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Natural resources in sub-Saharan Africa: Assets and vulnerabilities

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Natural resources in sub-Saharan Africa: Assets and vulnerabilities

Johan Holmberg

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List of acronyms

HIV	Human Immunodeficiency Virus
ACP	Africa, Caribbean and the Pacific
AfDB	African Development Bank
ANEW	African Civil Society Network on Water and Sanitation
AU	African Union
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centro internacional de mejoramiento de maiz y trigo
DAC	Development Assistance Committee (of the OECD)
DFID	Department for International Development
DR Congo	Democratic Republic of Congo
EAC	East African Community
ECA	Economic Commission for Africa
EC	European Commission
ECOWAS	Economic Community of West African States
EDF	European Development Fund
EIB	European Investment Bank
EITI	Extractive Industries Transparency Initiative
EDF	European Development Fund
EU	European Union
EUEI	EU Energy Initiative
EUWI	EU Water Initiative
FAO	Food and Agriculture Organisation of the United Nations
GDP	Gross Domestic Product
GW	Gigawatt
iSTAP	Infrastructure Short-Term Action Plan
ICT	International Communications Technology
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IFI	International Financing Institution
IGAD	Intergovernmental Authority on Development
IHT	International Herald Tribune
IPCC	International Panel on Climate Change
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resources Management
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goal
MT	Metric Ton
MW	Megawatt
NEPAD	New Partnership for Africa's Development
NGO	Non-governmental Organisation
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development

PRSP	Poverty Reduction Strategy Paper
RWSSI	Rural Water Supply and Sanitation Initiative (of the AfDB)
SADC	Southern Africa Development Community
SSA	Sub-Saharan Africa
TW	Terrawatt
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
US	United States
USD	US dollar
USDA	US Department of Agriculture
WFP	World Food Programme
WHO	World Health Organisation
WSP	Water and Sanitation Programme
WSS	Water Supply and Sanitation
WSSD	World Summit on Sustainable Development

Executive Summary

This is one of five background papers for the White Paper on Africa that the Swedish government will submit to parliament in early 2008. It starts with a discussion of the impacts of climate change on sub-Saharan Africa and the vulnerability of the region to such change as predicted by the fourth assessment report of the Intergovernmental Panel on Climate Change, released in February 2007. The report notes that by 2020, a projected 75–250 million people in Africa will be exposed to increased water stress due to climate change, with agricultural production severely compromised, local food supplies negatively affected and, towards the end of the 21st century, low-lying coastal areas threatened by rising sea levels. Climate change may also impact on security, cause increasingly severe natural disasters and lead to increased out-migration from affected regions. More attention will need to be devoted to eliminating impediments to economic growth if vulnerabilities to climate change are to be addressed.

Even absent climate change, Africa is suffering from water scarcity and the situation is worsening: 340 million people already lack access to safe drinking water and almost 500 million, over half of all Africans, lack access to adequate sanitation. On the whole, countries in Africa are not on track to achieving the Millennium Development Goal targets on water supply and sanitation, with implications for, *inter alia*, child mortality and maternal health. Africa has a multitude of transboundary water basins, which create special development challenges.

Biomass accounts for nearly 60% of the primary energy supply and satisfies the cooking and heating needs of 90% of the population. This has consequences not only for deforestation but also for human health as a result of indoor air pollution. The continent has substantial hydropower potential only 7% of which is exploited. Electricity consumption is increasing and steps are being taken to improve power distribution through sub-regional power pools.

As much as two-thirds of all arable land is estimated to be affected by degradation resulting from a variety of factors, including population pressure, inadequate or ambiguous land tenure rights, inappropriate farm technologies and insufficient extension support and research. Most African soils are difficult to manage sustainably, particularly as population pressure and other factors increasingly constrain traditional shifting cultivation.

Deforestation has proceeded at an annual rate of 0.7% through the 1990s and at a somewhat lower rate in 2000–05. Although there have been increases in the forest areas designated primarily for conservation and also for plantation forestry, progress towards sustainable forest management appears to have been limited during the last 15 years. Similarly, exports of forest products are declining, possibly reflecting a gradual depletion of prime log-producing areas.

Africa is rich in oil and mineral resources, with West Africa the world's fastest growing source of oil and with new discoveries being regularly made. However, there has been little development dividend in the oil-producing countries, most of which suffer from bad (or very bad) governance. Some African countries, South Africa in particular, are leading producers of various minerals, and the role of oil and minerals in exports from sub-Saharan Africa has increased during the 1990s.

Agriculture dominates the economy of African countries and is a major factor in de-

termining livelihood prospects, but the performance of African agriculture over the last 25 years has generally been poor. As a result, the number of hungry people has increased by 20% since 1990 and is now estimated at 32% of the total population, the highest of any region. The causes of stagnating productivity in Africa include low internal effective demand due to pervasive poverty, unfavourable external markets, limited development of irrigated agriculture, limited use of improved farm inputs, inadequate infrastructure and weak institutions. African countries are highly dependent on a few cash crops for their export revenues. In countries with access to the sea or major lakes, fisheries provide important supplements to the economy and to dietary intake. Employment in agriculture is high and decreasing only slowly because of the lack of economic opportunities in industry and services. Paradoxically, in view of the importance of agriculture for African development, the interest of donors in supporting the sector is declining.

In light of the vulnerabilities arising from climate change, it will be important to bring adaptation measures into the mainstream of sustainable development, with special attention being paid in the coming years to the role of water. Adaptation to climate change will require, among other matters, better forecasting and early warning systems, education and awareness creation, capacity building and good governance. Additional investment in infrastructure, particularly energy and transboundary water resources, will be required and the EU has launched a major initiative in this area. Steps will need to be taken to increase agricultural productivity, and research has an important role to play. Sanitation is an area where the situation in Africa is particularly dire, and underinvestment is most glaring.

The most important external actors with respect to natural resources in Africa are the World Bank, which in 2005 disbursed some US\$ 3.6 billion, of which about one-quarter was earmarked for natural resources, and the European Commission, which in the same year disbursed US\$ 3.2 billion, of which about 9% was for natural resources. The largest bilateral donors were the US, France, the UK and Germany, all of whom give high priority to water and sanitation and less to agriculture. The most important internal African actor is the African Development Bank with disbursements of US\$ 836 million in 2005.

The poorest countries are most vulnerable to climate change and Africa is particularly exposed. Sweden should consider the full integration of climate-change adaptation strategies into its development cooperation with African partners. This will likely mean that certain existing priorities will be further accentuated, such as the need to provide water and sanitation services to the poor, raise agricultural productivity and curb deforestation. Much more attention should be given to the development and dissemination of renewable energy technologies. With the prospect of increasingly frequent natural disasters, disaster-preparedness in several countries will need to be enhanced. There are opportunities for Sweden to collaborate increasingly with EU member states and institutions, for example in infrastructure. More attention should be given to strengthening African civil society, particularly in the countries exporting oil and minerals.

1. Purpose and Outline

The Swedish government announced its intention in its budget proposal to parliament for 2007 to submit a White Paper on Swedish relations with Africa. The previous White Paper on this subject, 'Africa on the Move', was submitted in March 1998, with a revised and shorter version appearing in 2002. The White Paper is intended as the basis for the formulation of Swedish government policies towards Africa, not only regarding development cooperation but also in trade, security, cultural exchange and other areas of particular Swedish interest. Work on the new White Paper commenced in spring 2007, with the first draft to be available by 1 November 2007 and anticipated final submission by December 2007. The project is coordinated by the Africa Department of the Ministry for Foreign Affairs.

The White Paper will highlight new developments in Africa as well as other trends of relevance to Swedish relations with the continent. It will explore how these trends affect Sweden and how Sweden can position itself in relation to them. It will discuss those changes relevant not only to Swedish bilateral relations with Africa but also to Swedish involvement in EU and UN initiatives. Its point of departure will be the existing Swedish policy on global development. The White Paper is to focus on sub-Saharan Africa (SSA) as a whole and will not describe developments in individual African countries or sub-regions other than for purposes of illustration.

