areas of concern. Furthermore, intensifying development is resulting in:

- Unsustainable water abstraction and insufficient consideration regarding the future ecological water reserve
- The questionable expansion of large-scale irrigation projects
- Increasing offshore and coastal zone mining activity

As Namibia becomes hotter and experiences increasing rainfall variability and aridity (as predicted by recent climate change studies), losses in production will be most acutely felt in the agricultural sector (Turpie *et al* 2010). These losses will impact most severely on subsistence communities that have limited opportunity for livelihood diversification. These communities, in turn, are likely to place increasing pressure on rangelands, protected areas, and biodiversity.

Land degradation and biodiversity loss in Namibia is currently offset by two positive trends:

- The increasing tendency amongst some freehold farmers, to invest in wildlife, mixed wildlife/livestock herds, and to gradually remove fences
- The development and success of communal conservancies and the growth of the CBNRM movement – particularly in the northwest and northeast
- Investments from the private sector in eco-lodges

6. RECOMMENDATIONS

In order to address rates of land degradation and biodiversity loss in Namibia, active intervention is needed to accelerate a shift towards more resilient land and natural resource use within all sectors. These interventions include improving connectivity between Namibia’s protected areas, strengthening the existing CBNRM program and promoting integrated, more sustainable farming methods. These and other recommendations are discussed below, followed by less detailed suggestions for Namibia’s marine and coastal environment.

RECOMMENDATION: IMPROVE CONNECTIVITY BETWEEN NAMIBIA’S PROTECTED AREAS

There are opportunities for realigning Namibia’s PA for optimal conservation success. Partnerships between the MET, conservancies (especially on communal land adjacent to parks), private landowners, tourism operators, NGOs, private investors, and donor agencies must continue to be strengthened through the formation of multi-stakeholder committees with a joint focus on adopting sustainable and pro-conservation land uses.

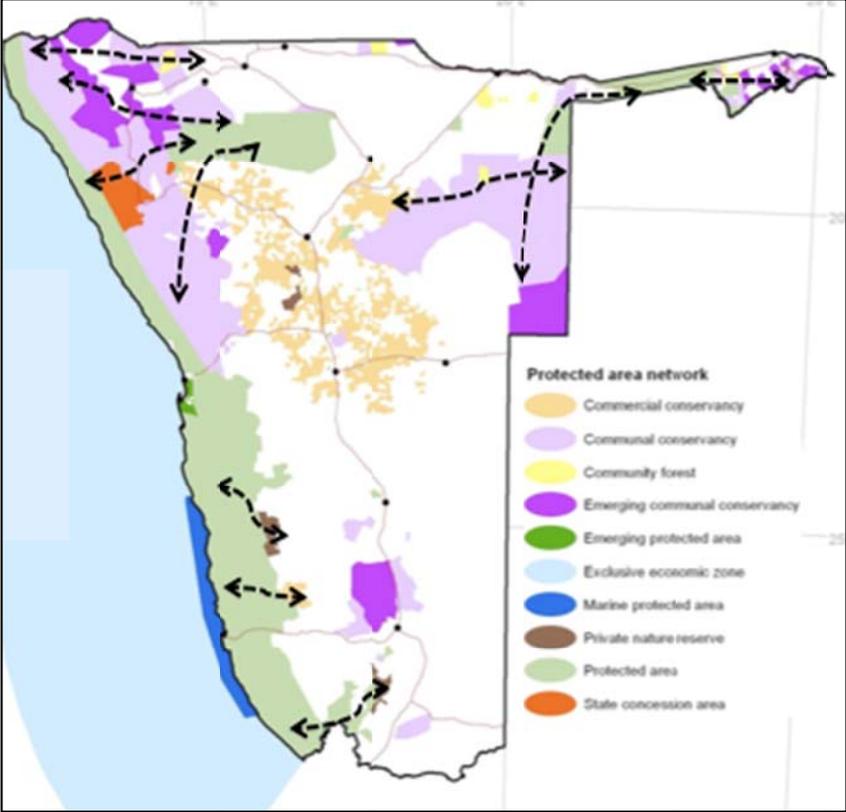


Figure 18: Namibia’s protected areas showing proposed corridors (stippled black arrows) that need to be established to create landscape level corridors for wildlife (Source: Turpie *et al* 2010).

Focus in the northwest should be on formalizing links between Etosha and the Skeleton Coast Park via the Kunene conservancies (Figure 18). This could be facilitated by expanding conservation areas and removing fences to provide “safe corridors” to facilitate repopulation of former home ranges and reintroduction of certain species. In the northeast (which incorporates the Bwabwata, Mamili, Mudumu and Mahango National Parks, Khaudum Game Park, the Mangetti Game Camp, and Waterberg Plateau Park) the key focus should be on establishing new conservancies (turning the conservation “patchwork” into a “network”) to provide protection for the eastern floodplains in Caprivi, as well as improving ecological linkages within the transfrontier conservation area.

By improving the connectivity of current PAs ecological functioning will be enhanced and landscape level corridors will be developed – corridors that will help to meet the challenge of the biomal shifts that are expected as a result of climate change.

RECOMMENDATION: BUILD ON THE EXISTING CBNRM PROGRAM

a) Weaknesses in the current CBNRM program must be addressed. Efforts to improve governance and capacity include:

- The development of entrepreneurship and managerial skills.
- Ensuring that management and decision-making structures are as representative as possible. Sub-committees (each representing a particular village, area, or interest group) are one possible strategy. Election of key leaders by the whole constituency, and not just by the management committee or board, is preferable.
- Harmonizing/integrating the management of resources wherever possible by improving communication between all relevant local level structures e.g. community forest committees, water point committees, farmers’ associations, and traditional authorities.
- Helping communities to have more influence in land use planning and project-level decision-making processes (e.g. pertaining to irrigation projects, development of dams, aquaculture projects, etc.).
- Develop opportunities to showcase (“market”) CBNRM and wildlife-based industries to relevant ministries including the MLR, MAWF, and MET so that there is greater appreciation at a high political level of the value of CBNRM, conservancies, and community forests. Lobby GRN to recognize and support freehold conservancies (currently neither recognized nor supported).
- Strengthen community-based forestry by raising awareness on and developing appropriate procedures for realizing the true value and sustainability aspects of timber harvesting (especially in Caprivi and Kavango). Currently, wood is sold at very low prices and there is inadequate control over tree harvesting both on the outskirts of towns and settlements and in the rural areas.
- Develop community-based inland fisheries. The GRN should be lobbied to revise inland fisheries legislation so that:
 - Fish can be managed by conservancies.
 - Regulations take cognizance of the different types (and sizes) of fish in the various rivers associated floodplains – current clauses prevent optimum utilization of fish resources.
 - Local community control over commercial exploitation of fish stocks can be effectively regulated.

