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Africa Environment and Climate Change Policy Brief¹

This Environment and Climate Change Policy Brief summarises key regional and sub-regional environmental and climate change problems and opportunities in Africa, related to poverty reduction, economic development and integration. Regionally the analysis focuses on Sub-Saharan Africa and sub-regionally West Africa (ECOWAS), East Africa (EAC), and Southern Africa (SADC). Specific thematic focus is put on trans-boundary water resources management, climate change and land-use change.² (*final draft May 25, 2009*)

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1. Introduction

Africa's environment is extremely varied, ranging from humid tropical forests in central Africa to drylands and deserts in Southern and Eastern Africa and the Sahel, to coastal zones and polluted slum areas in and around Africa's expanding cities. Africa depends on natural resource extraction as a key source of economic growth and poverty reduction. Although Africa and its sub-regions have attained historically high economic growth rates over the last couple of years (save for 2008), several trans-boundary ecosystems and natural resources are at risk and are subject to depletion and/or degradation (Millennium Ecosystem Assessment, 2005).

In Africa, the environment (nature), economic growth (wealth) and governance (power) are inextricably linked and are essential elements of poverty reduction and enhanced welfare. Although Africa's natural resources and the wealth they generate are essential to achieve the MDGs, sustainable development also presupposes good governance, *pro-poor* growth based on equitable distribution of incomes, capable institutions and a sustainable use of the natural capital. Sustainable natural resource use is highly dependent on the quality and performance of informal as well as formal institutions such as government ministries and agencies, and their capacity to direct, control and monitor individuals and others' (e.g. the private sectors') actions vis-a-vis nature. At the regional level, the role and capacity of the regional and sub-regional organisations are essential to sustainable management of shared, trans-boundary environmental issues such international water resources.

2. Linkages between Environment, Climate Change and Key Development Challenges

Africa is faced with a range of serious environmental challenges, where climate change and climate variability will add to the current problem complex. Climate variability is not a new phenomenon in Africa but *climate change* will add to existing and recurrent economic, social and ecological stresses, risks and uncertainties. With climate change follows *environmental* change which is manifested in changing resource abundance or scarcities of natural resources and ecosystem services.

Key environmental challenges include climate change and climate variability, widespread pollution, loss or degradation of ecosystem services, and large-scale natural resource depletion of land, water, forests, minerals and energy resources. In addition, Africa experiences significant change and loss of biodiversity resources, which constitutes a key *development challenge* to the region (MEA, 2005). Climate change adds to existing environmental, social and economic challenges. Africa's environmental problems are not isolated phenomena but are linked in multiple ways with other development themes across the region. Attaining development objectives such as sustained and pro-poor growth, public health, broad-based employment, devolution and strengthening of people's rights in the region as well as sub-regionally presupposes sustainable use of the region's natural capital, reduced levels of pollution and equitable management of shared natural resources including trans-boundary water resources, drainage areas and forest ecosystems.

Local environmental issues may have broader geographical implications: failing to sustainably manage natural resources in one country raises the risk of negative repercussions in neighbouring countries in the sub-region and occasionally in large parts of the continent.

This applies to the quest for water, grazing areas, agricultural lands, precious metals (e.g. gold, diamonds) and may lead to conflicts (see section on conflicts below). Moreover, implementing policies to reduce pollution or natural resource depletion in one country may lead extractive or polluting companies or other actors to move their businesses/activities to neighbouring countries. This applies to pollution control as well as timber logging, biodiversity protection or efforts to control over-fishing (Eskeland and Harrison 2003). This becomes particularly visible in sub-regional settings where countries share a common resource, such as in the case of Lake Victoria (Drakenberg, Nyangena and Lokina 2007). Political instability, corruption, poor policies, or weak policy implementation at the national level may harm neighbouring countries (Fredriksson and Svensson 2003). Hence, several national environmental problems have (sub)regional implications and can only or best be addressed in international collaboration.

Some of the key *development* challenges that Africa faces and are likely to face due to climate change and increasing climate variability in the near future, are expected to come in the areas of water and agriculture; IPCC (2007a,b) report plausible estimates that an additional 75-200 million people in Africa could be exposed to **additional water stress** by 2020, and that yields from rain-fed agriculture could decline by 50% in some countries. Such reductions are likely to increase **food insecurity**, and have major impacts on human health and poverty reduction efforts. It is also expected that many areas of Africa will face increased numbers of **natural disasters** such as floods and droughts. It is recognised that all of the impacts above, as well as an increase in the range of vector-borne diseases, could have significant negative impacts on human health. **Sea-level rise** and **coastal flooding** is likely to become a large issue towards the end of the century, and needs to be included in long-term planning, but is not an immediate priority.

Across Africa the vulnerability of certain groups of people to climate related stresses is already *very* high, and projected climate changes indicate that this vulnerability can increase dramatically, and new vulnerabilities will emerge, unless appropriate adaptation measures are taken. Recent assessments place Africa as a priority area for climate change adaptation assistance due to widespread poverty in the region, fragile resources, the large share of the world's drylands, highly variable climates and relatively weak institutions for managing the multiple stresses caused by climate change. Lack of alternative livelihoods forces vulnerable groups to utilise marginal ecosystems and resources, resulting in depletion of the resource stock, reduced carrying capacity and resilience in the systems. A vicious circle is thus formed. As an example, the need for firewood for domestic consumption around Lake Victoria has resulted in widespread deforestation, which leads to soil erosion, increased vulnerability to flooding and ultimately pollution of the shared waters of Lake Victoria (Drakenberg, Nyangena and Lokina 2007).

3. What are the Relationships between Environmental and Climate Change problems and On-going and Potential Conflicts?

The relationships between climate change, environmental degradation and conflict are complex and as yet poorly understood. Environmental factors are rarely the sole source of conflict, but changes in, and **depletion of natural resources** (e.g. water, grazing lands fuelwood) linked to **climate change** have been implicated as causal factors in the current crisis in Darfur (UNEP, 2007). The trans-boundary nature of major water resources and **water scarcity** in many regions of Africa are potential seeds of future conflict. **Shared water**

resources always constitute risks of conflict between riparian countries, particularly if poverty is widespread, property rights are insecure and/or unclear, if the resource is scarce, and the potential stakes are high (e.g. large forgone profits if the resources are untapped or captured by neighboring countries). Regarding rivers and river systems there is always a critical upstream-downstream relationship among countries, which can only be settled in international agreements and management schemes involving two or more countries. As climate change and socio-economic factors shift the balance between water supply and demand, strong regional coordination in the management of river basins and water resources will be needed to negotiate the equitable allocation of the available water and minimise disagreement between upstream and downstream countries that could potentially lead to conflict.

Food insecurity could be another point of conflict, for example cattle raids become more frequent during events that compromise food security, such as droughts (UNEP, 2009). Also, effective intra-regional transfer of, and well functioning markets for, staple foods (e.g. maize) are important mechanisms to compensate for deficits in countries that have suffered poor harvests. So if the region as a whole becomes more food insecure these coping mechanisms are likely to be compromised, potentially leading to conflict. Another associated feature of conflict is food riots in mostly urban areas due to food shortages and/or increasing food prices, fundamentally caused by climate change/variability.

Arguably, an important determinant of conflict in Africa is the **quest for natural resources** (Bannon and Collier, 2003; Collier, 2003). Resource abundance or possession of specific high-value resources in socio-political contexts of weak institutions and poor governance are not only associated with low economic growth (“the natural resource curse”³), but increases the likelihood and incidence of (civil and armed) conflicts, and stimulates violence between rival groups, typically the stakeholders of the resource. The relationship between environmental resources and conflicts are however highly complex, and normally a combination of social, historical, economic and other factors. Nevertheless, large open-access natural resources can undermine the quality of governance, aggravate corruption, weaken economic performance and thereby increase the vulnerability of countries to conflicts. Moreover, conflicts can also occur over the control and exploitation of resources and failed allocation of their revenues; resource rich developing countries typically have low savings and investments and relatively high consumption, which undermines long-term growth. Some of these causal factors are manifested in and driving forces behind armed conflicts in D.R. Congo, Liberia, Angola, Sierra Leone, Sudan, Nigeria and Chad, often with broader geographical and socio-economic and political repercussions, strained political/government-to-government relationships, and displacement of people and unsustainable use of natural resources around refugee camps.