Background material for the White Paper comprises five papers commissioned from external writers by the Nordic Africa Institute in Uppsala as well as a set of shorter, non-formal thematic papers mostly written within the Ministry for Foreign Affairs. The five papers cover the following areas:

- The 'New Africa'
- Natural resources – assets and vulnerability
- Human resources
- Demography
- Economic growth

This is the third of the five papers. Its chapters review the following issues:

- climate change in SSA, its foreseen impacts and the resultant vulnerabilities
- four dimensions of natural resource development: land use, water, energy, oil and minerals
- agriculture and employment
- vulnerability and adaptation strategies
- principal internal and external actors and suggestions for Sweden's role

The terms of reference are attached as Annex 1. They specify that the papers should be no longer than 30 pages, although this limit was later relaxed. The paper is intended to provide a broad overview and to highlight selected issues perceived to be of general interest to Sweden. It should be read along with the other papers mentioned above and will not dwell much on issues covered by them. Illustrations are taken mainly from African countries with which Sweden has, or had, development cooperation. Annex 2 provides a bibliography indicating principal references for each chapter.

2. Climate change: impacts and vulnerabilities

Different aspects of vulnerability to climate change are discussed in this chapter, ranging from impacts within the natural resource sector, such as water and food, to political and social aspects, such as security and migration. The latest estimates from the UN Intergovernmental Panel on Climate Change (IPCC) form the basis of the analysis.

2.1 Predicting African climate

It is necessary to preface discussion of the likely impact of climate change in Africa with a caveat on technical problems. Developing reliable predictions of future climate change in Africa is made difficult by the complexity of the African climate¹ coupled with the lack of accurate baseline data on the current climate needed for feeding into models of future climate. While global climate models can simulate changes to African climate resulting from increased greenhouse gas concentrations, two potentially important drivers of African climate variability, namely the El Niño/Southern Oscillation and changes in land cover, are not well represented in the models. Predictions of future climatic changes in Africa are therefore subject to more uncertainties than for other regions of the world.

2.2 The IPCC estimate of climate change in Africa

The fourth assessment report of the IPCC was released in February 2007. It stated that temperatures have risen by 0.76 degrees Celsius since the 19th century and predicted a minimum increase of 2.5 degrees in Africa by 2030. It concluded that SSA, small island states and the major river deltas of Asia are among the most vulnerable areas. On Africa, the report reached the following conclusions, all with a “high level of confidence,” and some building on the third IPCC assessment report of 2001:

- “By 2020, between 75 and 250 million people are projected to be exposed to an increase of water stress due to climate change. If coupled with increased demand, this will adversely affect livelihoods and exacerbate water-related problems”.
- “Agricultural production, including access to food, in many African countries and regions is projected to be severely compromised by climate variability and change. The area suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease”.
- “Local food supplies are projected to be negatively affected by decreasing fisheries resources in large lakes due to rising water temperatures, which may be exacerbated by continued over-fishing”.
- “Towards the end of the 21st century, projected sea-level rise will affect low-lying coastal areas with large populations. The cost of adaptation could amount to at least 5–10 per cent of GDP”.

The report goes on to note that, “Africa is one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity. While some adaptation to current climate variability is taking place, this may be insufficient for future

1. Africa is characterised by a wide variety of climate systems ranging from humid equatorial systems through seasonally arid tropical to sub-tropical Mediterranean type climates. These systems also vary because all these climate types exhibit differing degrees of temporal variability, particularly with regard to rainfall. Because of the deficiency in observational climate data, scientific understanding of these systems is considered rather low compared to many parts of the world.

changes in climate”.

There are significant difficulties in defining what impacts of climate change should be considered to be dangerous, in addition to the underlying problems of predicting impacts over time as a result of warming. Decisions on such impacts are ultimately value judgments determined through socioeconomic processes that take into account considerations such as development, equity and sustainability as well as uncertainties and risk. With that in mind, the third IPCC report highlighted the following areas of particular concern to SSA: water resources, human health, agriculture and food security, ecosystems and biodiversity, forestry, coastal zones and marine areas. Comments on each of these are provided below.

2.3 Water resources

Climate change is likely to be associated with increased water stress in much of Africa. By mid-century, annual river run-off and water availability are projected to decrease by 10–30% in dry regions at mid-latitudes and in the dry tropics, some of which are presently water-stressed areas. Drought-affected areas will likely increase in extent. Heavy precipitation events, which are very likely to increase in frequency, will augment flood risk. An assessment by UNEP in 2002 suggested that by 2050, rainfall in Africa would decline by 5% and become more variable year by year.

Within the Nile basin there is a high confidence that temperatures will rise, but there are disparities between models on rainfall predictions over both the Blue Nile and the White Nile. Temperature rise will lead to greater loss through evaporation and place additional stress on water resources regardless of changes in rainfall. Nine climate scenarios showed decreases in Nile flows from zero to approximately 40% by 2025.

The ice cap on Mount Kilimanjaro has been disappearing due to climate change, with serious implications for the rivers that depend on ice melt for their flow. One study shows a reduction in the ice cap of around 82% since it was first surveyed in 1912. Several rivers are already drying out in the summer season due to the depletion of melt water, and recent projections suggest that if receding continues at its present rate the ice cap may disappear completely within 15 years. Other glacial water reservoirs such as Ruwenzori in Uganda and Mount Kenya face similar threats.

2.4 Agriculture and food security

Modelling studies indicate that only 80,000 km² of agricultural land in SSA currently severely constrained environmentally (out of more than 15.1 million km²) are expected to improve with climate change, whereas more than 600,000 km² currently classified as moderately constrained would move into the class facing severe environmental limitations.

African countries whose economies rely heavily on one or two agricultural cash crops are vulnerable to climate change, while a general decline in most subsistence crops is seen as likely. The productivity of fisheries in major African lakes is likely to decrease. Box 1 cites some of these predictions.

Box 1: Predicted agricultural productivity losses resulting from climate change

- In Uganda, a study concluded that an increase in temperature by an average of 2°C would drastically reduce the area suitable for growing Robusta coffee, which is a major export crop, and restrict growth to highland areas only.
- Examples of subsistence crops predicted to decline include sorghum in the Sudan, Ethiopia, Eritrea and Zambia, maize in Ghana, millet in the Sudan and groundnuts in Gambia.
- The primary productivity of fish in Lake Tanganyika would decrease up to 20%, implying roughly a 30% decrease in fish yields.

Source: Studies cited by UNFCCC in documentation for 2006 workshop in Accra, Ghana.

General impacts of climate change on agriculture include reduced soil fertility, increased pest attacks resulting from increased temperatures and decreased livestock productivity, both directly (through higher temperatures) and indirectly (through changes in the availability of feed and fodder). Then there are the implications for human resources and hence for agricultural productivity resulting from the impacts on human health, as discussed below.

The food security threat posed by climate change is great for Africa, where agricultural yields and per capita food production have been steadily declining and where population growth will double the demand for food, water and forage in the next 30 years. According to the FAO, Africa's food supply will need to quadruple by 2050 to meet people's basic caloric needs, even under the most conservative population projections. Of the total additional people at risk of hunger due to climate change, Africa will likely account for the majority in the second half of the century.

2.5 Human health

The health effects of rapid climate change are likely to be overwhelmingly negative. The vulnerability of Africa to health impacts is a function of climatic as well as many other factors, such as poverty, conflict, availability of health services, and awareness of and attitude to preventive measures. Africa is already vulnerable to a number of climate-sensitive diseases:

- Rift Valley Fever, which afflicts people and livestock, is closely associated with the heavy rainfall events that are predicted to increase with climate change.
- Cholera, associated with both floods and droughts, may increase with climate change. Increased temperatures could increase the levels of cholera bacteria in tropical seas and lakes, while changes in rainfall will affect the transmission potential and the presence of vector-borne and waterborne pathogens.
- Malaria is already one of the world's most serious and complex public health problems, and it has now been identified as the disease most likely to be affected by climate change. Increased flooding could facilitate the breeding of malaria carriers in formerly arid areas. Small geographical changes in the distribution of malaria may expose large numbers of people to infection, e.g., in the densely populated highlands of East Africa.
- Vector-borne diseases considered sensitive to climate change also include Leishmaniasis, Chagas disease, Lyme disease, African trypanosomiasis and Onchocerciasis.