- Low-input fish ranching can be promoted and supported using carefully selected local indigenous fish species.
- Strengthen community-based tourism by:
 - Lobbying for improved access by conservancies (communal or freehold) to gain concessions and other rights in State-owned parks, so that conservancy tourism products are more viable.
 - Where appropriate, fences between these compatible forms of land use need to be removed or breached so that connectivity is improved and open landscapes are achieved – this will be good for tourism, biodiversity, and coping with climate variability and increasing aridification.
 - Build management capacity (especially in cases where a private sector partner is absent or unlikely to emerge – e.g. a community campsite).
 - Facilitate agreements (where necessary) between conservancies and investors.
 - Assist conservancies to identify and develop tourism products. Promote the adoption of Namibia’s Eco-Award criteria, which address issues such as the maintenance of “sense of place,” aesthetic design, water and energy efficiency, benefit sharing, and on and off-site impacts.

RECOMMENDATION: IMPROVE TENURE

As mentioned in previous ETOAs, achieving appropriate tenure rights for communities over as many natural resources as possible is one of the highest priorities in terms of enabling people to reduce their impact on Namibia’s environment. Rights over natural resources, including wildlife, fish, grazing, water, and forests, will provide communities with incentives to make long-term, sustainable investments in the land.

- There should also be secure, bankable tenure over commercial opportunities such as tourism, so that there is a reduction in the risks posed by private sector entrepreneurs who wish to invest as development partners in conservancies. Furthermore, more effective and extensive devolution of rights should be linked to incentives for co-managed landscapes (e.g. group accountability and delivery of larger open systems being directly linked to more rights and less bureaucracy).
- Better management of wildlife for production, especially in lieu of increasing and more stringent droughts – e.g. looking at carrying capacity of wildlife with livestock and addressing policy issues regarding offtake.

RECOMMENDATION: PRACTICE SUSTAINABLE IRRIGATION

Irrigation in a water-stressed country such as Namibia is controversial in terms of land and water use but the Green Scheme initiative is firmly set in the GRN’s sights for the future. Assistance is needed in:

- Supporting local community-based small-medium scale irrigation projects (a short distance away from rivers). This will enhance household food security, diversify livelihoods, and reduce vulnerability to climate variability.
- Improving irrigation efficiency for both small and large-scale irrigation farming.
- Identifying areas in or near conservancies that are likely to be targeted for major irrigation schemes and pro-actively undertake studies (e.g. cost benefit and mini-impact assessments) that will influence future decision making about those intended projects.

RECOMMENDATION: LAND-USE ZONATION

Encourage land-use zonation based on comparative advantages of the land (e.g. presence of attractive scenery, wildlife populations, opportunity for mixed wildlife/livestock farming, presence of valuable minerals) within the context of climate variability and risks such as drought and floods. A multi-sector approach to planning and decision-making, and the consistent use of safeguard tools such as Impact Assessment needs encouragement.

RECOMMENDATION: ADDRESS ISSUES RELATING TO THE RESETTLEMENT PROGRAM

Support the MLR with focused policy/legislation revision, so that the land policy does not further exacerbate land degradation and socio-economic decline.

RECOMMENDATION: BUILD CAPACITY IN MET AND IMPROVE POLITICAL WILL REGARDING EAS

There is a strong need to improve capacity within the MET with respect to reviewing and guiding EIAs and to showcase the value of environment assessment (EA) and strategic environmental assessment (SEA) as a sustainable development tool.

As Namibia experiences more environmental variability and more aridity, tourism and wildlife-based enterprises should gradually replace livestock farming. As a result, the MET should become one of the most important ministries and will need increasing support with respect to improving human resources and capacity for sustainable planning and cross-sectoral/integrated management. Ultimately, the GRN (especially MET) needs to start thinking about wildlife (both inside and outside of National Parks) in production and economic terms and not simply conservation terms.

RECOMMENDATION: PROMOTE INTEGRATED, SUSTAINABLE FARMING

Despite Namibia's climatic and other geographical constraints, farming is still vitally important to the livelihoods of the majority of rural Namibians who depend upon crop cultivation and livestock ownership for food security and currency.

- Lobby for consistent implementation of the Drought Relief Policy – and assist where possible in this regard.
- Improve and up-scale human wildlife conflict (HWC) mitigation efforts. In particular:
 - More effort needed to find ways of preventing and coping with HWC – particularly greater devolution of rights and responsibilities at the local level, combined with farmer training in HWC mitigation measures.
 - More interaction needed with agriculture extension officers so that they are better equipped to help address HWC.
- Provide more support to conservation farming initiatives (e.g. minimum tillage of rainfed cropping areas) and greater publicity of successful pilot projects.
- The issue of compartmental fencing for veterinary control purposes must be addressed. Efforts should be made to promote commodity-based trade of livestock products, which addresses disease-control through meat processing (i.e., deboning, chilling, etc), rather than compartmentalization. This would reduce the need for veterinary fences and open up large landscapes across southern Africa for re-establishment of traditional seasonal movement/migration patterns which will become even more important under climatic conditions that are likely to become increasingly arid.

- More support to efforts aimed at integrating livestock and wildlife farming and improving rangeland management (the two issues are linked), both on communal and freehold land. Ideas include:
 - Monitoring carrying capacity of livestock plus wildlife together against annual rainfall and fodder availability, and managing accordingly against decisions made early in the season
 - Investigating options for reintroduction of high-value buffalo into traditional large-stock farming areas, so that increased venison production, opportunities for trophy hunting, tourism, and live sale of disease-free animals can gradually compensate for declining beef output as a result of climate change. CBNRM partners could lobby government to reconsider its current policy on the relocation of buffalo to various parts of Namibia (currently confined, due to veterinary legislation, to the eastern Kavango and Caprivi regions, with two small populations of disease-free animals in the Waterberg Plateau Park and in a fenced game camp in the Nyae-Nyae conservancy). Permitting sales to conservancies and local farmers (disease-free individuals sell for about N\$250 000) would increase the revenue of wildlife producers (including conservancies) by an estimated 35%. The first step could be an independent economic and livestock risk assessment to help decision makers find a way forward on this issue.
 - CBNRM experts could train agriculture extension officers so that more balanced advice is given to farmers. Opportunity exists to support/become involved in the MCA livestock and rangeland project.
 - Farmers (whether through Namibia Agricultural Union – NAU, Namibia National Farmers Union – NNFU or local level) need to be informed and knowledgeably convinced about the economic and environmental value of game farming and the removal of fences - especially in lieu of Namibia’s future climatic constraints.
- Promote and support all opportunities to diversify livelihoods to include “off-farm” value adding, marketing, trade, and services. Relatively low-input activities such as bee-keeping, poultry production, irrigated market gardening, indigenous nurseries, together with improved efficiencies in main production systems such as minimum tillage (conservation) farming, better rangelands management, better wildlife management, more efficient water management, intensification of tourism, can offset the impacts of increasing climatic variability and result in better returns per ha that are currently being achieved.