There is growing recognition that environmental degradation and climate change hold the potential to result in significant **population migration** and displacement of people, which the Africa region and the world at large are presently ill-equipped to prevent or respond to in an effective manner. Climate change will aggravate this problem complex (IPCC, 2007a, b).

³ The resource curse has been explained to occur due to several reasons, including a decline in the competitiveness of other economic sectors (caused by appreciation of the real exchange rate as resource revenues enter an economy), volatility of revenues from the natural resource sector, government mismanagement, or political corruption (provoked by large capital inflows from the resource sector) (Bannon and Collier, 2003; Collier, 2003).

Africa is, and will continue to be, at the forefront of many of these concerns. Current policy responses tend to focus on how to deal with the impacts of sudden natural disasters rather than with the consequences of longer term environmental degradation. While migration is a coping (or adaptation) mechanism and survival strategy for those who move, increased migration may itself contribute to further environmental degradation, socio-economic and political stress. This practical but highly complex and chronic issue has largely been ignored in climate change research (e.g., it is not covered in any detail by the IPCC AR4) but is likely to become a major policy challenge of this century. Adequately planning for and managing environmentally induced migration will be critical for human security (AMCEN, 2008).

4. What are the Key Environmental and Climate Change Problems and Opportunities and their Causes and Inter-linkages, of Regional and sub-Regional Nature

4.1 Key environmental problems and their causes

Arguably, sub-Saharan Africa faces two inter-related environmental challenges: combining pro-poor economic and social policies with *sustainable utilization of the region's natural resources and ecosystem services*, and appropriate *adaptation to climate variability and climate change*. Africa has to a large extent built, and continues to build, its economic and social development on unsustainable natural resource use. This development approach can – for obvious reasons - not be the development model that should guide Africa into the future. An alternative development model has to emerge. However, large forces are in motion, and there is considerable inertia in moving away from natural resource depletion as a growth policy. As indicated in MEA (2005) this is manifested in depletion and/or degradation of fisheries, forests, water resources, minerals, soils and agricultural ecosystems, rangelands, air wetlands, fossil fuels (including oil, gas and coal) and biodiversity resources. Causes are found in the production and consumption patterns of individuals, communities, foreign and domestic companies and national governments. A large share of the resource depletion has sub-regional and regional manifestations, which require regional solutions (e.g. international water resources management).

The quest for resources is largely driven by the behaviour of foreign companies, and export of raw material/unprocessed natural resources to OECD countries. Recently, the resource depletion is aggravated by companies from, and exports to, China and India and to some extent also Brazil, Russia, Indonesia and Malaysia and OPEC countries. Investments by these countries provide foreign capital, modern technologies and employment, but these social and economic gains run the real risk of being short lived unless i) the natural capital is adequately sustained across time, and ii) revenues are invested in economic sectors which promote sustainable development, rather than undermining it.

Regarding the second challenge – climate change - projected regional increases in climate variability and weather extremes (such as floods, droughts, storms and heat waves) are likely to severely affect Africa's economic performance, food security and livelihoods of the poor. It will also impact negatively on transport infrastructure (roads, railways, bridges, ports etc.), energy infrastructure (hydropower, thermal plants, transmission and distribution systems etc.), water and sanitation systems, and protection infrastructure of coastal zones.

A balanced and appropriate starting point for the identifying key regional environmental challenges is NEPAD's assessment (NEPAD 2003), which also constitute priority program

areas for regional environmental cooperation: (1) combating land degradation, drought and desertification, (2) conservation and sustainable use of marine, coastal and freshwater resources (including wetlands), (3) prevention, control and management of invasive alien species, (4) climate change including mitigation and adaptation, and (5) trans-boundary conservation or management of natural resources, (6) management of cultural heritage; (7) sustainable management of (sub-soil) non-renewable resources; (8) sustainable management of cities; (9) integrated waste management and pollution control; (10) sustainable energy production and consumption, and (11) addressing negative impacts of population dynamics (including AIDS and war) on the environment.

In addition to climate change, which is treated partly separately in this Brief, our assessment focus on 4 areas of particular regional and/or sub-regional concern in response to the two key environmental challenges presented above: (i) loss of ecosystem services and biodiversity; (ii) deforestation and forest resources degradation; (iii) land use change and degradation; and (iv) shared water resources, availability and management:

(i) Loss of ecosystem services and biodiversity: Despite significant endowments in natural capital, Africa's ecosystem services and biological resources/biodiversity are under threat from a number of natural as well as human induced pressures. Examples include land-use conversion due to deforestation, agricultural expansion and livestock production, and subsequent habitat destruction, pollution, poaching, armed conflicts, introduction of alien invasive species, and population growth. Biodiversity in plant genetic species is under threat due to increasing expansion of mono-cropping in agriculture and a relative reduction of tree species and animal species in forestry and livestock production, respectively.

Projected increases in droughts, floods and other climate-related vulnerabilities are expected to have multiple negative impacts on the ecosystems in large parts of the region. Lakes and reservoirs in arid and semi-arid regions such as the Sahel, lowlands of East and Southern Africa are expected to reduce storage capacity and economic potentials. Changing precipitation patterns could lead to accelerated soil loss, sedimentation and siltation of rivers, dams, lakes and water courses, and reduce the productivity of watersheds. Wetlands, wildlife and biodiversity in currently fragile areas would be under increased pressure to reduce productivity and economic potential (Holmberg 2007).

Deforestation and Forest resources degradation: Africa's forest resources are subject to high pressure from demand for firewood and charcoal as energy sources and from the export of forest products such as timber. As a result, African forests are being degraded at alarming rates. The underlying driving force is often population growth. The forest-to-people ratio has gone down considerably in all sub-regions implying that there is relatively less forest resources (forest area per habitant) to be shared among the populations in Africa's sub-regions. To exemplify, the forest area per habitant in Africa region has decreased with more than 10% between 2000 and 2005. During the same period the total forest area has decreased with more than 20,000 ha in the region (AfDB 2008). This decrease is likely to continue with increasing populations, and increased needs for cultivation/food production areas. Moreover, the decrease is likely to accelerate in view of the risks associated with climate change.

Africa's forest resources constitute a significant share of the world's greenhouse-gas emissions originating from forests. Conversely, reducing deforestation reduces greenhouse gas emissions and promotes adaptation to climate change, in addition to other benefits associated with forest resources, such as biodiversity, maintaining hydrological balances,

timber and non-timber forest products, etc. However, rising temperatures resulting from climate change are likely to contribute to further degradation of forests. Fires will be an increasing problem for desiccated forests. The ability of forests to provide ecological services, such as protecting watersheds and conserving biological diversity, will be impaired, leading to a negative spiral of ecosystem degradation (Holmberg (2007)).

Land Use change and degradation: Climate change constitutes one of the top challenges facing Africa in general and land use and land degradation in particular, during the next couple of decades and beyond (Commission on Growth and Development, 2008; IPCC 2007a,b; Stern et al, 2006). The African region is highly vulnerable to the impacts of climate change, especially its poorer sub-regions highly dependent on land as a source of growth and employment. This is largely due to their geographic exposure, low level of incomes and opportunities to cope and adapt, and greater reliance on climate sensitive sectors such as agriculture. Only a small portion of the costs and other impacts of climate change between now and 2050 can be realistically avoided. This is due to inertia in the climate system as well as inertia in the behaviour of individuals and institutions.

Poor peoples' agricultural incomes will be under particular threat from climate change; falling farm incomes will reduce the ability of poor households to invest in land and adequately adjust to shocks like drought, pests and floods, which are likely to increase in intensity and in frequency in the years to come (IPCC 2007a,b). Food production is already very sensitive to climate variability due to the dependence of crop yields on climatic factors such as temperature and rainfall. Agriculture currently accounts for 24% of world output, employs 22% of the global population, and occupies 40% of the land area. Climate change will aggravate this sensitivity and have a wide range of effects on the agro-ecological environment (e.g. soil loss, loss of soil moisture and reduced water access in drier regions) which could have knock-on consequences for food production. It is expected that the *combined* effect of several factors could be very damaging. Impacts that are particularly important for future food production are loss of essential species⁴, increased incidence of flooding, forest and crop fires, climate-induced outbreaks of pests and diseases, and rising surface ozone.