Increased food insecurity will lead to undernourishment, particularly in children. Lack of water is associated with poor sanitary conditions, which affect child mortality as well as school attendance (particularly for girls) and maternal health. Heat stress and drought are likely to impact negatively on animal health, production of dairy products and meat and animal reproduction, with consequences for food security, protein deficiency and malnutrition. Together, these aspects of health vulnerability will negatively affect life expectancy and child mortality, unless determined corrective strategies are put in place.

2.6 Biodiversity

Africa is endowed with highly diverse fauna and flora, but this biodiversity is already under threat from a number of natural as well as human-induced pressures. Examples include land-use conversion for agricultural expansion and associated habitat destruction, pollution, poaching, civil war, introduction of exotic species and population growth. According to a study by the IUCN, foreign aid has not helped much: documentation for a conference in 2006 noted that, “European development assistance is often assessed as contributing to biodiversity loss more than to its sustainable management”.²

Increasing frequency of droughts and floods associated with climate variability could have a negative impact on the ecosystems of some areas of Africa, while lakes and reservoirs in traditionally dry regions such as the Sahel could lose part of their storage capacity. Changing rainfall patterns could lead to soil erosion, siltation of rivers and deterioration of watersheds. Wetlands of international importance, such as the Okavango Delta and the Sudd, and their associated wildlife would be under threat. Temperature increase would likely impact on the biodiversity of montane species, which have limited opportunity to migrate to higher elevations (Box 2).

Box 2: Loss of African biodiversity

Central Africa had lost about half of its wildlife habitats by 1986, while between during 1980 and 1995 the number of extinct plants in Southern Africa increased from 39 to 58, with more than 700 vertebrate species and around 1,000 tree species threatened with extinction. Climate change will trigger species migration and lead to further habitat reduction. One study examining over 5,000 African plant species predicts that suitable habitats for 81–97% of the plant species will decrease or shift due to climate change and that by 2085 about one-third of the species' habitats are expected to be lost altogether.

Source: Studies cited by UNFCCC in documentation for workshop in Accra, Ghana in September 2006

2.7 Forests and woodlands

Forests in Africa are currently under pressure as a result of demand for firewood and charcoal as energy sources and of the export of forest products such as timber, the underlying driving force often being population growth. As a result, African forests are being degraded at alarming rates (Section 3.3.2 below).

Deforestation has been documented in field inventories of forest species, which show a 25–30 km shift in the Sahel, Sudan and Guinean vegetation zones in the past half century.

2. The conference on Biodiversity in European Development Cooperation (September 2006) was organised by IUCN and supported by the EC, France, Finland, Belgium and Sweden.

This shift is likely to accelerate as a result of climate change. The changes discussed above regarding water availability, rising temperatures and declining biodiversity resulting from climate change are likely to contribute to further degradation of forests. Fires will be an increasing problem for desiccated forests. The ecological role of forests, such as protecting watersheds and conserving biological diversity, will be impaired, leading to a negative spiral of ecosystem degradation.

Globally, emissions of greenhouse gases from deforestation are significant and are estimated to represent 18% of the total, a share greater than is produced by the global transport sector. The Stern Review analysing the economics of climate change underlined curbing deforestation as a highly cost-effective way to reduce greenhouse gas emissions.

2.8 Coastal zone and marine areas

Coastal ecosystems are among the most productive yet highly threatened systems in the world. They make a disproportionately greater contribution to human wellbeing than most other ecosystems. Yet they are already under serious threat from the various effects of high population concentrations along the coasts: more than 25% of Africa's population lives within 100 km of the coastal waterline, a steadily increasing number. By 1998, the Indian Ocean had already experienced massive coral bleaching with over 50% mortality in some regions.

Sea levels around Africa are projected to rise by 15–95 cm by the year 2100, according to IPCC. Impacts of sea level rise include reduced productivity of coastal fisheries, coral bleaching, mass migration of populations from the coast and associated health issues, salt water intrusion, loss of recreational beach facilities with negative impacts on tourism and loss of coastal infrastructure such as ports. Some country impacts of a rise in sea level due to climate change are noted in Box 3.

Box 3: Impact of sea level rise

Coastal settlements in the Gulf of Guinea, Senegal, Gambia, Egypt and along the East-Southern African coast would be partly or completely inundated. In Tanzania, a sea level rise of 50 cm would inundate over 2,000 km² of land. Sea level rise would destroy coastal and marine ecosystems in lagoons and mangrove forests in both Eastern and Western Africa and would impact urban centres such as Cape Town, Maputo and Dar es Salaam. In the Nile Delta, it would destroy weak parts of the sand belt and low-lying agricultural lands, forcing perhaps 20 million people to migrate.

Source: Documentation for UNFCCC seminar in Accra, Ghana in September 2006

2.9 Climate change as a security threat

In April 2007, Britain, holding the rotating presidency of the UN Security Council, called for a meeting of the Council to discuss global climate change as a threat to international political stability. The British ambassador to the UN listed “border disputes, migration, energy supplies, resource shortages, societal stress and humanitarian crises” as examples of the threat to international peace and security that climate change poses. The thesis is that in SSA conflicts

between fragile states would increase on the back of, for instance, increasingly scarce water or land resources and resultant migrations.

This is, of course, a hypothesis that remains to be proven. In the mid-1990s, it was widely postulated that conflicts over shared water resources would increase as a result of increasing water scarcity, but that has not really happened. On the contrary, there are several examples where shared water resources have brought countries with conflicting interests closer together, the Nile Basin Initiative being one such example.

But the climate change now envisaged is on a different scale altogether and will affect the very survival of badly affected communities. As overall resources diminish, there is clearly a risk of increased conflict, perhaps more within than between countries. As governments become increasingly preoccupied with adaptation to the immediate effects of climate change, they are more vulnerable to social strife and the discontent of affected population groups. It has been suggested that “many of Africa’s armed conflicts can be explained as tinderboxes of climate change lit by the spark of ancient rivalry”.³

2.10 Natural disasters and migration patterns

The effect of extreme weather on poor communities is devastating. Approximately three in four natural disasters – such as droughts, floods or cyclones – are weather related, and 97% of deaths from natural disasters occur in poor countries. Poor communities struggle to recover as disasters become more severe and frequent. Disaster-prone regions have difficulty in attracting investment, which further undermines their development prospects. A basic problem is that few African countries have any disaster preparedness and most of them lack the institutional and financial capacity to respond to extreme climatic events.

An example is Mozambique, where torrential rainfall in 2000 led to the worst flooding in 50 years. It directly affected two million people and forced 650,000 to leave their homes, and it cost US\$ 600 million and reduced economic growth from a target of 10% to below 4%. It is clear that countries exposed to natural disasters, such as Mozambique, will become increasingly vulnerable as the frequency of such events increases, and that they must keep this in mind when designing adaptation strategies.

As a consequence of climate variations, it may be expected that migration from rural to urban areas will accelerate, particularly in vulnerable countries in marginal regions, e.g., the Sahel or the Horn of Africa. It is not unrealistic to expect that over several decades to come entire areas in marginal regions will be depopulated. This will lead to rapid growth of urban slums but also the increased risk of social upheaval that was discussed above. It will also increase the ‘ecological footprint’ (mainly) through deforestation around fast-growing African cities, as residents seek wood for fuel and charcoal and food.

Illicit migration from SSA to Europe is increasing rapidly, with dramatic images of overloaded boats trying to make the crossing to Spain or Italy from North Africa becoming so common they no longer make first-page news. Such migration is likely to continue to increase as inhabitants of marginal areas, mainly but not only in the Sahel region, find it difficult to make a sustainable living.

3. *Time*, 7 May 2007. The article suggests that climate change is the underlying cause of the conflict in Darfur.