RECOMMENDATION: STRENGTHEN WATER RESOURCES MANAGEMENT.

- Support the work of existing river basin management committees.
- Where they don’t already exist, promote/facilitate the establishment of BMCs, especially for the westward flowing linear oases in Kunene where there are established conservancies, and for the Kwandu-Linyanti system.
- Assess potential for Ramsar Site declaration of Zambezi and Kwandu-Linyanti systems, as well as the Kunene mouth.

RECOMMENDATION: DEVELOP INTEGRATED COASTAL ZONE MANAGEMENT

Sustainable development strategies along the Namibia coast include zonation and sound development planning, the use of SEA and EIA tools to ensure that decision making is consistent and inclusive, and encouraging far greater cooperation between institutions than has been the case thus far. The legal framework is largely in place to enable this.

RECOMMENDATION: DEVELOP SUSTAINABLE MARICULTURE

Sustainable mariculture offers possibilities for protein-rich food production and economic development within the BCLME. There is increasing interest in the industry – both from Government (research and planning) and the private sector within the BCLME region. Iitembu (2005) has completed a viability analysis of several species and, in addition to oysters and black mussels, considers Namibia’s waters highly viable for the future expansions of abalone and rock lobster.

ANNEX A.

INDIVIDUALS CONSULTED

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ANNEX B.

SCOPE OF WORK FOR USAID/NAMIBIA ENVIRONMENTAL THREATS AND OPPORTUNITIES ASSESSMENT WITH AN EMPHASIS ON TROPICAL FORESTRY AND BIODIVERSITY CONSERVATION

1. PURPOSE

The purpose of this work is to deliver to USAID/Namibia a countrywide Environmental Threats and Opportunities Assessment (ETOA), with a special focus on Tropical Forestry and Biodiversity Conservation needs, and related issues analysis that will inform the USAID/Namibia Operational Plans (OP) and Country Operational Plans (COP), joint country assistance strategy and USAID-only country strategic plan in the coming years, under ADS 201.3.4 and ADS 204.5. Based on the results of this assessment, this work will provide recommendations to USAID/Namibia on how to efficiently contribute to the conservation needs identified, and plan for environmentally sound development and humanitarian interventions. The last ETOA of USAID Namibia was conducted in 2003 and the last update on the 118/119 analysis was in 2005.

2. BACKGROUND AND JUSTIFICATION

Updating the ETOA and revisiting FAA 118/119 analyses are justified for three reasons:

The first reason is related to the **strategic and operational planning process** requirements. The ETOA is a useful programming tool which will help USAID/ Namibia to update its data and assumptions on the national environmental status and better integrate environmental concerns into its overall programming during the annual operational planning (OP) and country operational planning (COP) processes and long term strategic planning.

The second reason is linked to the **environment requirements**. The core environmental requirements of USAID operating unit strategic plans are spelled out in 201.3.4.11.b Technical Analysis for Strategic Plans, Environmental Analysis, and are derived from provisions of the Foreign Assistance Act (FAA) of 1961:FAA 117 on "*Environment and Natural Resources*," and dictate that operating units will implement their programs with an aim toward maintaining (and restoring) natural resources upon which economic growth depends, and consider the impact of their activities on the environment. USAID/Namibia recognizes that protection of the environment and wise management of the natural resources base are absolute requirements of any successful development program. The legal requirements of the FAA are reflected in USAID's *ADS Chapter 204 "Environmental Procedures*," which provides essential procedures and policy on the application of *22 CFR Part 216*. This regulation codifies the Agency's procedures "to ensure that environmental factors and values are integrated into the USAID decision making process." Further, *22 CFR 216.5* requires USAID operating units to conduct their assistance programs in ways that are sensitive to the protection of endangered or threatened species and their critical habitats. Sections 118 "*Tropical Forests*" and 119 "*Endangered Species*" of the FAA codify the more specific U.S. interests in forests and biological diversity. These two provisions require that all USAID Missions conduct a periodic country analysis of the conservation and sustainable use of tropical forests and biological diversity. Specifically, FAA Sections 118 and 119 require that all country plans include: (a) an analysis of the actions necessary in that country to achieve conservation and sustainable management of tropical forests (118) and conserve biological diversity (119); and (b) the extent to which current or proposed USAID

actions meet those needs. By mandating these analyses, Congress is recognizing the fundamental role that tropical forests and the conservation of biodiversity play in sustainable development.

The third reason concerns the **new developments in Namibia's environmental context** which need to be taken into consideration at the programmatic level:

- Science has confirmed that the Earth's climate is warming. Namibia has been identified as being significantly vulnerable to climate change variation (increased temperatures, reduced precipitation, increased drought and other extreme weather events such as floods). These changes will have significant impacts on both terrestrial and marine ecological resources. Changing temperatures may also impact the length of seasons and ultimately change the migration patterns of a host of wildlife species.
- Namibia's limited underground water supplies are being increasingly overexploited because of state subsidies on the price of water, and a policy that favors meeting water demand rather than managing and reducing it. In addition, the quality of Namibia's few perennial rivers and the critical habitats alongside them are being degraded by unsustainable range management practices and overgrazing. Programs in the Okavango and Zambezi river basins are underway to improve cross-border management of water sources.
- The increasing importance of community-based natural resource management has implications for both the Namibian environment and its peoples. Through the USAID funded LIFE (Living in a Finite Environment) program, significant strides have been made in connecting Namibian communities to their natural resources. However, settlements in forests and conservancies are in conflict with animal behavior such as elephant migratory patterns and a thorough understanding of how this evolving relationship helps define the environmental context of Namibia is important. The Millennium Challenge Corporation programs are addressing tourism opportunities in the conservancies.
- In 2004 Namibia developed a national development strategy known as *Vision 2030*. Identifying wildlife and tourism as critical to Namibia's development, the Vision stresses the importance of maintaining the integrity of the natural habitat and wildlife populations, and promotes low impact, consumptive and non-consumptive tourism.
- On December 27, 2007 the Environmental Management Act, 2007 (Act No. 7 of 2007) was promulgated to promote the sustainable management of the environment and the use of natural resources by establishing principles for decision making on matters affecting the environment. The objectives of the Act are to prevent and mitigate the significant effects of activities on the environment. . The Ministry for the Coordination of Environmental Affairs (MICOA) has the responsibility for promoting and coordinating the implementation of sound environmental policies. The National Environmental Management Program (NEMP) was drawn up for this purpose.
- While the development of Reduced Emissions from avoided Deforestation and Degradation (REDD) activities is in its nascent stages in Namibia, there is increasing interest in community-based REDD strategies across Southern African dry forests. As these programs begin to be discussed and developed at the national and community levels, USG programs might also be interested in collaborating with REDD activities in the short and long-term in Namibia.
- Rising commodity prices have increased incentives for higher levels of water-intensive mining activity for diamonds as well as precious metals, such as copper, lead, zinc, tin, silver and tungsten. In addition, Namibia is expected to continue to be one of the leading exporters of uranium in the world fueling the growing global demand for nuclear power.