Shared Water resources, availability and management:

While Africa generally is well endowed with respect to water resources, the utilization within and between countries and sub-regions is characterized by inefficiency, ineffectiveness and inequity. Potential conflicts between up-stream and down-stream users need to be prevented; inefficiencies and inequity across and within countries need to be addressed. The trans-boundary nature of many of the regional and sub-regional water resources call for reinforcing/instituting international agreements, coordination, management. Hence, international river basin management is of utmost importance to ensure sustained supply and equitable distribution of countries (and local) water rights.

The number of people suffering increased level of water stress as an effect of climate change (reduced rainfall, increased evapo-transpiration and increased surface temperatures) and the associated risk of more people in hunger are likely to increase over the next couple of years and decades, unless attended to. This is particularly critical in the arid and semi-arid parts of

⁴ Climate change may affect pollinators and hence pollination, which is essential for reproduction of many wild flowers and crops; its economic value worldwide has been estimated at \$30 - 60 billion (Stern et al, 2006).

Africa's sub-regions, particularly in Southern Sahel in West Africa, the arid lowlands of East Africa and in the Kalahari desert in Southern Africa (Warren et al, 2006, IPCC 2007a,b).

4.2 Key Issues relating to Climate Change

Africa has the lowest greenhouse gas emissions in of any continent, yet it is particularly vulnerable and expected to be hardest hit by climate change⁵; this situation is exacerbated by multiple stresses such as high levels of poverty, complex governance issues, ecosystem degradation and conflict, which limit adaptive capacity (Boko et al. 2007). In coming years expected economic losses may range between 1-2% of GDP. Rain-fed agriculture reduction in yields can reach up to 50% in some African countries (AfDB, 2007). Certain groups in society will be disproportionately hit by climate change; women are increasingly vulnerable due to their traditional responsibilities of fetching water and fuelwood, cultivation of (drier/wetter) agricultural lands, and performing household chores. Climate observations in Africa show that there has been a trend of increasing average temperatures across almost all parts of the region since the 1960s, associated with an increase in the number of warm days and nights. The changes in annual rainfall over Africa present a more varied picture. West Africa and much of central Africa have experienced a marked decline in annual precipitation. Southern Africa shows no clear long-term trend, while east Africa shows patterns of increasing rainfall over the northern sector and declining amounts over the southern sector. There has been an increase in the number of droughts, and in southern Africa the number of extreme rainfall events has increased, leading to severe flooding.

Projections of anthropogenic (human-induced) climate change in Africa are still largely based on results from global circulation models, as there have been few studies using regional models or empirical downscaling experiments⁶. Model projections for temperature are better than those for precipitation, as many models find it hard to accurately capture aspects of African climatology that affect rainfall, such as dust aerosol concentrations, sea-surface temperature anomalies, the role of vegetation and land-use change, deforestation in the equatorial region, and soil moisture in southern Africa.

Nevertheless, IPCC projections show that average temperatures are expected to increase in the range of 3-4°C for the period 2081-2099 over most of Africa, with smaller increases in coastal and equatorial regions. These increases are likely to vary locally and seasonally, however, and the possibility of greater increases cannot be ignored. Along with increases in average temperatures, the maximum and minimum temperatures and the numbers of extremely hot days and seasons are also expected to increase. Uncertainty associated with changes in precipitation make it difficult, for example, to provide any precise estimation of future water runoff, especially in arid and semi-arid regions where slight changes in precipitation can result in dramatic changes in the runoff process. However modelling results do indicate an expected increase in precipitation over East Africa and parts of Central Africa, and a decrease in austral winter precipitation in southern Africa. Projections for West Africa range from a large increase to a large decrease in precipitation, and the IPCC state that projections of

⁵ Africa as a continent accounts for just 3% of global emissions, so any mitigation activities must have clear adaptation and development co-benefits.

⁶ Empirical downscaling is a statistical technique to produce station level projections of climate change from global climate models.

precipitation for West Africa should be 'viewed with caution'. Annex 1 provides two tables giving more details of observed and projected climate changes as reported in the IPCC Fourth Assessment Report (IPCC 2007 a,b), for each of the four regions of sub-Saharan Africa.

Impacts of climate change in Africa are increasingly common and even observable. Specific impacts on (poor) people are reduced access to water in dry regions, declining crop productivity and thus food insecurity, increasing temperature and heat-wave events, increasing incidence of floods and droughts. Other bio-physical impacts and phenomena include melting glaciers, decreased river flows, and spread of vector-borne diseases. Many of Africa's major economic sectors (e.g. agriculture, forestry, fisheries, tourism, construction, etc.) are sensitive in various ways to weather and climate conditions and large portions of the continent's population are involved, to varying degrees, in subsistence livelihoods making them highly vulnerable to climate and other environmental changes. Levels of vulnerability to climate change, as socially differentiated across populations, are compounded by existing problems, particularly: (i) developmental challenges, such as endemic poverty, weak governance, limited access to capital and markets, low levels of infrastructure and technology; (ii) natural resource management challenges, including land degradation, decreased soil fertility, degraded riverine systems, inequitable access to water resources, and loss of biodiversity; (iii) health threats, particularly HIV/AIDS; and (iv) complex conflicts (IPCC 2007a,b).

By 2020, between 75 and 250 million people are projected to be exposed to increased **water stress** due to climate change. The overall increase in numbers of people exposed to water stress will be particularly marked in southern (and northern) Africa, but important local scale variations will exist; central to this is not just variations in the amount of rainfall received but in the ability to capture and store rainwater. Negative impacts on local livelihoods and national economic productivity will be felt through: the inability to irrigate commercial crops or water livestock; the spread of water borne diseases; the burden of household labour of walking long distances for water collection; limited water for mining and manufacturing purposes; etc. Many of these impacts undermine efforts to reduce poverty, adequately adapt to climate change, and fuel development at both the local and national scale.

Agricultural production and access to food is currently in a poor state in most countries in Africa, with declining food per capita over the last couple of decades. However, agricultural production is projected to be severely compromised by climate change, specifically manifested in changes in the timing and duration of precipitation events, daily temperatures, and levels of soil moisture. This would cause significant and increasing **loss of agricultural productivity** and **food insecurity**. In some countries, yields from rain-fed agriculture could be reduced by up to 50% (IPCC 2007b). Unless counteracted, dependence on food imports will increase. Short of financial capital and foreign exchange, this would further adversely affect food security and exacerbate malnutrition. Subsistence-based farming systems are expected to be at greater risk than the commercial sector, much of which is under irrigation and thereby able to manage reductions in rainfall. However, food prices are likely to increase, which may have negative repercussions on the urban poor in particular. Increasing food prices may also provide an incentive for increased crop production and thus promote the agricultural sector in the mid- to long-term, which will counteract some of the adverse impacts hitting the (urban) poor in the short run.

The increase in heavy rainfall events and any change in cyclone activity under climate change, is associated with more frequent and extensive **flooding** across much of the continent,

with crippling consequences for households, communities and be transmitted from the local, through the national to the regional economy. Mobility is reduced, access to food and water is limited, public and private infrastructure is damaged, crops and livestock are lost, and people are often temporarily (or permanently) displaced. For example, the floods of 2000 in southern Africa had a devastating impact, particularly in parts of Mozambique where the cost of the combined impact of the floods and the cyclones in 2000/2001 was estimated at US\$ 600 million and more than 500,000 people were displaced. All such local /national events have (sub-)regional repercussions. Towards the end of the 21st century, projected **sea level rise** will affect low-lying coastal areas with large populations (especially in places of rapid urbanisation) through permanent or periodic inundation.

A number of impacts on terrestrial and aquatic ecosystems are being observed, partly attributable to climate change, and more are expected. In mountain, forest, grassland and wetland ecosystems climate change is expected to result in **loss of and changes in biodiversity**, in particular changes of certain plant, animal and bird species. Also in marine ecosystems and along coastal zones in Africa's sub-regions (particularly in East Africa), increased water temperatures lead to coral bleaching, and reduction and eventual loss of various fish species. Large-scale losses of species will have negative effects on key economic sectors such as fisheries, forestry and tourism, as well as reduced food security and resilience of ecosystems.