2.11 Economic development

In 2004, primary commodities comprised 69% of merchandise exports from SSA and included oil, minerals and agricultural produce. These exports are vulnerable to changes in world market prices over which SSA countries, for the most part, have little influence. Climate change and extreme weather conditions are likely to impact negatively on the production of cash crops for export. Some of these crops, such as sugar, place great demands on the increasingly scarce water resource. In several cotton-exporting countries in the Sahel, for example Mali, reduced precipitation may curtail production and force changes in cultivation patterns.

On the other hand, production and exports of oil and minerals will not be affected by climate change and these commodities will likely continue to command, for the most part, strong world-market prices. It is true that production conditions for important cash crops will be affected by climate change, but that will also be true of other regions and countries with which SSA exporters compete, such as Brazil (cocoa) or Colombia (coffee). It is not clear what the impact of climate change will be on those and other countries relative to countries in SSA, but it is likely that world market prices will rise for all cash crops produced under conditions strongly affected by climate change.

Nevertheless, most SSA countries will become more vulnerable to climatic events affecting their economic development, as illustrated in the case of the floods in Mozambique mentioned above. The other symptoms of vulnerability already mentioned will affect their economic development negatively, as illustrated by the ICPP estimate that adapting to sea level rise could cost affected countries as much as 10% of GDP (Section 2.2). While such rough estimates should be treated with caution lest they become received wisdom, it is clear that economic development in SSA in the years ahead will become increasingly vulnerable to climate change. The conclusion for development is that, if anything, more attention must be devoted to eliminating impediments to economic growth: no alternative is possible if vulnerabilities resulting from climate change are to be addressed.

3. Four Dimensions of Natural Resource Development

This chapter discusses four dimensions of natural resource development, all of crucial importance to present and future development in SSA.

3.1 Water scarcity

3.1.1 Water Stress

Even absent climate change, Africa is suffering from water scarcity and the situation is worsening. While Africa uses only about 4% of its renewable freshwater resources, water is becoming one of the most critical natural resource issues. Availability of water on the continent is highly variable. Only the humid tropical zones in Central and West Africa have abundant water. However, many others already face, or will soon face, water stress (defined technically as 1,700 m³ or less per person annually) or scarcity conditions (1,000 m³ or less per person annually).⁴

Currently, 14 African countries are subject to water stress or water scarcity, with those in Northern Africa facing the worst prospects. Over one-third of all Africans do not have safe drinking water and more than half lack adequate sanitation. This situation is worsening as a consequence of rapid population growth, expanding urbanisation and increased economic development. One UNEP estimate predicts that by the year 2025 25 African countries will be subject to water scarcity or water stress. Box 4 summarises some of the water challenges facing Africa.

Box 4: Africa's Water Challenges

- 340 million people, 39% of the population, lack access to safe drinking water
- 497 million, 57% of all Africans, lack access to adequate sanitation facilities
- Low water storage capacity of less than 50 m³ per person compared to 3,500 m³ per person in Europe and 6,000 m³ in the US
- Only 3.8% of Africa's total renewable water resources of 5,400 billion m³ are developed for water supply, irrigation and hydropower
- 59 transboundary water basins covering 60% of the continent

Source: African Development Bank, press release on World Water Day, 22 March 2007

Africa has a plentiful supply of rainwater, an average of 673 mm per year. However, there are substantial variations at sub-regional and national level. The continent also has a long history of rainfall fluctuations of varying frequency and intensity, leading to prolonged droughts and floods, and climate change will exacerbate the situation in years to come. For example, during the 25 years between 1980–2004, Ethiopia experienced drought in 15 of these years, Zambia in 11, Tanzania and Zimbabwe in nine.

Groundwater accounts for about 15% of African water resources. It is crucial for many countries, particularly during the dry season and in large arid zones. Because of the low level of rainfall

4. When the figure drops below 1,000 m³, nations are considered water scarce, which means that lack of water becomes a severe constraint on food production, economic development and protection of natural systems, often forcing residents to migrate.

in some countries, large numbers of people depend on groundwater as their primary source of freshwater. For example, groundwater accounts for 60% of water use in Algeria, 80% in Botswana and 40% in Namibia. There are some 38 transboundary groundwater aquifers in Africa, the largest of which is the Nubian Sandstone Aquifer System, which is shared among four countries in Central and North Africa. Groundwater studies have in general been greatly lacking, since substantial investment and expertise is required to assess the quantity and quality of aquifers accurately.

3.1.2. Water supply and sanitation basic services

Countries in SSA are not, on the whole, on track to achieving the Millennium Development Goal targets by 2015, and performance is poor regarding the MDG target “to halve by 2015 the number of people without access to safe drinking water and improved sanitation”. UNICEF monitors progress towards this MDG target and reported in September 2006 that of 46 countries in SSA, 22 were on track to achieve the water target but only two were on track to meet the sanitation target. This is directly correlated with mortality in children under five years of age, which at 191 child deaths per 1,000 births in West/Central Africa and 149 in Eastern/Southern Africa is the highest in the world. The water and sanitation target is key for achieving most of the MDGs (Box 5).

Box 5: The importance of water for achievement of MDGs

Many African countries suffer from water stress or water scarcity and climate change will exacerbate the situation. Water has a special importance for the MDGs because of its multiple roles. Achieving the target on water supply “to halve by 2015 the proportion of people without sustainable access to safe drinking water” will impact not only MDG 7 (environmental sustainability) but also MDG 1 (poverty and hunger), MDG 2 (primary education), MDG 3 (gender equity), MDG 4 (child mortality) and MDG 5 (maternal health). All told, water and sanitation services contribute towards the achievement of seven MDGs and nine targets.

Source: Review of the EU Water Initiative, March 2007, see www.euwi.net.

A particular difficulty relating to water supply and sanitation (WSS), often referred to as basic services, is the low priority given to it by many SSA governments, despite the obvious shortcomings and needs and despite the role played by water in meeting a multitude of needs in society and indeed several of the MDG targets. Governments relatively rarely highlight the needs of the sector in annual investment plans or in PRSPs, conceivably because of a disinclination by ministers to dwell on mundane matters such as drinking water or sanitary facilities. An assessment conducted by the African Development Bank in 2005 of 34 countries in Africa indicated that of these only 14 had a water resources policy and only 16 gave priority to water and sanitation in their PRSPs. In the absence of suitable policies and priorities in key planning documents, it becomes difficult to attract resources to the sector from internal and external sources and underinvestment continues. According to one calculation by AfDB in 2004, an additional investment of US\$ 14.2 billion will be required until 2015 for African countries to achieve the MDG water target, while others have come up with larger estimates.⁵

5. For example, the UNDP Human Development Report 2006 estimates over US\$ 2 billion per year over the next decade.

The Water and Sanitation Programme (WSP) has assessed the performance of all African countries with regard to WSS as follows:⁶

- a. Countries that will reach the MDG WSS target – 10 (e.g., South Africa, Mauritius, Namibia, Botswana, Tunisia)
- b. Countries that can, with help, reach the MDG WSS target – 10 (e.g., Uganda, Senegal, Benin, Burkina Faso, Kenya, Tanzania)
- c. Countries that struggle with key reform/capacity issues but could improve sector performance with considerable help – 19 (e.g., Zambia, Ethiopia, Malawi, Mali, Niger)
- d. Countries with fragile environments (e.g., internal strife) unable to make significant state-led development initiatives – 14 (e.g., DR Congo, Sudan, Somalia, Zimbabwe)

The WSP cites Benin, Ethiopia and Senegal as particular success stories in extending coverage of basic services and strengthening financing mechanisms. The best performing countries are usually those that have undertaken institutional reforms, recognising that provision of WSS cannot be undertaken by central ministries or agencies but must be devolved to the more local level.

3.1.3 Transboundary water resources

African water resources are characterised by a multiplicity of transboundary water basins. Africa has about one-third of the world's major international water basins, with a total of about 59 international river and lake basins (Box 4). Most countries share many water basins and most of the basins in the region are shared. For example, the Nile River basin is shared by ten countries, while Guinea shares 12 river basins with other countries. The largest basin is that of the Congo River (3,690 km²), which is shared by nine countries.