- The World Food Program (WFP) and International Food Policy Research Institute (IFPRI) data show that nearly a fifth of all Namibians suffer from chronic food insecurity and fully one quarter of the Namibian population is undernourished. Three in ten children in Namibia under the age of five are stunted. Recurring droughts and floods exacerbate the already high risk of a future food security crisis in Namibia.
- The HIV/AIDS epidemic has expanded rapidly in Namibia with prevalence among the general population estimated at 13.3% in 2009, and an HIV Ante-natal Care (pregnant women) sentinel survey rate of 17.8%, placing it among the most affected countries. Namibia also has one of the highest TB case notification rates in the world, and has a 60% TB/HIV co-infection rate. Potential direct and indirect environmental impacts resulting from activities supported by the HIV/AIDS and Health Program include the disposal of medical waste (e.g., HIV/AIDS testing kits, TB screening supplies, and other biological samples) and the storage, management and/or disposal of public health commodities, including pharmaceutical drugs, immunizations and nutritional supplements.

3. USAID PROGRAMS IN NAMIBIA

In its first 20 years of independence, Namibia has made impressive progress establishing a free, viable nation. Namibia's press is one of Africa's most free, and it has one of the highest "business competitiveness" rankings and the lowest levels of corruption in sub-Saharan Africa. However, Namibia is confronted by two formidable challenges: controlling one of the world's worst HIV/AIDS epidemics and correcting the world's worst income disparity, which leaves far too many in poverty. Namibia has a generalized epidemic with an adult national prevalence of 13.3% and with transmission occurring primarily through heterosexual contact. In 2008/9 there were an estimated 174,196 people living with HIV in Namibia of which 80% of those eligible are receiving ART. Estimates of orphans & vulnerable children (OVC) differ based on methods used, there are likely between:

- 113,000-152,000 orphans (13-17% of all children)
- 128,000-250,000 OVC (14-28% of all children)

Despite a relatively high gross national income of \$4,200 per person, Namibia has one of the largest income gaps between rich and poor in the world, and over half of Namibians survive on less than two dollars a day. USAID works to provide critical support to prevent and treat HIV/AIDS and tuberculosis, and to support Namibia's struggling education system.

Investing in People - Health: To respond to one of the worst HIV/AIDS epidemics and the highest tuberculosis case rate in the world, the United States provided nearly \$100 million to Namibia in 2009 through the U.S. President's Emergency Plan for AIDS Relief. USAID's programs focus on providing treatment, care and services to people living with HIV/AIDS (PLWHA) and orphans and vulnerable children, reducing the spread of HIV, and supporting Namibia's national tuberculosis program. USAID has funded palliative care for 26,866 people and services to 45,304 vulnerable children. Five hospitals and 51 health centers provided anti-retroviral treatment and services to prevent mother-to-child transmission of HIV, and 53,507 clients received counseling and testing at 14 USAID-funded centers. USAID also launched a program to treat and care for those co-infected with tuberculosis and HIV/AIDS, which has reduced the prevalence of tuberculosis by 20 percent in just the past five years.

Investing in People - Education: With two-thirds of Namibia's sixth grade students lacking reading and math skills and 51% Grade 10 failing, USAID is helping improve teaching quality of core subjects. Trainings provided to teachers, administrators, school boards, and parents to improve the quality of education were so successful that the Namibian government replicated it nationwide. This intensive

training led to an 8 percent average improvement in student performance in primary schools in targeted regions. USAID also helps increase the capacity of the Ministry of Education to establish and implement effective, equitable HIV/AIDS policies and strategies to improve teaching and learner performance and to increase the number of vulnerable children having access to education.

Humanitarian Assistance: In 2008 and 2009, Namibia experienced record-setting seasonal floods in the north, where the majority of Namibia's poor reside. Approximately 300,000 Namibians-nearly 15 percent of the population-were affected. Many were driven from their homes and lost what few possessions they had in the flood waters. Many more lost vital subsistence crops and livestock. The United States provided funding and support through UNICEF and the Namibian Red Cross to respond to the emergencies. USAID also assisted the Government of Namibia in preparing for future emergencies by supporting disaster response planning.

4. STATEMENT OF WORK

The assessment team shall perform the following activities organized into 3 steps:

4.1. Data collection

4.1.1. Pre-travel informational meetings and information gathering.

Prior to traveling to the field, the assessment team is expected to:

- Gather and get acquainted with existing background information on Namibia such as the country's natural resources, geographical, ecological and biological specificities, current status of environment and biodiversity, policies and strategies, institutional organization at the entity and State levels, key stakeholders and donors in environment and biodiversity, legislation related to the environment and biodiversity, and other relevant information required for the country assessment.
- Meet or speak with key stakeholders or managers at USAID, the World Bank, USDA agencies (including Forest Service), Millennium Challenge Corporation (MCC), World Wildlife Fund, IUCN, Cheetah Conservation Fund, and other organizations involved in biodiversity conservation in Namibia or relevant regional efforts.
- Hold meetings with the Bureau Environmental Officers (BEO) and the Bureau Environmental Advisor (BEA) in the USAID Bureaus for Africa and Global Health and relevant AFR/EGAT/NRM staff to ensure full understanding of USAID environmental procedures, the role of the bureaus in environmental compliance, and purpose of this assignment.

4.1.2. After arrival in the field

The field team will conduct an overview and general analysis of the country's environment, forestry and biodiversity and their current status. Upon arriving in Namibia, the team will:

- Meet with USAID/Namibia to get a solid understanding of Mission program goals and objectives under its current Operational and Country Operational Plans, and perspectives of this assignment and specific interests for the team, including advice and protocol on approaching USAID partners and host country organizations with respect to this assignment. The team shall be aware of sensitivities related to an assessment exercise (i.e., the potential for raising expectations, and the need to be clear about the purpose of the assessment) and respect Mission guidance. The team will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.