Although specific figures are uncertain, **human health** is expected to be adversely affected by projected climate change, especially in parts of Africa where the capacity to administer preventative and curative health care is particularly low. Increasing temperatures will extend the habitats of disease vectors such as mosquitoes carrying malaria. More intense droughts and floods will result in more extensive outbreaks of water-borne diseases, like cholera, particularly where sanitation is poor. There are also multiple complex interactions between the prevalence of HIV and AIDS and climate change, both in terms of climate change impacts increasing the likelihood of risky behaviour and exposure to HIV/AIDS, and - as a consequence - a decreased capacity to prevent or adapt to climate change impacts. The links between health and climate change are not yet well researched in the region.

It is important to recognize different levels of vulnerability within communities and households associated with **gender**, age, HIV status, ethnicity, etc. For example, in peri-urban Malawi, when rains are insufficient and crop yields are low, significant numbers of women resort to sex-for-food transactions to secure food for their families, leading to an increase in the spread of HIV. Moreover, climate change is likely to fundamentally change rural behaviour due to decreased access to household water and fuelwood in several parts of the region. This will impact negatively on women's work burden and labour supply in e.g. crop production. The recognition of cultural and social dynamics is therefore of paramount importance when supporting adaptation to climate change.

4.3 Opportunities

Africa has a wealth of natural capital. The most important **renewable resources** in Africa include water resources, forest ecosystems, and agricultural land. Other key renewable resources include grazing lands, wildlife, and fisheries. The most important **non-renewable resources** include: fossil fuels and minerals (metals and non-metals), of which the most important are crude and petroleum oil, natural gas, diamonds, gold, copper and coal (AfDB, 2007). Africa has the largest tropical rain forests and the second largest freshwater lake in the

world. Despite widespread poverty, the region offers significant potential for human, social and economic development. Moreover, Africa has world class biodiversity resources, which contribute to form the region's natural capital on which much of the social and economic systems and activities are based. The region currently holds six of the world's 25 biodiversity hot spots. These **biological resources** are local, regional as well as of global importance, in terms of world heritage, and supporting millions of poor people, in addition to maintaining **ecosystem functions** of global importance. The region has more than 50,000 known plant species, 1,500 species of birds and 1,000 mammals. The biological diversity found in any one area or country varies depending on physical size, local climatic conditions, topography and vegetation and soil types. For example, In Southern Africa there is an estimated 20,000 plant species; East Africa has at least 8,000 species and Central Africa has more than 15,000 species. The African **coastal regions** are equally diverse with more than 4,000 fish species, offering large opportunities for fisheries as well as tourism.

Africa's **water resources** are characterized by extreme spatial and temporal variability. While Africa uses only about 4 per cent of its renewable freshwater resources, water is becoming one of the most critical natural resource issues. The continent is one of the two regions in the world facing serious water shortages. Average water availability per person in Africa is 5,720m³/capita/year compared to a global average of 7,600m³/capita/year. The wet equatorial zone produces 95 per cent of Africa's total flow, while the arid and semi-arid zones produce only 5 per cent. Africa has 17 rivers with catchment areas exceeding 100,000 km² and more than 160 large lakes (>27 km²). In addition to freshwater resources in rivers and lakes, the continent is endowed with significant trans-boundary aquifers. Agriculture is the largest user of water in the region. Water used for irrigation purposes represents around 70% of the total water use in the region. Africa also boasts a huge potential for hydro-electric power generation. Water for household consumption makes up a small fraction of the water usage in Africa. Recent studies indicate that more than 300 million people in Africa lack access to safe water. In sub-Saharan Africa around 50% of the population has access to safe water supply and to sanitation services, respectively.

As indicated above, although Africa is endowed with significant environmental resources, the region is facing enormous challenges. Rapid population growth, rising levels of poverty and inappropriate development practices are the main factors that affect the state of the environment in Africa. Other factors that have led to continued environmental degradation include the impact of drought and other natural disasters, disease, ineffective development policies, unfavourable terms of trade and the debt burden. The issues of concern include, but are not limited to, widespread land degradation and desertification, loss of biodiversity, deforestation and loss of arable and grazing land, declining soil productivity, pollution and depletion of freshwater resources and deteriorating air quality. These have wider implications on food security, sustainable natural resources management, human health and poverty eradication efforts.

4.4 Assessment of the Regional Nature of the Key Environmental Challenges

As outlined above, sub-Saharan Africa faces the inter-related environmental challenges of combining pro-poor economic and social policies with sustainable utilization of the region's natural resources and ecosystem services, and appropriate adaptation to climate variability and climate change. Although many of Africa's specific environmental problems have local manifestations, they are typically caused by (sub-)regional driving forces, which occur across and affect the whole or parts of the region (e.g. labour migration, markets, conflicts etc.).

Consequently, this requires regional or sub-regional solutions. In our view, the key environmental challenges of regional nature include (i) loss of ecosystem services and biodiversity; (ii) degradation of forest resources and deforestation; (iii) land degradation; and (iv) inefficient trans-boundary water resources management (including coastal and marine resources). These challenges are strongly characterized by resource depletion (as exemplified above) and compounded by the other main challenge: climate change. Again, climate change impacts will be experienced locally, but have (sub-)regional repercussions in many instances. Hence, in addition to local and national approaches, adequately addressing climate change - mitigation as well as adaptation - requires sub-regional as well as regional approaches.

To put this in perspective, many responses to e.g. land degradation (e.g. soil conservation, agro-forestry), deforestation (afforestation, land tenure reform), water resource depletion (integrated water management, reformation of allocation of access rights etc.) are local/national. However, (sub-)regional approaches may be warranted and indeed necessary in order to scale up good examples and best practices, wider (region-wide!) dissemination of resource management techniques that work in practice, sharing of the cost burden and pooling of knowledge across countries etc. Here, provided that the financial resources are well managed and targeted to its assigned purposes, regional approaches to some of Africa's local environmental issues (water, land, forests) would speed up and enhance implementation.

Similar to the environmental issues listed above, there is a need to identify useful regionally coordinated approaches, regional sharing of experiences and responsibilities, undertaking regional research efforts in cases when i) the critical mass is too limited nationally, ii) the natural resources are shared (waters, watersheds, forest resources etc.) and/or iii) there are positive returns to scale (sharing of info, investment costs, R&D etc.). In addition to any national efforts, sub-regional and regional interventions (policies, practices) are warranted when there is value-added or the issue can only or best be addressed at the international level. Arguably this applies to cases when problem analyses and interventions are more cost-effective at the (sub-)regional level. As indicated above, legislation needs to be internationally coordinated and harmonized in order to prevent countries from seeking advantages by lax environmental regulation for e.g timber logging, land use, food safety in crop production, fisheries regulation etc. Africa as a region would also benefit from increased regional cooperation (coordinated approaches) in the case of accessing funds for capacity building for, and implementation of, international/multi-lateral environmental agreements (on biodiversity, desertification, climate etc.). A prerequisite for this is strengthening/supporting efforts to enhance the capacity of key sub-regional and regional institutions, which are charged with the responsibility of managing natural resources and ecosystem services sustainably (e.g. energy, water, lands, forests infrastructure etc.). At present, the institutional capacity is clearly insufficient to implement existing policies (e.g CAADP, NEPAD's Strategic Plan to Build Africa's Capacity to Implement Global and Regional Environmental Conventions, sub-regional environmental strategies formulated and adopted by the RECs).

Supporting institutional capacity building relates to the important issue of **sequencing** in environmental strategy implementation. Clearly, Africa's key regional and sub-regional governing bodies have formulated largely adequate policies and strategies pertaining to environment and climate change. This is a necessary first step towards sustainable development. However, in order to take the step and ensure progress and appropriate implementation, it is necessary to strongly enhance capacity among and within the key institutions responsible for implementation. This challenge is not limited to regional bodies in the "environmental" sphere, but a shared task among all regional bodies affecting and

utilizing natural resources and fundamental ecosystem services (again: energy, infrastructure, agriculture, water resources management, mining, land use etc.). On sequencing, it is also necessary to “get the institutions right” (easier said than done, nevertheless of utmost importance) before undertaking major investments in the area of environmental management. Investing heavily in environmental management prior to having adequate environmental institutions (for control, monitoring, verification and follow-up) drastically increases the risk of failed outcomes.

5. What are Key Actors doing to Manage and prevent key Environmental and Climate Change Problems?

It is difficult and not always useful or even possible to distinguish or disentangle local manifestations of environmental change and climate change. Nevertheless, for purposes of clarity and structure we present below actors in environmental and natural resource management, and in climate change adaptation, respectively.