Fewer than ten of the transboundary water basins in Africa have the cooperation agreements necessary for sustainable management and equitable sharing of resources among riparian states. Management of these basins raises a number of specific problems. Technical information on many of them is limited, in part because of difficulties connected with data collection across borders. Multi-country efforts for integrated development of transboundary water basins are limited to a relatively small number of basins and aquifers. The water interdependency within SSA is accentuated by the fact that, for some countries, high percentages of the flows of crucial rivers originate outside their borders. For example, almost all of Egypt's flows of the Nile originate outside its borders, while for Mauritania (the Senegal River) the figure is 95% and for Botswana (the Okavango River) it is 94%. Despite this, few shared waters are jointly managed at present and the issues of water rights and ownership of international waters often remain unresolved, resulting in national interests prevailing over shared interests.

Nevertheless, there are several examples of joint initiatives towards common basin management that are making good progress, such as the Nile Basin Initiative, the Volta River Basin Authority and others. Properly managed basin organisations have several benefits. They ensure enhanced monitoring and early warning, provide opportunities for information and risk sharing and facilitate pooling of technical and financial resources, thereby reducing the burden on individual countries. The Southern African Development Community protocol on shared watercourses is a comprehensive cooperation agreement in this area.

6. The WSP is administered by the World Bank and supported by several donors, including Sweden.

3.1.4 Water and food security

The water shortage has serious implications for food security in SSA. Food production per capita is stagnating and the region is now in a worse nutritional position than it was 30 years ago. In the past, additional food in SSA came from increases in the area cultivated, but as good land becomes increasingly scarce, the region will be forced to increase yields, including by expanding irrigated farmland.

Currently, the percentage of arable land and permanent crops that is irrigated is 3.5. But ten countries control over 80% of all irrigated areas, while 28 countries, covering more than 30% of the continent, share a mere 5% of irrigated farmland. Irrigated land in Africa expanded at a rate of 1.2% per year some 30 years ago, but the rate of expansion began to fall in the 1980s and is now below 1% per year, although this varies considerably from one country to another.

There is wide scope for expansion of irrigated areas in SSA by increasing the proportion of cultivated lands under irrigation. However, since agriculture typically consumes about 70% of all freshwater resources, such expansion can only occur with due attention to other uses of water under an integrated water resources management (IWRM) regime. In many instances where the land is suitable for irrigation and the demand for more food is strong, the real constraint will be water availability.

3.2 Energy supply

3.2.1. The role of biomass

Africa is the world's largest consumer of biomass energy. The amount of biomass used as primary energy has more than doubled since 1971. Biomass energy accounts for nearly 60% of the primary energy supply in SSA and satisfies the cooking and heating needs of 90% of the population, this figure being even higher in many countries.⁷ The biomass in question consists almost entirely of solid waste or solid organic matter, ranging from wood fuels (firewood, wood chips, sawdust, charcoal, etc.) and solid waste of agricultural origin (straw, husks, briquettes, dung, etc.) to purpose-grown crops. Other forms of 'refined' biomass energy and combustible material such as biogas, liquid biofuels and municipal waste are still fairly rare. Biomass energy serves principally as fuel for cooking and heating. Its main users are households, notably those in rural areas, which account for some 80% of total biomass energy consumption.

There are several reasons for the prominence of biomass energy in SSA. For major applications such as cooking and heating, close substitutes are often either not available or beyond the means of the majority of the population. Even where modern fuels such as kerosene and LPG are widely available, their high and rising costs, including those for complementary appliances, hinder their use for cooking and heating. Similar arguments apply to electricity: most households, particularly in rural areas, are not connected to the grid. For many households with access to electricity, its use in thermal applications is prohibitively expensive and often not feasible. By contrast, biomass is diverse and widespread, may be available in large volumes, can be produced or grown and can be compressed to make handling and transport easier.

However, the reliance on traditional biomass energy also has some serious drawbacks, including:

7. To put this in perspective, the share of biomass in primary energy is 30.3% in Asia and 18.3% in Latin America.

- inefficient heat conversion
- barrier to poverty alleviation
- trigger for respiratory diseases, and
- source of deforestation.

The use of solid biomass is prone to considerable heat loss through incomplete combustion, inefficient equipment (e.g., the common three-stone fires) or inefficient conversion technologies (traditional charcoal production with earth-mound kilns has a conversion efficiency of 10% or less). Excessive biomass harvesting and inadequate or non-existent resource management can easily undermine the sustainability of supply.

Reliance on traditional biomass energy is not only a result of poverty, it may also act as a barrier to poverty alleviation or may even be a factor contributing to poor living conditions. Where biomass resources are scarce or used inefficiently, their procurement, mostly wood-fuel collection in rural areas, may consume a considerable portion of time that household members, usually women and children, could use more effectively on other tasks.

Cooking and heating with solid biomass energy, notably with open fires and traditional stoves, is a major source of indoor air pollution, triggering respiratory diseases that are a leading cause of mortality in African countries.⁸ According to WHO, indoor air pollution is the biggest health risk in developing countries after malnutrition, HIV/AIDS, lack of clean water and adequate sanitation. It is estimated that 396,000 people, mostly women and children, died as a result of indoor air pollution in SSA in 2002.

Extensive use of biomass energy also correlates with deforestation and African countries with a large proportion of biomass in primary energy supply tend to experience comparatively high rates of deforestation. While the prime reason for deforestation is often large-scale clearing of forests and woodland for agriculture or commercial logging, such activities may in the short term increase the biomass supply but in a longer perspective be a symptom of impending deficits.

No discussion of the role of biomass energy in SSA would be complete without reference to the other side of the coin, the modern use of thermochemical biomass energy conversion routes for heat and electricity and the production of ethanol by fermenting sugars from maize or sugar cane. Indeed, Sweden has pioneered gasification technologies, the so-called biomass integrated gasification/combined cycle (BIG/CC), which are rapidly being disseminated elsewhere. The costs of biomass plantations, often using eucalyptus, are favourable in some developing countries although such plantations are not yet common in SSA. Modern technologies for biomass conversion into energy may hold future promise for SSA.

3.2.2. Electricity from hydropower and hydrocarbons

The gross theoretical hydropower potential of Africa is estimated to be about 4,000 TWh/year, while the technically feasible hydropower potential is at least 1,900 TWh/year, with the economically feasible potential being much less. According to the World Energy Council 2004 survey, in 2002 the total installed hydropower capacity in Africa was almost 21,000 MW, generating about 85,000 GWh/year (around 3% of the world total). Small-scale hydropower potential for rural energy supply is hardly exploited. However, the real figures are likely to be somewhat larger, as data on hydropower are not available from all SSA countries.

8. The millions of women and children who spend hours every day cooking and living in poorly vented spaces are frequently exposed to air pollution equivalent to smoking two packs of cigarettes a day.

In 2002, only 7% of Africa's technical and economic hydropower potential was exploited,⁹ the DR Congo alone reportedly having the potential to provide three times as much power as all of Africa presently consumes (Box 6).

Box 6: Potential hydropower developments in SSA

The assessed potential for hydropower is by far the highest in Africa and one of the highest in the world. The gross theoretical potential is almost 1,400 TWh/year, of which about 55% is regarded as technically feasible. A significant increase in capacity would be provided by the projected Inga III (3,500 MW) planned for 2010. There is also a huge scheme (Grand Inga) for the installation of up to 52 generators of 750 MW each to supply electricity to Egypt and South Africa via long-distance transmission lines. Both generating plant and transmission lines are the subject of feasibility studies.

Source: World Energy Council, *Survey of Energy Resources 2004*, chapter on hydropower

The constraint on development of these schemes is, as so often in SSA, lack of capital and implementing capacity. The World Energy Assessment reports very limited new capacity under construction but may underestimate the real situation. However, the limited ability of most SSA countries to embark on large new loan-financed schemes in combination with the controversies surrounding the construction of dams is likely to have constrained construction of new hydropower plants. A recent focus for some individual SSA countries is to develop renewable energy sources for decentralised generation of electricity, which can be suitable for increasing access in rural areas, although relatively few examples of such projects are yet in operation.

Power plants based on hydrocarbons (oil and coal) supply 67% of total electricity consumption in SSA, while only 32% is covered by hydropower (the remaining 1% being geothermal and other renewable technologies).