- Hold meetings with donor organizations (e.g. the World Bank, UNDP, UNICEF, FAO, WFP), international NGOs (IUCN, WWF, Cheetah Conservation Fund) and local NGOs (Namibia Association of Community-Based Natural Resource Management Support Organizations (NACSO), Namibia Nature Foundation (NNF), Integrated Rural Development and Nature Conservation (IRDNC), Namibia Community-Based Tourism Association (NACOBTA), Rossing Foundation, Namibia Water Partnership), relevant government agencies such as the Ministries of Environment and Tourism; Agriculture, Water & Forestry; Lands and Resettlement; Fisheries and Marine Resources; and Trade & Industry, other organizations (University of Namibia, Southern African Institute for Environmental Assessment), the private sector and communities that are knowledgeable about environment, biodiversity and tropical forestry conservation or are implementing noteworthy projects and gather information locally.
- Conduct at least two priority site visits to the North East and South West of the country which would supplement understanding of USAID’s programs, or of environment and biodiversity issues that arise in interviews and literature or would confirm information in previous assessments. The site(s) for field visits will be determined by the team prior to the assessment in consultation with USAID.
- Ecotourism development presents interesting opportunities within the environmental arena, while also presenting economic growth potential to Namibian communities and should be particularly researched. Namibian tourism is an established industry and opportunities should be examined on how to expand the beneficiaries of this industry. In particular, projects which support community-based ecotourism, such as the MCC and NACSO-CESP projects which support small tourism enterprises like campsites and cultural villages should be evaluated and visited if possible.

4.2. Analysis

- Evaluate how the recommendations of the previous ETOA (2003) and the updated FAA 118/119 assessment (2005) have been implemented by USAID/Namibia and draw the lessons for the new ETOA and FAA 118/119 assessments.
- Assess and summarize the needs for environment, human welfare, biodiversity and tropical forestry conservation in Namibia based on key threats and opportunities and analysis of country, donor, NGO, private sector and community responses to meet these needs.
- Prepare a report on the status of environment, human welfare, biodiversity, tropical forestry and conservation efforts in Namibia and potential implications for USAID or other donor programming and environmental monitoring which shall define the actions necessary for environmental management and conservation.

4.3. Report

This report will provide details on the threats and opportunities and major participants in the environment, biodiversity and forest conservation sectors of Namibia, as well as information on current U.S. Foreign Assistance and USAID programming, with recommendations on actions necessary to conserve environment, human welfare, forests and biodiversity. This document would contribute to meeting the legal requirements of FAA 118/119. That is why it shall include the following:

- The current status of environment, human welfare, biodiversity and tropical forests in Namibia based on current and available information. At the environment level, the report will document the biophysical condition, productivity, abundance, and distribution of key natural resources as well the state of management of those resources, and identify threats (*e.g.*, degradation, depletion,

pollution) to which they and humans are subjected. The status of biodiversity will include major ecosystem types, highlighting important, unique aspects of the country's biodiversity, including important endemic species and their habitats, genetic diversity, agricultural biodiversity, ecological processes and ecosystem services, and values and economics of biodiversity and forests.

- A map of potential natural vegetation and of land use or land/forest cover should be provided if available.
- Descriptions of natural areas of critical importance to biodiversity conservation, such as forests and wetlands critical for species reproduction, feeding or migration, if relevant. Particular attention should be given to critical environmental services and non-commercial services they provide (watershed protection, erosion control, soil, fuel wood, water conservation and amenity and recreation). It will also summarize how current land tenure arrangements affect conservation in Namibia.
- Descriptions of natural areas of critical importance to biodiversity conservation such as deserts and semi-desert areas particularly with regard to land degradation, soil erosion, fauna and flora adaptation and practices of indigenous people to preserve the environment.
- An overview table and map of the status and management of protected area system in Namibia including: an inventory of all declared and proposed areas (national parks, wildlife reserves and refuges, forest reserves, sanctuaries, hunting preserves and other protected areas).
- The inventory will provide an overview of the major threats and challenges facing protected areas in Namibia including vulnerability of areas to predicted changes in climate, and a brief summary of any recognized economic potential of these areas (including productive assets, environmental services and recreation and tourism opportunities) should be provided.
- Descriptions of plant and animal species that are endangered or threatened with extinction. Endangered species of particular social, economic or environmental importance should be highlighted and described, as should their habitats. Technical information resources such as the IUCN red list and their websites should be referenced for future Mission access as required. This section should not emphasize species counts, but look at the relation of endangered species and important habitat conservation areas and issues, and evaluate the pressure on those areas, including vulnerability to predicted changes in climate, and current efforts to mitigate pressures, including the participation and compliance with CITES and other international efforts.
- Recent, current, and potential primary threats to environment, human welfare and biodiversity, whether they are ecological (i.e., fire, pests), related to human use (i.e., agriculture, contamination), or institutional (i.e., failed policy) or trans-boundary issues, as appropriate. These should emerge from a general assessment of national policies and strategies and their effectiveness, issues related to institutional capacity, trade, private sector growth, participation in international treaties, and the role of civil society.
- Conservation efforts, their scope and effectiveness. This section also should include recent, current and planned activities by donor organizations that support biodiversity and tropical forestry conservation, identification of multilateral organizations, NGOs, the private sector, universities, and other local organizations and communities involved in conservation, and a general description of responsible government agencies. A general assessment of the effectiveness of these policies, institutions, and activities to achieve biodiversity conservation

should be included. Priority conservation needs that lack donor or local support should be highlighted.