5.1 Actors in Environmental and Natural Resource Management

Regionally: At the regional level **African Union (AU)** has developed Action Plan of the Environment Initiative of The New Partnership For Africa’s Development (**NEPAD**). This Action plan identifies 11 regional key environmental issues, which are also identified as priority program areas for regional environmental cooperation. They include: (1) combating land degradation, drought and desertification, (2) conservation and sustainable use of marine, coastal and freshwater resources (including wetlands), (3) prevention, control and management of invasive alien species, (4) climate change adaptation and mitigation, and (5) trans-boundary conservation or management of natural resources, (6) management of cultural heritage; (7) sustainable management of (sub-soil) non-renewable resources; (8) sustainable management of cities; (9) integrated waste management and pollution control; (10) sustainable energy production and consumption, and (11) addressing negative impacts of population dynamics (including HIV/AIDS and armed conflicts) on the environment.

This agenda of priority environmental issues is not exclusive or controversial, most other key regional actors buy-in to it, and the challenges are largely in line with those identified by other key actors working regionally such as AfDB, EU, UNDP, UNEP and the World Bank. Strategies guiding these actors’ work in the region include **AfDB’s** Regional Environmental Strategy, the **World Bank’s** Africa Environment Strategy, **EU/European Commission’s** Sub-regional Environmental Strategies, and **UNDP/UNEP’s** Poverty–Environment Initiative.

Sub-regionally: At the sub-regional level there is a large set of actors, programs and agendas. Key sub-regional actors include: SADC, ECOWAS, EAC, COMESA, ECCAS, which all have developed environmental strategies. As an effect of strengthened pan-African leadership (creation of AU, formulation of NEPAD, AMCEN etc.) and designated sub-regional responsibilities via the Regional Economic Communities (RECs), sub-regional cooperation on environment and climate change is progressing. Progress is mainly achieved in terms of policy and strategy formulation (and financing), and less in forceful implementation on the ground.

Progress varies between sub-regions. Arguably most progressive, **SADC** Member States have committed themselves to sustainable development and to actively participate in negotiation and ratification of major multilateral environmental agreements. Key guiding documents for action include SADC's *Environment and Sustainable Development Policy and Strategy Document* and the *Protocol on the Environment*. The objective on environmentally sustainable development as expressed in SADC's *Regional Indicative Strategic Development Plan* (RISDP) is to mainstream environmental and sustainable development issues into all sector policies, programs and activities at national and regional level. Although the level and quality of implementation remains to be fully assessed, SADC is becoming very active and ambitious with respect to considering environmental and climate change issues in its development work. SADC's commitments and plans constitute a tall order but points at their ambition in this field.

EAC has made considerable progress to enhance sub-regional cooperation, mainly regarding joint management of Lake Victoria and its drainage basin. The EAC member states have signed and ratified a Protocol for sustainable development of the Lake Victoria basin and are also funding the entire recurrent budget of the Lake Victoria Basin Commission, set up to administer the Protocol and coordinate the countries' activities. However, much remains to be done in practice, in particular when it comes to formulate and enforce joint forest policies, control of pollution into shared waters, trans-boundary water resources management etc.

Regarding regionally shared water resources management, key regional trans-boundary water cooperation and basin organisations include The Southern Africa Development Community (**SADC**), Senegal River Basin Organisation (**OMVS**), Niger Basin Authority (**NBA**) and the Nile Basin Initiative (**NBI**).

The integration of environmental concerns into the policies and actions of NEPAD as well as the sub-regional coordination bodies form important starting points for identifying Africa's agenda on environment. Many of the environmental concerns may very well be considered and appropriately addressed within associated sectors, in which environmental management is a natural concern. This applies for instance to NEPAD's regional program for agricultural development (**CAADP**), and its subsidiary sub-regional strategies and commitments for sustainable land management.

Obstacles to effective environmental management in Africa include (i) slow environmental policy implementation, (ii) inadequate and un-coordinated environmental legislation and institutions at the national and sub-regional levels, (iii) poor legal enforcement, and (iv) insufficient financial and human capacity at all levels of implementation. Moreover, integration of environmental concerns into key national development plans (primarily Poverty Reduction Strategies) has also been poor, which has had implications (sub)regionally for shared natural resources or trans-boundary environmental problems. To ensure adequate environmental management, capacity has to be strengthened and the key environmental challenges ought to be (better) mainstreamed in key (national, regional) development plans and not pursued as isolated efforts. Moreover, over-laps in policies, formulation of strategic objectives and implementation on the ground are currently large. Potentially, increased collaboration across actors would enhance efficiency. Hence, key challenges at present are to scale up promising interventions and activities, increase coordination, harmonize and collaborate in practical implementation efforts, rather than to re-define and re-formulate policies and operational priorities.

5.2 Actors on Climate Change Adaptation and Mitigation

Various levels of government in Africa are starting to address issues of climate change adaptation and disaster risk reduction, but many of the policy and programmatic interventions are externally driven and financed, such as the **UNFCCC National Adaptation Programme of Action** (NAPA) process and large pilot programmes developed by the UN agencies, international finance institutions and alike. These international undertakings provide a starting point for mobilising government activity around climate change issues, but the connections are often not made between international, regional and national initiatives and local realities.

Regional bodies, including **SADC** and the **AU**, are beginning to establish groups mandated with addressing climate change, formulating policy on climate-related issues and engaging in international decision-making on adaptation financing. This is all very new and progress is expected to be slow in terms of translating this into action on the ground. However, these regional fora may prove important for influencing positions in the international negotiation process and for addressing many of the trans-boundary climate change impacts (including directing the research agenda and facilitating *coordinated* interventions and spreading good practices, drawing on strengths distributed across the region). The **African Ministerial Conference on the Environment** (AMCEN) provides a permanent forum where African Ministers of the Environment discuss matters of relevance to the continent and climate change is now firmly on their agenda. **African Ministers of Finance** are also meeting in May focussing on climate change, which shows increasing political will to tackle the issue. A number of international and regional networks are being established to encourage and support climate adaptation, notably the **UNEP Africa Network on Climate Adaptation** which recently convened a large consultation meeting to discuss the structure and scope of the proposed network.

A recent **SADC Parliamentary seminar on climate change**, water and food security, held in October 2008 concluded that parliamentarians in southern Africa need to take urgent action on climate change, and that they should build on the African and European Parliamentary Action Plan on Climate Change and Food Security which was launched in Kenya in August 2008 by the **Association of European Parliamentarians for Africa** (AWEPA) and the **Pan-African Parliament**⁷. There is also a Climate working group under COMESA, and various sector-specific activities such as the **COMESA/SADC/EAC** initiative on climate, agriculture, land-use and livelihoods. The **Climate for Development in Africa Programme** (ClimDev) is funded by the AU, AfDB and UNECA, but despite having been in planning for several years it is still not operational.

A number of **international NGOs** (like ActionAid, the Red Cross, CARE, Oxfam, etc.), in partnership with national and local NGOs, are starting to lobby across the continent on various climate justice issues, and some are already mainstreaming climate adaptation and disaster risk reduction activities into their programmatic work. However, there is a sense that the lack of government leadership and confusing messages coming out of the scientific community are limiting progress on this. NGOs are well placed to support local communities in documenting and voicing concerns about the climate impacts they are already experiencing,

⁷ AWEPA Press release 2008

and to promote responses and express local demands for adaptation support to their national government, RECs, regional governing bodies and the international community.

A major problem is the concentration of capacity on climate change within too few institutions in Africa. Investment needs to be made in expanding and diversifying the institutions/organisations (governmental, academic, civil society, private, etc.) with the capacity to facilitate adaptation to climate change by rapidly building capacity in existing institutions. Taking advantage of synergies with other resource management and risk reduction efforts (e.g., water, land degradation, biodiversity, coastal zones, health and disasters) is imperative.

Policies and strategic decisions on complex issues such as biofuels (bio-energy and food trade-offs), trans-boundary water management and agrarian reform, in the context of climate change should be backed by reliable scientific guidance. The soundness of African policies will therefore depend, to a large extent, on the scientific community's ability to provide a solid backing which considers the continent's diversities and specificities. Effective science communication will be critical to open the required channels between science and policy-making in Africa. Donors constitute an important stakeholder in these dialogues.