Electricity consumption in Africa is expected to grow at a rate of 3.4% per year up to 2020. Power shortages and irregularities have forced many countries to look to their neighbours to supplement their own supplies. Steps are therefore being taken to integrate regional energy systems. Progress is being made on improving power distribution through regional power pools, interconnected electricity grids and plans for regional power development. For example, the Southern African and West African Power Pools are increasing the transit capacity for electricity interchange between the countries concerned, while Central and East Africa have established their own power pools.

3.2.3. The potential for renewable energy

One source which at least in theory would seem to hold immense potential in Africa is solar energy. An estimate by the World Energy Assessment 2000 of primary energy reflecting the physical potential of solar energy, but without consideration of the (substantial) technological, social and economic constraints, suggested that the annual minimum potential in SSA was 372 exajoules and the maximum 9,500 exajoules, exceeding, for example, all of North America (181 and 7,410 exajoules respectively). The same source estimated the geothermal

9. The figure of 7% includes schemes under construction but not yet in production.

energy potential in SSA to amount to a little less than 12% of the potential global total, and wind energy at 7% of the global theoretical total. There are wide variations nationally and locally, where the potential for specific renewable energy sources can be much higher. Costs of solar and wind energy are declining rapidly and these technologies should be more widespread in SSA in years to come.

3.3 Land Use

3.3.1 Land Degradation and Desertification

Of the total land mass of SSA of some 2.4 billion ha, about 0.6 billion ha or 27% is defined as forest and woodland and 1 billion ha is 'agricultural area'. This is equivalent to about 1.45 ha agricultural area per inhabitant (2003). The agricultural area is divided into arable land (17.5%), permanent crops (2.1%) and permanent pasture (80.3%). All these types of land are subject to various forms of degradation.

Estimates by the CGIAR suggest that land degradation affects two-thirds of total arable land and one-third of the area under pasture. A study by the USDA estimates that 46% of Africa's land area is vulnerable to degradation or desertification, which is nearly the entire cultivable dryland area. Those living on the desert margins and in the highlands of Eastern and Southern Africa are the most threatened, but land degradation occurs throughout the continent.

Definitions of land degradation are difficult to express in simple and universal terms. Some drylands undergoing degradation may be viewed as in transition to a different state of stable equilibrium that some may interpret as desirable or at least inevitable. The encroachment of unpalatable bush species across rangelands may degrade their economic value but provide greater erosion protection to soils. The erosion of soils in one area may enhance them in another through deposition, and so on.

The concept frequently used to consider degradation in measurable terms is 'loss of productivity'. Soil degradation begins with the removal of vegetation. Unprotected, dry soil surfaces are readily eroded by rain and wind, leaving lower soil layers that bake in the sun and become an unproductive hardpan. Sand dunes may form where the blown surface material accumulates. Losses of vegetation threaten biodiversity and habitat for other species.

Removal of the protective cover of vegetation, in turn, can be driven by a number of factors, alone or in combination, such as tillage for agriculture, drought, over-grazing, removal of crop residues for feed or construction, deforestation for fuel and construction materials and inappropriate irrigation practices leading to salinity.

These proximate causes are themselves triggered by a wide range of underlying causes, some of which originate outside the rural areas concerned. They include climate change; population growth; policies that encourage frontier expansion and mechanised land-clearing; inadequate or ambiguous land tenure rights that discourage investment in permanent land improvements, such as bunding, and encourage wasteful use of commonly held lands; landlessness and inequitable asset distribution; inadequate infrastructure; limited market access; inappropriate farm technologies; and insufficient extension support and research.

There has been much debate about what the World Bank calls "the poverty-environment nexus", i.e., the relationship between poverty and environment. The relationship is complex and seems to work in contradictory directions. Many rural poor live on marginal lands high-

ly vulnerable to soil erosion. A combination of agricultural over-exploitation and adverse trends in rainfall leads to a vicious circle of falling yields, increasing poverty, continued exploitation of marginal lands (such as steep slopes or areas with insufficient rainfall), leading to further erosion, more poverty, etc. This situation has obtained in much of the Ethiopian highlands, providing the backdrop for the severe famines that have accompanied recurring droughts in that region.

But there are also cases where the rural poor have proved themselves efficient guardians of the environment. Perhaps the best-known example is from the Machakos district in Kenya. There was widespread concern about soil erosion among colonial officials in the 1930s, but by the 1990s, after a sixfold increase in population, agricultural yields have increased fivefold in combination with a higher density of trees. Similarly, the 'forest islands' observed in the savanna lands of Guinea were not, as many believed, remnants of more extensive forests degraded by population pressure but were created and protected by the very people held responsible for their degradation.

There are two points to make. First, the great majority of African soils are difficult to manage sustainably. The problem is not just in the soil but the combination of soil and climate. Most of Africa outside the rainforests receives very little rain for much of the year and long stretches of very hard rain over a few months. The heavy rainfall blasts away the lighter, more fertile humus, the wind blows it away, leaving heavier sands behind, while the sun dries them out. In traditional African agriculture, peasants discovered that fertility was quickly used up and could be replaced only by replacing humus and soil nutrients. Thus they developed shifting cultivation, where an area is cleared, planted and harvested for a few years and then left to regenerate while farmers plant elsewhere, or rotational fallow cultivation where people stay in the same village but plant fields in rotation with years of fallow in between to allow for regeneration of fertility. In many areas, these practices have broken down as a result of population pressure on the land and other factors, some of which were noted above.

The second point is that, as the experiences from Machakos suggest, the vicious circle can be broken by the opposite of the conditions that contribute to its creation, namely security of land tenure, availability of improved farm technology and the credit necessary to acquire it, access to markets and good infrastructure. Reducing land degradation in Africa is therefore a question of reducing poverty by creating the right circumstances for growth of rural incomes.

3.3.2. Forests and deforestation

Land degradation and deforestation have much in common, both in respect of proximate and underlying causes and remedies. The area of forest cover¹⁰ in the three sub-regions examined by FAO (Eastern and Southern Africa, Northern Africa and Western and Central Africa) decreased at an alarming rate during the 1990s, although there are indications that the net loss of forests is slowing. In the period 1990–2000, the net area change was about -4.4 million ha per year, corresponding to a loss of total forest area of 0.7% per year, whereas in the period 2000–05 it averaged -4.0 million ha per year. The decrease in other wooded land was about half of that of forest area (2.2 million ha per year). The decrease in growing stock of trees was below the replacement level of 0.5% per year.

10. FAO defines a forest as "land spanning more than 0.5 ha with trees higher than 5 metres and a canopy cover of more than 10%, or trees able to reach these thresholds in situ". It includes areas with bamboo and palms, provided that height and canopy criteria are met, but excludes tree stands in agricultural production systems, for example in fruit plantations and agro-forestry systems.

The area of primary forest in Africa decreased by some 270,000 ha annually during 1990–2005. However, FAO has data only from 46 African countries, together accounting for about two-thirds of the forest area, with information missing from most of the countries in the Congo Basin (which represents the second largest area of primary tropical forest in the world after the Amazon Basin). On the other hand, there has been an increase of close to 3 million ha in the area of forest designated primarily for conservation of biological diversity since 1990, most probably as a result of the efforts of conservation organisations such as IUCN. The area covered by plantation forestry increased at a rate of 3.9% annually to almost 8 billion ha in 2000.

An important problem in the sustainable management of forests in SSA relates to forest fires caused by the clearing of land under the shifting cultivation regime. Information on this phenomenon is scarce, but its effects (charred vegetation) can be readily seen in rural areas in most SSA countries after the harvest season. It is evident that more sedentary farming practices would contribute to a reduction in deforestation.

FAO concludes that, on the whole, progress towards sustainable forest management in Africa appears to have been limited during the last 15 years. While there are some indications of a slowdown in the rate of deforestation and increases in areas designated for conservation of biological diversity and for plantation, the continued rapid loss of forest area, the largest of any region in the world during this 15 year period, is described as disconcerting. Within Africa, Western and Central Africa had more positive trends than negative ones, while Eastern and Southern Africa had predominantly negative trends, but the data availability for Western and Central Africa was generally poorer than for other sub-regions.