- Analysis of the current legislations and policies related to the environment, human welfare, forestry, biodiversity, and climate change. This section should include identification of laws and policies related to protection and management of biological resources and endangered species. It should also point out any differences in laws and policies that require further harmonization. This section should also review international treaties signed and ratified, as well as those that Namibia needs to sign in order to conserve and manage its biological resources more efficiently.
- An overview of the major environment, biodiversity and tropical forest conservation activities of the commercial private sector to identify ways to better foster private sector alliances. Of interest are the norms and standards followed by those commercial entities most engaged in management and use of Namibia's tropical forests and tracts near protected areas, including tourism developers. Consideration of policies promoted by the key relevant governmental ministries should also be included.
- An overview of climate change activities in Namibia: past, present and future. How they affect the development and environment, strengths and weaknesses, gap analysis, REDD activities, potential synergies with USAID programming, opportunities for intervention for USAID and other donors, and communities, strategies to address climate vulnerable areas, etc.
- A brief overview and recommendations for environmental concerns related to USAID's health and education programs, especially with respect to HIV/AIDS programs and medical waste disposal. As the most significant portion of USAID's programming in Namibia, the health, education, environment and democracy portfolios represent a not insignificant area in which USAID can affect the environment. This should include an analysis of how climate change variation might affect the health sector (drought, famine, flood, malaria outbreaks, etc) and how the health sector may affect the environment so that USAID/Namibia can better prepare its programs to adapt to these changes.
- An assessment of how USAID's programs and operational plans meet the needs for environment, human welfare, biodiversity and tropical forestry conservation, and climate change consistent with Mission program goals and objectives, through strategic objectives and project implementation. The assessment shall include recommendations on where U.S. comparative advantages and capabilities are likely to have the greatest impact. These issues and recommendations should be prioritized to identify those requiring the most immediate attention. This section shall identify opportunities and entry points for USAID/Namibia efforts that would positively influence the conservation of the environment, tropical forests, biodiversity and human welfare and improve environmental management. Particular focus should be made on activities that are environmentally sound, commercially viable (sustainability), occur in population dense areas (affect the most people possible), have market access (make use of the road networks) and have agricultural potential (food security).
- A brief section of how USAID/Namibia could expand its inter-governmental collaboration and cooperation with other USG agencies (USFS, Department of State, USFWS, etc) in the areas of climate change, biodiversity, forestry, and conservation.

Illustrative Outline:

- a) Introduction, describing the biophysical/human/economic contexts, environmental laws, policy and institutions, overview of environmental programs and initiatives, and the purpose of the present review
- b) An overview of the state of the natural resources, including forests and terrestrial biodiversity, aquatic ecosystems, and agricultural resources
- c) An analysis of past and current initiatives in Namibia
- d) Climate Change section
- e) Health section
- f) Opportunities and entry points for USAID/Namibia, including integrated threats analysis, optimal results areas, analysis of legal requirements under the FAA, interventions of other donors, recommendations of environmental experts and recommendations of opportunities and entry points.
- g) All references used and cited in the report, including Web URLs, people consulted, and their institutional affiliation, endangered and protected species and authors' biographical data. Other references such as the SOW for the analysis, other background or supporting material, including maps and photographs should be included. Copies of key documents, maps and images, and copies of photographs obtained during the assessment should also be appended in a CDROM with electronic versions of written materials.

5. EXPERTISE REQUIRED

A multi-person team with the following composition and expertise is required to conduct this analysis:

- **International Technical Assistance (1 person):**
 - Senior Level Natural Resources and Environmental Management Specialist with post-graduate qualifications in biology, zoology, forestry or closely related field in natural resource management or natural resource economics.
 - Background in tropical biodiversity and natural resource conservation.
 - Experience in integrating health, environment, population and poverty reduction issues.
 - Knowledge of USAID Strategic Planning process related to Environmental Threats and Opportunities Assessment and Tropical Forestry and Biodiversity (FAA Sections 118 and 119).
 - Knowledge of 22 CFR 216 and of FAA 117.
 - Demonstrated expertise in assessing development programs for impacts on environment and tropical ecosystems.
 - Demonstrated expertise in the design and production of environmental impact assessments (EIA).
 - Experience in Southern African region and in Namibia desirable.

- **Local Technical Assistance (1 person).**
 - Senior Level Natural Resources and Environmental Management Specialist or Environmental Policy Analyst with demonstrated experience in Namibian natural resource management.
 - General knowledge of Namibian land use, wildlife, forestry, marine fisheries, coastal management, tourism, water, and indigenous natural products sectors, and the relationships of climate change and health to these various sectors.
 - Good contacts within Namibian government agencies, international and in-country NGOs, international donors, and private sector preferred.

6. DELIVERABLES

The main deliverable is an Assessment Report (40 to 60 pages without appendices) for

USAID/Namibia that examines the environmental threats and opportunities, the biodiversity and the tropical forests conservation and other environmental and human welfare management related issues and identifies contributions and/or potential contributions to meeting identified environmental needs by the Mission's operational plans. Other deliverables are the following:

- Oral in-briefing shortly after arrival and debriefing within five working days preceding the departure date. The team shall meet with USAID/Namibia to provide them with a brief of the report findings. The exit brief shall be accompanied by a presentation and short written summary of initial key findings and recommendations.
- Following a two week comment and review period, a revised final report incorporating all comments will be submitted within five weeks of the field work.
- Three copies of the bound final draft and an electronic copy will be made available when the final report is approved by the Mission.

7. ANTICIPATED LEVEL OF EFFORT

The consultancy will be carried out within the period of September 15, 2010 through October 31, 2010. About 15 days will be in-country, 30 days will be for preparation and wrap-up, and 3 days for travel. The international consultant will oversee the work of the local-hire consultant. The international consultant will work under the technical direction of the Africa Bureau Environmental Officer and the United States Forest Service Africa Program Coordinator. The Senior Regional Environmental Officer based at USAID/Southern Africa and the USAID/Namibia Mission Environmental Officer (MEO) will have an advisory role.

8. SCHEDULE AND LOGISTICS

The team will coordinate logistical arrangements with the USAID/Namibia Mission Environmental Officer and the MEO will accompany the team on site visits. The Mission will assist the team by providing key references and contacts as well as logistical support where necessary. USAID/Namibia's Program Office will also help facilitate meetings with other Mission SO Team Leaders or their staff to fully brief the team on USAID's program and future vision for their strategy. Field work in Namibia will take place from September 27, 2010 to October 8, 2010. The report is due within 5 weeks after the field work.

9. SELECTED REFERENCE DOCUMENTS

- USAID 2003 ETOA
- USAID 2005 118/119 Assessment
- USAID/Namibia Annual Report(s)
- Namibia Vision 2030: Policy Framework for Long-Term National Development
- 3rd Namibian Government National Development Plan (2007/08 – 2011/12)
- Namibia's Communal Conservancies – State of Conservancy Update 2008 (NACSO annual report)
- Integrated Water Resources Management Strategy and Action Plan - Ministry of Agriculture, Water and Rural Development
- USAID Support to the Community-Based Natural Resource Management Program in Namibia: LIFE Program Review
- USAID/Namibia Health and Education IEEs dated 10 August 2010
- USAID/Southern Africa Environment and Democracy program - Program Descriptions and IEEs
- Namibia Environmental Policy (2007)
- USAID/Namibia 2011 Operational and Country Operational Plans
- MoHSS Medical Waste Management plan
- MoHSS Infection Prevention Control Guidelines
- GRN Draft Climate Change Strategy
- GRN Draft Disaster Management Policy

ANNEX C

Interpretation of CC projections for Namibia (After Turpie *et al* 2010)

Because of the high level of uncertainty in projections for future climate in southern Africa, particularly of rainfall change, it seems useful from a policy perspective to estimate the potential ranges of impacts, including high, median and low impacts, by 2050, as it is unlikely that the uncertainty range will be reduced in the near future, and because of the impacts of current levels of climate variability in the region. Variability is likely to dominate the climate signal for at least a few decades until clear climate change signals become evident. Using high resolution spatially downscaled climate information seems of little use in this regard, as it is more important for policy development to estimate the impacts particularly at the median and “tails” of the distribution of possible future climate scenarios. Estimates at the tails of the distribution can provide an assessment of impacts that have a low probability but a high societal relevance if they do occur.