Regarding the development cooperation (donor) organisations' agenda and actions pertaining to environment and climate change, a large range of donors contribute to shape Africa's regional, sub-regional management agendas. Key donors include World Bank, EU, AfDB, UNDP, UNEP, GEF, and some major bilaterals like DFID, GTZ, JICA, DANIDA, and the Dutch and French development cooperation agencies. A fair assessment of all these institutions call for a longer presentation. Therefore, only *some* key actors and their work are indicated below. Many major initiatives on the environment in Africa are co-financed and joint efforts.

The **World Bank** plays a principal role in initiating and harmonizing environmental management interventions regionally as well as sub-regionally in several major partnerships. The World Bank has developed a specific environment strategy for Sub-Saharan Africa. To illustrate collaboration on the implementation of the environment strategy the following partnerships are of interest: (i) integrated Land and Water Management: regionwide; World Bank with the UNDP, the UNEP, the GEF, the African Development Bank, the FAO, the CCD Secretariat, and the IDB; (ii) Soil Fertility Initiative: projects in eight countries; World Bank with the FAO, the International Fund for Agricultural Development (IFAD), and the Consultative Group on International Agricultural Research (CGIAR); (iii) Nile Basin Initiative: all Nile Basin countries; World Bank, the Swedish International Development Authority (SIDA), the German Agency for Technical Cooperation (GTZ), and the Canadian International Development Agency (CIDA), and financial contributions from the GEF, the FAO, and several bilateral donors; (iv) Regional Environmental Information Management Program: a network of public, private, and NGO participants in Central Africa; WB with the EU, the IFAD, Belgium, Canada, and France; hosted by Gabon; (v) Regional Traditional Energy Sector Program: regionwide; cofinanced by the GEF and the Norwegian and Danish trust funds, with the African Development Bank (AfDB), the WBI, MNA and the IFC as strategic partners; (vi) Program for Capacity Development on Environmental Assessment: based at Ghana's Environmental Protection Agency; other current and prospective partners include the EU, the Netherlands, Norway, and the AfDB; (vii) the Lake Victoria Environmental Management Programme phase two: Lake Victoria sub-region, with all EAC states and cofinanced by Sweden and GEF, and; (viii) African Water Resources Management

Initiative: regionwide, at country and river basin levels; co-financed by the U.K Department for International Development (DFID), Norway, Netherlands and Sweden; other partners include the UNDP, the UNEP, the FAO, the World Conservation Union (IUCN), the GTZ, France, Japan, Switzerland, USAID, and the Development Bank of Southern Africa.

DFID focuses on Southern Africa (essentially SADC member states) and includes Environment as one among eight areas for “Harmonization and cooperation” in its Southern Africa Regional Plan. Key themes for intervention include (i) resilient livelihoods, (ii) food security, (iii) sustainable water management, and (iv) climate change mitigation and adaptation. DFID has been active in seeking collaboration with other major donors and sub-regional and regional actors, including NEPAD.

African Development Bank (AfDB) has developed and starting implementation of the regional *Policy on the Environment* ((2004). It basically works on two fronts: first, it addresses pollution and natural resource depletion issues; second, it strengthens the existing environmental assessment procedures and develops new environmental management tools within AfDB. It sets out to mainstream environmental sustainability considerations in all of AfDB’s operations, and emphasizes institutional capacity building, environmental governance. Priority environmental problems and interventions are similar to many other donors in the region: (i) adaptation to climate change, (ii) reverse land degradation and desertification, (iii) protect the coastal zones, (iv) protect global public goods, (v) improve public health, (vi) enhance disaster management capabilities, (vii) promote sustainable industry, mining and energy resources, and (viii) improve urban environmental management.

European Commission is active in all regions of Africa with specific sub-regional plans set up for each region. Environmental aspects are set out to be implemented both as a cross-cutting issue in the operations as well as a standalone theme with specific environmental interventions in the sub-regions. EC strives to promote development of common strategies, tools and strengthening of networks and regional bodies to promote regional management of natural resources , in order to ensure the coordination of trans-boundary resources such as watersheds, grazing lands, wild life, coastal areas, tropical forests etc.

6. How and to What Extent are the Responses to the Environmental and Climate Change Problems and Opportunities Implemented and Followed-up?

6.1 Governance, enforcement

Clearly, the key regional and sub-regional inter-governmental organizations have developed largely appropriate environmental policies, operational strategies and action plans. This constitutes a necessary first step and is a promising sign of commitment. Integration of climate change issues is weaker compared to the treatment of “traditional” environmental issues like sustainable land use, integrated water resources management, biodiversity protection etc. In practice, however, the distinction between environmental and climate change issues is difficult to make which implies that many of the traditional environmental management activities (soil conservation, afforestation, sustainable water management etc.) also promote/constitute climate change adaptation and/or mitigation activities.

Despite some reports on progress (e.g. European Commission's review of environmental management in the SADC sub-region⁸), obstacles to effective environmental management in Africa include (i) slow environmental policy implementation, (ii) inadequate and un-coordinated national, sub-regional environmental legislation and institutions, (iii) poor legal enforcement, and (iv) insufficient financial and human capacity at all levels of implementation. Moreover, integration of environmental concerns into key national development plans (primarily Poverty Reduction Strategies) has also been poor. This is largely due to weak institutions and in some cases insufficient political will. Moreover, despite efforts at strengthening it remains true that partner absorption- and delivery-capacity in the area of environmental management is generally very weak. Analytical and policy formulation capacity is progressing. Successful realization of existing regional and sub-regional environmental strategies pre-supposes considerable strengthening of the existing capacity. Bottle-necks exist at all levels, including nationally and locally. A large majority of African governments have signed and ratified all the main regional environmental conventions multi-lateral environmental agreements (MEAs). Despite formal commitments and a growing recognition of the importance of environmental management and climate change adaptation for pro-poor growth, Africa is currently insufficiently equipped to adequately address its key environmental challenges. To ensure adequate environmental management, capacity has to be strengthened and the key environmental challenges ought to be (better) mainstreamed in key (national, regional) development plans and not pursued as isolated efforts.

In view of the weak capacity at the regional level, NEPAD's *Strategic Plan to Build Africa's Capacity to Implement Global and Regional Environmental Conventions* is of importance. Specifically, in order to improve the current situation, NEPAD has proposed to: (i) build capacity in all aspects of sustainable environmental management in Africa, (ii) secure political will and commitment of African governments; (iii) mobilise and harmonise international, regional and national resources, conventions and protocols to identify realistic programs appropriate environmental management in Africa; and (iv) support best-practice-in-action pilot programs that can serve as good examples regionally/sub-regionally. Although weak governance and enforcement can be used as arguments for discontinuing, down-scaling or phasing out support to regional or sub-regional environmental management efforts, such a strategy would be counter-productive given the fact that many of the key environmental problems and climate change impacts can only be addressed or solved via (sub-)regional cooperation. Hence, the implication is that governance and enforcement at the regional and sub-regional levels must be strengthened, in particular by reinvigorated capacity building within the key institutions.

Noteworthy, civil society actors like trade unions, NGOs, CBOs, media, universities and the private sector play a considerably *smaller* role at the regional level than at the country level. For these actors to have an impact regionally and sub-regionally they need to join forces across borders, coordinate better, and seek financial and organisational support.

7. What are the implications for Swedish Development Cooperation?

⁸ EC, 2005. A1 *3 (06) D/624; 2005; Regional Mid-term Review of SADC EDF 9 Regional Strategy Paper/Regional Indicative Programme

Below we address issues for Sida to consider, suggest some recommendations, and outline generally how environment and climate change considerations can be integrated in Swedish support to the region.

7.1 Issues for Sida to consider and recommendations

Regional and sub-regional water resources management: The priorities that need to be considered within the water sector are coordination with the framework for NEPAD and relevant Regional Economic Communities (RECs). The Lake Victoria initiative is a case where Sweden has assumed a special role. The impact has been positive but major challenges remain. The Swedish programme faces a consolidation and concentration where the main focus towards a programme based approach to the Lake Basin Commission and Nile River Commission may be given priority.

Key issues to consider include how Sida can promote strengthened African capacity for enhanced joint (coordinated) management of its trans-boundary water systems, including ensuring pro-poor allocation, sustained access and ensured rights to water resources – especially benefiting the poor, prevention of depletion and pollution of shared/trans-boundary water resources? Other issues include (supporting) identification and implementation of appropriate and cost-effective (combinations of) policy instruments (such as dialogue, analytical work, enhanced use of tools like EIA and SEA at project and sector level, respectively; institutional capacity development, regional/sub-regional investment programs) via support to regional and/or sub-regional inter-governmental organisations like the Regional Economic Communities, or independent actors (regional NGOs) outside the Government sphere, in order to attain sustainable use of the region's shared water resources and associated ecosystem services.