Exports of forest products from SSA declined from almost 9 million m³ in 1988 to about 4.3 million m³ in 1996 (later data not available), possibly reflecting gradual depletion of prime log-producing areas. For example, exports from Liberia fell from 0.7 million m³ in 1989 to 0.2 million m³ in 1996. Principal exporting countries in 1996 were Gabon (1.6 million m³), Ghana (1.0 million m³), South Africa (0.5 million m³) and Swaziland (0.27 million m³).

Although exports declined, there was a steady increase in wood removal from 500 million m³ in 1990 to 661 million m³ in 2005, an annual increase of almost 11 million m³. Most of the increase in wood removal stemmed from increased production of fuel wood – on average, an increase of more than 9 million m³ per year, particularly in West and Central Africa. A large, albeit unknown part of this may have been collected from areas outside forests (other wooded land and trees outside forests).

Mangrove forests are found along sheltered coastlines in the tropics and subtropics, where they fulfil important functions in conserving biological diversity and providing wood and non-wood forest products as well as coastal protection, habitat and spawning grounds for a variety of fish and shellfish, including many commercial species. High population pressure in coastal areas has led to the conversion of many mangrove areas to other uses, including infrastructure, aquaculture, rice-growing and fuel wood collection. Deforestation of mangroves in SSA proceeded at an annual rate of 0.5% during the 1980s and appears to have slowed to 0.3% during the 1990s. In 2000, there was a total of 3.4 million ha of mangrove forest in SSA, the principal countries being Nigeria (1 million ha), Mozambique (0.4 million ha), Madagascar (0.31 million ha) and Guinea (0.3 million ha).

3.4 Oil and Mineral Resources

3.4.1 Reserves of oil and gas

Africa's riches in mineral resources were one of the major driving forces behind the European carve-up of Africa, with discoveries of oil coming later and further fuelling this interest. Today, many of those resources are being commercially exploited and new discoveries continue to be made, adding to Africa's development potential. At the same time, many of the known mineral deposits are in a fragile state, with poor systems of governance. The result is that incomes from exploitation of oil and minerals do not support development but mostly benefit a small elite and seem to create more social problems than they solve.

TABLE 1: RESERVES OF OIL AND NATURAL GAS, SELECTED COUNTRIES

Oil reserves			Natural gas reserves		
World rank	Country	Billion barrels	World rank	Country	Trillion m ³
(1)	(Saudi Arabia)	(262.7)	(1)	(Russia)	(47.57)
10	Nigeria	36.0	(7)	Nigeria	4.98
13	Angola	25.0			
31	Gabon	1.9			
33	Sudan	1.6			
34	DR Congo	1.5			
47	Equatorial Guinea	0.6			

Table 1 above shows that the SSA country with the largest reserves, Nigeria, has only about one-tenth of the reserves of the countries richest in oil and natural gas, Saudi Arabia and Russia respectively (shown for purposes of comparison). The only country in SSA with significant reserves of natural gas is Nigeria (in North Africa, Algeria and Libya have large reserves of natural gas). But this may underestimate the true situation, since one of the main issues related to Africa's mineral resource endowment is that it is poorly surveyed and that good information is not available on the potential except in certain specific country situations. One example is Angola, where significant recent discoveries suggest that production could in a few years match that of Kuwait, currently ranked sixth in the world with reserves of 100 billion barrels (Box 7).

Box 7: "Poverty-rife Angola emerges as an oil giant"

A recent newspaper article said that Angola, "a corrupt, underdeveloped and war-scarred country" is becoming one of the world's major oil suppliers. Its promise stems from a string of big discoveries more than 160 km from the coast that propelled the country's oil production to 1.5 million barrels per day last year. Angola should reach two million barrels in 2008 and 2.6 million by 2011, the equivalent of the output of Kuwait. Last year, Angola moved ahead of Saudi Arabia as the largest supplier of oil to China, and it is already a major exporter to the US. According to the article, Angola may be one of the last large untapped regions of the world.

Source: IHT, 20 March 2007

The world's fastest growing source of oil is West Africa. The crude from this region is of a light quality, making it particularly attractive to importers. The US imports more crude from West Africa than from Saudi Arabia and Kuwait combined. As mentioned in the box above, Angola has become China's biggest supplier, while the EU imports almost one-fifth of its oil from Africa. However, there was also a report in May 2007 that oil companies were taking an increased interest in East Africa, with some countries, such as Sudan and Ethiopia, showing early promise as oil and natural gas producers; recent oil discoveries in Uganda and Madagascar; and surveying taking place in several other countries

3.4.2. The 'oil curse'

Box 7 suggests that in Angola there is still little development dividend from the oil revenues. In fact, in Africa it is relevant to talk about an 'oil curse': the sooner a country discovers oil, the faster corruption and bad governance increase. It appears to be impossible for elites in an otherwise poor country where there is a sudden flow of great wealth from oil revenues to resist the temptation of corruption. It would be fair to say that all the SSA countries mentioned in Table 1 suffer from bad (or very bad) governance. In the oil fields of the Niger Delta there is an ongoing insurgency by locals dissatisfied with the squalor of their lives, despite the riches being generated below the very ground they live on (Box 8).

Box 8: Oil and bad governance in Nigeria

"In an effort to redistribute wealth, the (Nigerian) government now gives 13% of the proceeds from oil sales to the producing states, but there is little accountability on how the money is spent. Much of it simply disappears, wasted by inefficient or corrupt local officials, according to a recent Human Rights Watch report. The Rivers State government, for example, had a budget of US\$ 13 billion in 2006, the report said. It includes transportation fees of US\$ 65,000 a day for the governor's office; USDUS\$ 10 million for catering, entertainment, gifts and souvenirs; and US\$ 38 million for two helicopters. Health services received US\$ 22 million".

Source: IHT, 23 April 2007

The Group of 8 industrialised countries (G8) has started to challenge this one-dimensional approach to securing oil supplies without consideration for accompanying social costs by launching, along with Norway, the Extractive Industries Transparency Initiative (EITI). Under this initiative, producer governments and companies can voluntarily commit themselves to disclosing all payments from corporations to governments as well as all government revenue from oil. Civil society is supposed to act as a watchdog. Since its launch in 2002, the initiative has attracted more than 20 member countries as well as the support of leading NGOs and corporations.

The results to date are reported to be less impressive. It is a purely voluntary initiative that lacks teeth. The multinational oil corporations have, on the whole, turned a blind eye to the behaviour of the governments with which they need to do business. Governments and corrupt officials may sign off on the EITI principles in the knowledge that there will be no real sanctions and that, besides, civil society in most of the countries involved is too

weak and divided to push for increased transparency. However, a high level meeting at the UN Economic Commission for Africa in February 2007 endorsed the EITI and called for its expansion.

In fact, oil is but a subset of a wider problem relating to natural resources in general, including minerals, diamonds and timber. A paper by the UK-based NGO Global Witness suggests that “an abundance of natural resources, as measured by the ratio of primary commodity exports to GDP, is the single most important factor in determining whether a country experiences civil war”. It went on to say that, “other things being equal, countries that did not export any natural resources had a 0.5% chance of experiencing civil war, whereas countries where natural resource exports made up 26% of GDP had a 23% chance of experiencing civil war”, and illustrated this finding by reference to a variety of countries in West and Central Africa. For example, timber exports are said to have financed much of the warfare in Liberia.