Climate scenarios that are currently generated using General Circulation Models (GCMs) have two main sources of uncertainty that result in a relatively wide range of projections, especially for rainfall futures, for southern Africa in particular. These are 1) the GCM design itself, which varies between the several models used in the IPCC AR4, and 2) the emissions scenarios used to drive the GCMs. The largest source of uncertainty by the middle of this century is due to GCM design, and rather little is due to emissions scenario. Emissions scenario is however an important source of uncertainty and variation for simulations towards the end of the century. As mentioned above, due to the potentially large range of uncertainty in scenarios, it seems of little value to focus on fine spatial scales for climate scenarios and impacts studies, as by far the largest source of uncertainty is at large spatial scale. It is also of limited value to consider a range of emissions scenarios, but rather to focus on understanding the range of GCM variation, and to attempt to represent impacts that might relate to the median and the extremes of that range for policy relevant information.

Unfortunately it is currently difficult to obtain spatially downscaled climate projection data for measures other than rainfall or temperature for southern Africa outside of South Africa for the IPCC AR4 climate projections, especially for the middle of this century. We have thus compared the best available information for the IPCC AR4 generated by GCM's for the year 2100 (median projections of 21 GCMs, driven by the A1B emissions scenario) with the interpolated HADCM3 GCM data used for the previous most comprehensive impacts assessment on Namibia for 2050 (Midgley *et al* 2005). Because this comparison (Figure A) shows that the HADCM3 GCM used by Midgley *et al.* (2005) represents roughly a median climate future for the 21 AR4 GCMs, climate surfaces representing rainfall and temperature change at the monthly temporal scale for 2050 and 2080 have been created for this project using the HADCM3 GCM (as driven by the A2 scenario). These have been overlaid on a current climate surface that is taken from the recognized and quality-controlled WorldClim data set and used for impact assessments of species-level change.

Comparison of IPCC AR4 scenarios with those used by Midgley *et al* (2005) reveal that the median rainfall change projected for 2100 by the IPCC AR4 (between 5 and 20% reduction) is comparable to the least extreme median rainfall change used by Midgley *et al.* (2005), represented by the HAD CM3 model for 2050, under an A2 emissions scenario. By 2080, this scenario suggests a more extreme rainfall change of between a 10 and 30% reduction. The 2050 scenario used by Midgley *et al.* (2005) shows a relatively spatially uniform rainfall change, with the largest reductions of ~ 20% across the centre of Namibia, with more severe drying suggested in the northwest and on the central coast. This contrasts with the IPCC

AR4 spatial pattern that suggests more severe drying of up to 20% in the south, and less drying in the north (between 5 and 10% reductions).

This suggests that rainfall impacts as modelled by Midgley *et al.* (2005) may tend towards the conservative in the south, and be less conservative for the north-west and northern coastal regions. Temperature increases modelled by Midgley *et al.* (2005) agree well with those projected by the IPCC AR4 for 2100, of around 4°C.

One key feature of Namibia's climate is the coastal fog system, which is known to be key for several elements of biodiversity, but there are unfortunately currently no credible projections of change for this system.