Agriculture and forest resources management: Although cultivation of soils and forestry/deforestation are always local in nature, agriculture and forest resources management in Africa - and associated problems of land degradation, soil erosion, deforestation and forest degradation – have regional implications and warrant regional solutions. AU has taken a region-wide initiative to prioritize Africa's agriculture through increased sector support within CAADP. The merits and necessary adjustments needs to be assessed and continued/increased support to CAADP may be considered. Pros and cons of CAADP needs to be identified vis-a-vis support to independent regional actors in the agricultural sector. Opportunities to obtain funds for mitigation (carbon storage) in agricultural soils may be significant and a real opportunity to inject capital in the agricultural sector and also obtain adaptation benefits in terms of enhanced soil moisture, increased yields, soil fertility, food security etc.

Regarding forestry, opportunities to access funding for reduced deforestation and forest degradation (REDD) in order to save/sustainably utilize Africa's forests while contributing to reducing greenhouse gas emissions and adaptation co-benefits may be considered. Reduced deforestation and forest degradation may also be viewed as a significant opportunity to promote climate change adaptation.

Climate change adaptation: Monitoring trends in climate and associated environmental changes underpins the identification of vulnerable regions, sectors and groups, and motivates taking serious action on climate change. However, monitoring systems in Africa are incomplete and in many cases degrading through lack of investment. Networks for monitoring

climate and environmental changes need urgent strengthening and Sida could support this working with the Global Climate Observation System.

Effective science communication is a key gap which will require long-term dialogue and organisations to 'translate' science into useful forms for policy-makers and other audiences, e.g the media. This is vital if policy is to be based on a clear understanding of the best available science. Efforts on risk communication are currently limited and programmes such as UNITAR's Capacity Development for Adaptation to Climate Change project, which have a risk communication component, could be expanded and sustainable dialogue developed with further funding.

There is a clear need to build a body of professional practitioners on climate change adaptation in Africa. This will require going beyond training workshops towards extended training courses incorporating elements from vulnerability assessment to the interpretation of climate scenarios.

Strong support for regional networks on climate adaptation is a valuable way of supporting adaptation across Africa. UNEP's incipient Africa network on Adaptation appears to be a good candidate for support, as UNEP is working to strengthen capacity on climate change adaptation, and the network will work through existing regional institutions.

Sida may wish to pursue a dialogue about the implementation of NEPAD's Action Plan of the Environment Initiative as well as the sub-regional environmental action plans. Here, it is vital that the dialogue focus in particular on the *implementation* of the multilateral environmental agreements.

In view of the large depletion of shared natural resources, Sida should contribute to (i) sustainable natural resource management for broad-based benefit sharing, trust building and conflict prevention, and (ii) maintained functioning of shared ecosystems and ensuring sustainable utilization (in particular regarding shared water resources, joint forest resources and management, and sustainable agricultural land use).

Synergies across sectors: In practice there are numerous links between environmental and natural resource problems (including climate variability and climate change) and the performance of a range of key economic sectors. To exemplify, poorly managed trans-boundary water resources have negative repercussions on public health, poverty reduction, economic production and trade, business investments and productivity. It may also compromise or deprive people of their rights and undermine democratic governance, and ultimately lead to insecurity and conflict.

Conversely, promoting sustainable environmental and natural resource management, and adaptation to climate variability and climate change contributes to enhancing the performance achievement of goals in other sectors such as promoting human rights (HR) and democratic governance, trade, strengthening financial systems, enhancing infrastructure, research; conflict, peace and security, health, and education. Moreover, performing environmental analysis and integrating environmental issues in sectoral planning and implementation (energy, trade, health, infrastructure etc.) contributes not only to enhancing the performance of these sectors but also to achieving environmental objectives. The specific links between environmental issues and other sectors need to be identified in more in-depth analyses, but it remains true to that much of the work of attaining environmentally sustainable development may not be achieved by standalone environmental projects (at regional, or sub-regional level)

but by integration of the key environmental issues in the policy design and practical interventions undertaken in other sectors.

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Annex 1: Africa region - key Environmental Indicators

Fig. A1.1 Land use in Africa region and sub-regions

	Permanent pastures		Other land uses		Annual rate of deforestation (%)		
	1990	2005	1990	2005	1980-89	1990-95	1980-95
Africa	892	901	1144	1164	0.8	0.7	8.7
Central Africa	79	79	176	187	0.6	0.6	13.6
East Africa	251	240	129	147	1.0	0.8	6.9
North Africa	108	111	534	528	0.3	0.6	5.6
Sothern Africa	309	320	100	104	0.7	0.8	2.9
West Africa	143	148	203	195	1.9	0.9	10.9
COMESA	354	353	322	345	0.8	0.8	6.5
ECOWAS	143	148	203	195	1.9	0.9	10.9
SADC	315	322	168	189	0.7	0.8	6.3

Source: AfDB, 2008. *Gender, Poverty and Environmental Indicators on African Countries 2008*, AfDB.

Fig. A1.2 Forest resources and change in Africa region and sub-regions

	Total Forest				Plantations	
	Area ('000 ha)		annual change %		Extent (ha)	% of tot forest
	2000	2005	2000	2005	2005	2005
Africa	654 505	634 307	-0.6	-0.6	13 166	3.1
Central Africa	238 862	235 409	- 0.4	- 0.3	107	0.2
East Africa	138 842	132 320	- 0.9	- 0.9	6 825	5.4
North Africa	8 024	8 248	0.9	0.6	2 099	23.6
Southern Africa	189 945	183 991	- 0.6	- 0.6	2 457	1.5
West Africa	78 832	74 339	- 1.1	- 1.1	1 678	2.7
COMESA	377 963	367 184	- 0.6	- 0.5	7 725	3.4
ECOWAS	78 805	74 312	- 1.1	- 1.1	1 678	2.7
SADC	349 487	340 060	- 0.6	- 0.5	2 319	1.2

Source: AfDB 2008. *Gender, Poverty and Environmental Indicators on African Countries 2008*, AfDB.

Annex 2: Observed and Projected Changes in Climate by African sub-regions, summarised from IPCC Fourth Assessment Report

Region	Observed Trends	Extremes
West	<ul style="list-style-type: none"> - greater warming trend since 1960s (changes not uniform) - increase in number of warm spells (1961-2000) - decrease in the number of extremely cold days (1961-2000) - decline in annual rainfall since end of 1960s (e.g. decrease of 20 to 40% noted between 1968-1990,), with an increase again since 1990, but still significantly below 1960s levels -Inter-annual variability has become larger since 1980 - decline in mean annual precipitation of around 4% in tropical rain-forest zone (1960-1998) 	Increased incidence of drought 1900-2002
Central	<ul style="list-style-type: none"> - greater warming trend since 1960s (changes not uniform e.g. decadal warming rates of 0.29°C in the African tropical forests) - declines in mean annual precipitation in the tropical rain-forest zone for period 1960 to 1998 (e.g. around 3% in North Congo and 2% in South Congo) - 10% increase in annual rainfall along the Guinean coast during the last 30 years 	
East	<ul style="list-style-type: none"> - greater warming trend since 1960s (changes not uniform) - decreasing trends in temperature from weather stations located close to the coast or to major inland lakes - intensifying dipole rainfall pattern on the decadal time-scale, characterised by increasing rainfall over the northern sector and declining amounts over the southern sector 	
Southern	<ul style="list-style-type: none"> - greater warming trend since 1960s (changes not uniform e.g. 0.1 to 0.3°C in South Africa) - increase in number of warm spells (1961-2000) - decrease in the number of extremely cold days (1961-2000) - no long-term trend in annual rainfall has been noted, but increased interannual rainfall variability has been observed in the post-1970 period - in certain parts (e.g. Angola,Namibia,Mozambique,Malawi, Zambia) there is evidence of changes in seasonality 	<ul style="list-style-type: none"> - more intense and widespread droughts - in certain parts (e.g. SADC) significant increase in heavy rainfall and flooding