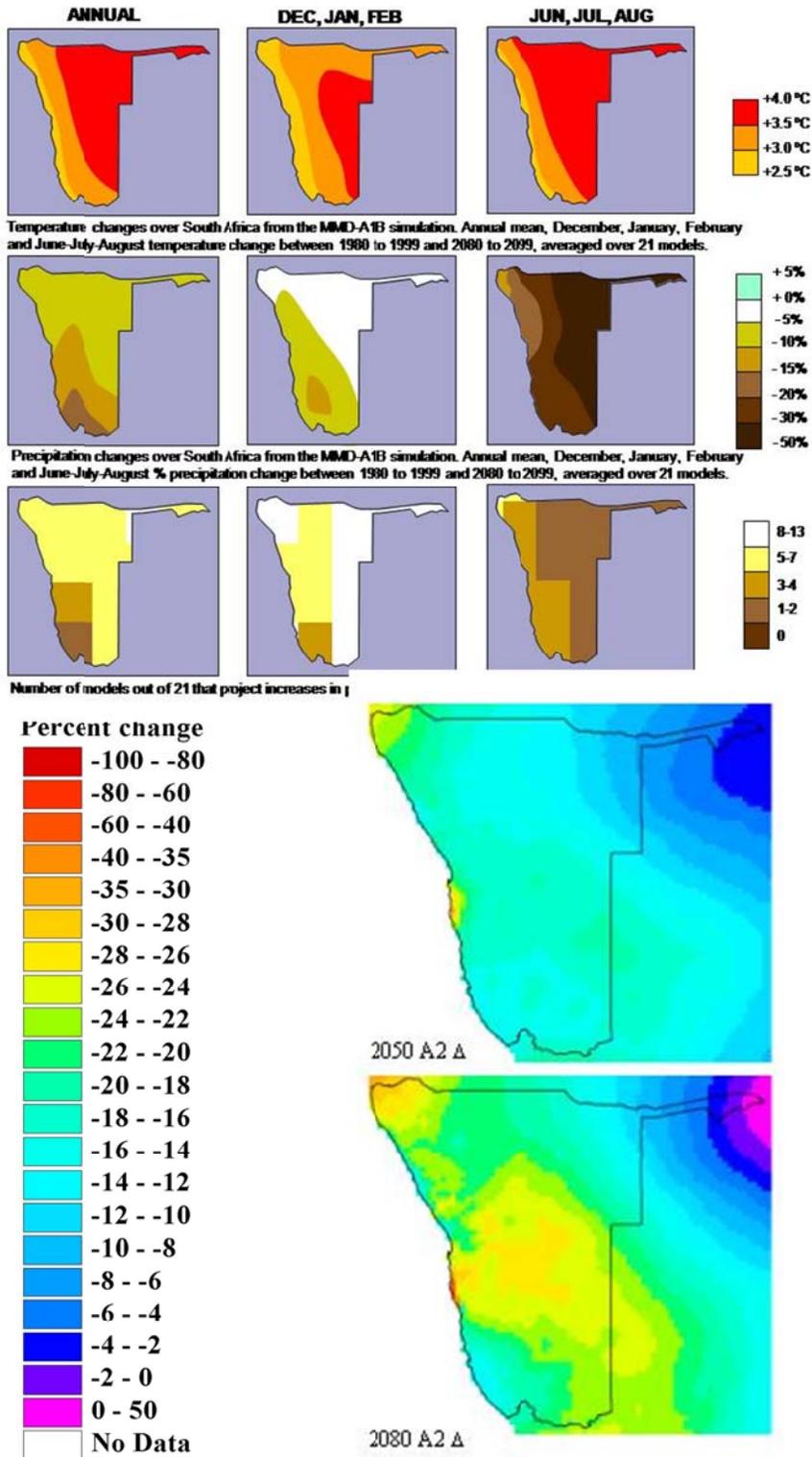


Figure a Upper panel – Annual, summer and winter changes in temperature and rainfall, and an indication of the uncertainty in rainfall projections for 21 IPCC AR4 GCMs. Lower panel – Annual rainfall changes projected by HAD CM3 as driven by the A2 emissions scenario for 2050 and 2080, interpolated by Midgley *et al.* (2005)

The findings by Turpie *et al* 2010 can be summarized as follows :-

- It is predicted with a high degree of certainty that Namibia will experience increasing temperatures which will be higher inland than at the coast (an increase of between 2 - 6°C depending on the locality)
- It is estimated that for every degree of temperature rise in Namibia, potential evaporation will increase by 5%.
- It is predicted with a fair degree of certainty that Namibia can expect a 10% decrease in rainfall in the northern and southern regions, and a 20% decrease in the central part of the country by 2050. This situation will worsen with possible rainfall reductions of 20% and 30% respectively by 2080. Despite these predictions there is a possibility that eastern Caprivi will receive more rain, as this (currently) sub-humid area lies on the edge of the ITCZ which, under many predictions, will become wetter in future decades. In all likelihood this will translate into *increased rainfall variability* in this region.
- The fire-affected areas of Namibia presently lie above the 250 mm rainfall isohyet and currently affect Caprivi far more than Kunene. With climate change, under the decreasing/more variable rainfall scenario, a commensurate eastward shift in fire frequency is likely which means that Kunene will become less vulnerable to seasonal fire hazards.
- Future precipitation in the Angolan highlands and Zambia is predicted to increase. This will influence streamflows in Namibia's northern rivers, which are likely to experience a 10 – 15% increase in water volume – with floods becoming more frequent and of greater magnitude.
- The cumulative impacts of higher temperature, lower rainfall, lower humidity, higher evaporation rates and lower plant cover will cause dramatically reduced soil moisture and primary production (PP) and a corresponding decline in carrying capacity. Increasing aridification will result in a shift in the hyper-arid desert and arid shrublands eastwards.
- The reduced primary production of rangelands could be offset to some degree by the CO₂ fertilisation effect.
- A decline in numbers of large trees in westward flowing ephemeral rivers (linear oases) will occur due to lower water tables, increasing elephant damage and increasing upstream abstraction.
- A loss of unique (endemic) plant assemblages that occur on the western escarpment is predicted.
- There is the likelihood of improved availability of arid-adapted *veldkos* and important INP species (e.g. *Commiphora*; *Harpagophytum* & *Hoodia*). *Commiphora*, for example, produces more resins (the valuable INP ingredient) when under stress.

With respect to water availability the following responses are expected:-

- Periodically higher flows in the Kunene River and other north eastern perennial rivers – more intense and frequent flooding events.
- Lower flows in the Orange river.
- Declining surface water (small springs, seeps etc) which will affect wildlife presence in the more arid parts of the country.

- Reduced groundwater recharge, lower water tables and threats to valuable ephemeral river habitats

The expected responses of selected game species include:-

- Reduced carrying capacity will lead to a decline of 11-22% in the numbers of the main grazing species. However, in areas where wildlife is below carrying capacity, these impacts may not be as severe.
- Arid-adapted species (springbok, gemsbok) experience expansions into the north east;
- Blue wildebeest, impala & red hartebeest, giraffe range remains unaffected – although giraffe may decline as a result of fewer large trees;
- Valuable woodland ungulates (e.g. Roan & Sable) will no longer prosper in Etosha/Waterberg but will still be able to survive in Bwabwata, Mudumu and the adjacent conservancies (although may require extra fodder in dry years);
- Conditions in Caprivi will improve for White Rhino;
- Possible increase in wetland and floodplain species although riparian forests are likely to have been reduced considerably by 2050 due to insufficient protection/increasing abstraction/pollution from more ambitious irrigation schemes/flood control measures;
- Elephant distribution may not be affected but they will exert increasing pressure on habitats;
- There will be increasing incidents of human-wildlife conflict.

In addition to the direct responses summarised above, the northern regions of the country will experience the following secondary/ knock-on impacts as a result of the impacts of CC on farming systems and farm-based livelihoods:-

- A steady decline in rain-fed crop production. Increasing pestilence & higher incidence of crop failure
- A gradual decline in large livestock carrying capacity
- Higher irrigation water demand and Increasing use of fertilisers and pesticides.

These impacts, in turn, will result in:-

- Overgrazing and increasing rates of land degradation and biodiversity loss ;
- Increasing competition and potential conflict over grazing, wildlife, veldkos and INPs which could lead to inter-conservancy conflict;
- Increased poaching in conservancies and parks;
- Increasing pressure on MET to allow access to parks for livestock grazing ;
- Increasing pollution and constraints on ecological reserves, water quality and biodiversity in the perennial rivers;
- Increasing rates of soil salinisation as a result of irrigation; and

- Increasing human-wildlife conflict.

However, at the same time, there are likely to be some positive spin-offs for biodiversity conservation. These include an increase in trends that have already begun as a result of the comparative advantages offered by wildlife to farmers and conservancies, viz:

- Further shifts in land use from agriculture to mixed/wildlife enterprises on freehold land as well as an opportunity to develop more communal and freehold conservancies;
- Increasing demand by farmers for wider devolution of rights over natural resources.
- Increasing demand for wildlife stock (more resilient than livestock) from protected areas (parks and conservancies); and
- Increasing opportunities for improved connectivity between conservancies and Parks and the development of landscape-level biodiversity corridors.

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