Region	Projected Trends ⁹	Extremes
West	<ul style="list-style-type: none"> - annual mean surface air temperature for the period 2080-2099 is expected to increase between 3 and 4°C compared with the 1980-1999 period, with less warming in equatorial and coastal areas and greater warming towards the Sahel. - other experiments indicate higher levels of warming -There is large model disagreement over changes in precipitation, ranging from a strong drying to a strong wetting. Projections should 'be viewed with caution' -Some empirical downscaling experiments show a strong drying in the region. 	<ul style="list-style-type: none"> - there is still limited information specific to Africa on extreme events, despite frequent reporting of such events. -The frequency and intensity of heavy rainfall events is likely to increase - on a global basis,

⁹ All projections are for the A1B SRES emissions scenario

Central	<ul style="list-style-type: none"> - annual mean surface air temperature for the period 2080-2099 is expected to increase between 3 and 4°C compared with the 1980-1999 period, with less warming in equatorial and coastal areas - other experiments indicate higher levels of warming - mean annual rainfall for 2080-2099 is likely to increase in tropical areas (around +7%) - equatorial regions (north of 10°S and east of 20°E) show an increase in summer (December to February) rainfall 	droughts were also estimated to be slightly more frequent and of much longer duration by the second half of the 21 st century relative to the present day
East	<ul style="list-style-type: none"> - annual mean surface air temperature for the period 2080-2099 is expected to increase between 3 and 4°C compared with the 1980-1999 period, with less warming in equatorial and coastal areas - other experiments indicate higher levels of warming - mean annual rainfall for 2080-2099 is likely to increase in eastern Africa (around +7%) - equatorial regions (north of 10°S and east of 20°E) show an increase in summer (December to February) rainfall - regions located south of 10°S show a decrease in rainfall associated with a decrease in the number of rain days and in the average intensity of rainfall 	<ul style="list-style-type: none"> - The intensity of tropical cyclones in the Indian Ocean is likely to increase, but there is little information on changes in frequency or storm tracks. -The frequency of extremely hot days and seasons will increase.
Southern	<ul style="list-style-type: none"> - annual mean surface air temperature for the period 2080-2099 is expected to increase between 3 and 4°C compared with the 1980-1999 period, with less warming in coastal areas - other experiments indicate higher levels of warming, up to 7°C for southern Africa in September to November - Regional Climate Model (RCM) experiments generally give smaller temperature increases, e.g. southern Africa in the 2080s might expect a 3.7°C increase in summer (December to February) mean surface air temperature and a 4°C increase in winter (June to August) - austral winter (June to August) rainfall will very probably decrease in much of southern Africa, especially in the extreme west (up to 40%) - regions located south of 10°S show a decrease in rainfall associated with a decrease in the number of rain days and in the average intensity of rainfall - recent downscaling experiments for South Africa indicate increased summer rainfall over the convective region of the central and eastern plateau and the Drakensberg Mountains - RCMs indicate a decrease in early summer (October to December) rainfall and an increase in late summer (January to March) rainfall over the eastern parts of southern Africa 	

Annex 3: The Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment in brief

The Millennium Ecosystem Assessment (MA) was called for by the United Nations Secretary-General Kofi Annan in 2000. Initiated in 2001, the objective of the MA was to assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being. The MA has involved the work of more than 1,360 experts worldwide. Their findings, contained in five technical volumes and six synthesis reports, provide a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide (such as clean water, food, forest products, flood control, and natural resources) and the options to restore, conserve or enhance the sustainable use of ecosystems.

There is a growing understanding of the fundamental role ecosystems and the services they provide play for human welfare, see Fig 1. describing the linkages between biodiversity, ecosystem services and human well-being.

Key findings of the Millennium Ecosystem Assessment¹⁰, finalised in 2005 and the so far most comprehensive survey of the ecological state of the planet, include:

- 60% of world ecosystem services have been degraded
- Of 24 evaluated ecosystems, 15 are being damaged, see Table 1.
- About a quarter of the Earth's land surface is now cultivated.
- People now use between 40 percent and 50 percent of all available freshwater running off the land. Water withdrawals have doubled over the past 40 years.
- Over a quarter of all fish stocks are overharvested.
- Since 1980, about 35 percent of mangroves have been lost
- Nutrient pollution has led to eutrophication of waters and coastal dead zones
- Species extinction rates are now 100-1,000 times above the background rate

The degradation of ecosystem services is hence already a significant barrier to achieving the Millennium Development Goals, contributes to growing inequities and disparities across groups of people, and is sometimes the principal factor causing poverty and social conflicts.

Ecosystem Services in Africa region

Based on the findings in this Environmental Policy Brief we estimate that at least the following ecosystem services are either seriously degraded, or under risk of possibly being so:

<i>Seriously degraded:</i> Fresh water Air quality regulation Erosion regulation Natural hazard regulation Spiritual and religious values	<i>Under risk or possibly degraded:</i> Wild foods and Genetic resources Carbon sequestration Water regulation and purification Disease and Pest regulation Regional and local climate regulation
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Figure 1. Links between biodiversity, ecosystem services and human well-being

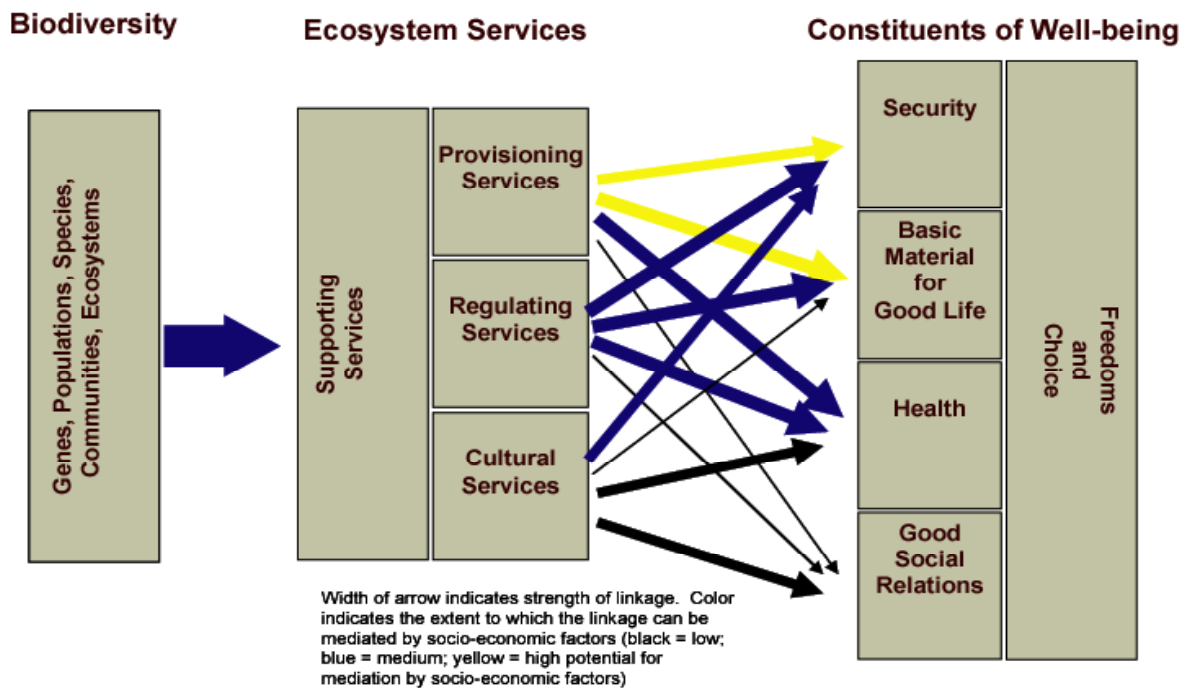


Table 1: Global condition of Ecosystem Services Examined by the Millennium Ecosystem Assessment

Ecosystem Services	Enhanced	Mixed	Degraded
Provisioning	Crops Livestock Aquaculture Carbon	Timber Fiber	Capture fisheries Wild foods Wood fuel Genetic resources Biochemicals Fresh Water
Regulating	Carbon sequestration	Water regulation Disease regulation	Air quality regulation Regional & local climate regulation Erosion regulation Water purification Pest regulation Pollination Natural Hazard regulation
Cultural		Recreation & ecotourism	Spiritual & religious Aesthetic values

For additional information on the MA including presentation materials etc, see <http://www.maweb.org>