3.4.3. Other mineral resources

Several countries in SSA also have rich deposits of other minerals. Again, the caveat should be made that the mineral resources in these countries have been insufficiently surveyed to date. For example, as late as March 2007 important new discoveries of uranium were announced in Namibia. Most of the known deposits are located in Southern Africa, particularly South Africa, and in the Congo River basin. Some examples:

- *Zambia* in 2004 accounted for the equivalent of about 3% of the world’s production of copper and had about 4% of the known reserves of this metal. In that same year, Zambia also produced 19% of the world’s output of cobalt. The country has attracted new private investment to revitalise the formerly declining mining industry.
- *In Mozambique*, the mineral industry in 2005 produced gold, tantalum and several industrial minerals such as bauxite, beryl, brick clay, diatomite and gemstones, in addition to coal and natural gas. The country was also responsible for 2% of the world’s production of aluminium, although this was based on cheap energy and bauxite imported mostly from Australia. The value of output in the mining sector increased by no less than 216% in 2004 and 40% in 2005.
- *South Africa* is one of the world’s leading mining and mineral-processing countries. In 2005 it was the world’s leading producer of andalusite, chromite, ferrochrome, gold, platinum-group metals, vanadium and vermiculite, and the world’s fifth-ranked producer of industrial diamonds. It holds, for example, 89% of the world’s known reserves of platinum-group metals, 23% of reserves of vanadium, 14% of reserves of gold and 12% of diamond reserves.
- The *DR Congo* produces cobalt, columbium, tantalum, copper, germanium, gold, tin and zinc ores, diamonds and coal, in addition to a small quantity of oil. This is one country where better surveying is thought likely to yield information on large new deposits, and where current production is kept down by insecurity and ageing equipment.
- *Zimbabwe* has large deposits of chromite and smaller reserves of copper, gold, iron ore, nickel, silver and platinum-group metals. Future prospects for the mining industry are rated poor due to the political situation in the country and high inflation.

In many countries, the production of oil and minerals is, at least to date, relatively insignificant on a global scale with the main exceptions being Nigeria and Angola for oil and South Africa for minerals. However, their dependence on revenue from exports of these commodities is high, in some cases very high. The extreme case is Nigeria, which in 2001 gained 100% of its export revenue from oil and gas, with Angola not far behind, with 93% in 1990 and most likely close to 100% in the 2000s (precise figures are not known). Gabon earned 83% of its export revenue from oil, Zambia 73% from copper. However, South Africa, with its much more diversified economy, in 2001 derived only 9% of its merchandise export revenue from 'ores and metals', down from 11% in 1990.

The role of oil and minerals in exports from SSA has increased during the 1990s. The total value of merchandise exports from SSA in 1990 was US\$ 68 billion, in 2001 US\$ 92 billion (current US\$), of which 'fuels, ores and metals' together accounted for 35% in 1990 and 39% in 2001. With the exception of the Middle East and North Africa, SSA is the only region in the world where export dependency on oil and minerals increased during the 1990s.

With world market prices for oil and minerals steadily increasing due to strong demand from countries such as China and India, for example, dependency on these commodities does not seem to be associated with great risk. On the other hand, oil and minerals do not generate much employment and can, as seen above, lead to considerable resentment due to poor income distribution brought on by bad governance and corrupt behaviour. Governance reform is one of the main challenges facing the SSA countries fortunate enough to be endowed with oil and mineral resources.

4. Agriculture and Employment

Agriculture dominates the countries in SSA, and its generally poor performance is a major source of the economic vulnerability of these countries and the poor employment prospects for their inhabitants.

4.1 The role and performance of agriculture

Agriculture in SSA accounts for some 30% of GDP, 40% of exports and as much as 70% of employment. The performance of agriculture in the region is therefore a major factor in determining livelihood fortunes. As of 2001, slightly less than half of all people in SSA (46.5%), 314 million, were living below the international poverty line of US\$ 1 per day. The number of hungry people in SSA has increased by 20% since 1990 and is now estimated at 206 million, or 32% of the total population, the highest prevalence for all regions. Similarly, the number of underweight children is estimated to have increased in most parts of Africa between 2000 and 2005, while there were decreases in all other developing regions.

Principal food crops in SSA produced mainly for domestic consumption are maize, sorghum, millet and, mostly in highland areas, wheat and teff. For some of them, notably maize and wheat, which are also widely produced in industrialised countries, world market prices are rising, in part the result of government subsidies for crops suitable for biofuels.

Table 2 below illustrates the share of agriculture in the economies of a sample of SSA countries. Some of them, such as Kenya, Zambia and Zimbabwe, have comparatively better developed industrial, services and mining (Zambia) sectors, thus reducing the relative contribution of agriculture to GDP, while in DR Congo, Ethiopia and Tanzania the absence of economic activity outside agriculture increases its relative share.

TABLE 2: SHARE OF AGRICULTURE IN TOTAL GDP, SELECTED COUNTRIES (PERCENTAGES)

Country	1979–81	1989–91	1999–2001	2003	2004
Burkina Faso	33	32	33	30	34
DR Congo	28	33	61	55	55
Ethiopia	-	-	45	39	41
Kenya	20	19	17	17	17
Mozambique	34	31	25	24	24
Tanzania	39	42	42	39	39
Zambia	14	16	20	18	18
Zimbabwe	16	14	16	18	18

SSA is the only region in the world where livelihoods and food security continue to deteriorate. Over the last 14 years, the number of Africans living below the poverty line has increased by 50%. If the region follows current trends, it is projected that 39.3% of the population will remain below this line by 2015 and SSA will be the only developing region where the number of poor people actually increases from the 1990 level – the MDG baseline. SSA is set to miss the targets of the first MDG – eradicating extreme poverty and hunger – by a wide margin unless very innovative interventions are made and approaches to development

pursued, especially in sectors such as agriculture that promise to have the greatest impact in attaining the targets. Table 3 below illustrates current trends.

TABLE 3: PER CAPITA AGRICULTURAL PRODUCTION INDEX, SELECTED (1999–2001 = 100.0)

Country	1979–81	1989–91	1999–2001	2003	2004
Burkina Faso	67.1	89.2	100.0	116.2	106.8
DR Congo	155.2	155.6	100.0	89.7	86.5
Ethiopia	-	-	100.0	99.9	101.7
Kenya	100.9	107.8	100.0	103.6	98.7
Mozambique	115.2	97.5	100.0	99.6	102.1
Tanzania	130.9	120.4	100.0	97.7	101.1
Zambia	109.7	112.2	100.0	100.6	99.5
Zimbabwe	112.9	99.1	100.0	77.5	71.1

Of the countries shown, only in Burkina Faso does agricultural production per capita have a consistently positive development. The table illustrates the disastrous effects on agricultural production of the civil wars and bad governance in DR Congo and Zimbabwe respectively. The other countries shown have more or less managed to keep production level with the base period 1999–2001, but declined relative to the situation 20 years earlier.

The crucial role of agriculture in improving livelihoods of the rural poor is widely documented. Increasing the productivity, profitability and sustainability of agriculture forms the core of several multifaceted strategies to reduce poverty and hunger and subsequently achieve economic growth. Growth in agricultural productivity is one of the most effective ways of reducing poverty because it increases the incomes of small-scale farmers, raises the wages earned by landless labourers, improves the availability and quality of food, reduces food prices and creates jobs. Estimates of the extent to which poverty falls as agricultural productivity rises are generally high. For example, one estimate suggests that a 1% increase in crop yield in SSA reduces the number of poor people by 0.72%.

4.2 Livestock

Some 25% of agricultural GDP in Africa is accounted for by livestock, up to 30% if by-products such as manure are included. Principal SSA exporters of meat products in 2003 included Namibia, Benin, South Africa and Botswana.

Livestock is of critical importance to the rural economy and the well being of the rural poor, but it has been neglected subject to misguided interventions by governments and donors. Attempts to increase the welfare of pastoralists have failed to meet their objectives of ‘improved’ stock practices and raised living standards. Many of these interventions have been misconceived because they have approached the problem as one of overgrazing leading to environmental degradation, and seek to limit access to what is seen as the carrying capacity of the land for sustainable grazing, while drought is the main determinant of both livestock numbers and vegetation status, and the survival strategy is to move to where vegetation is available. Failures of livestock projects are doubtless one reason why foreign aid for agriculture has declined (see below).

4.3 Fisheries

Fisheries play an important role in the economy of many SSA countries, mainly those with access to the sea or major lakes, providing important supplements to incomes, export revenue and dietary intake. Fish provides about 19% of animal proteins consumed in Africa, with wide variations among and within countries: for example, in Angola annual per capita food supply from fish in 2002 was 17 kg, in Ghana 29, and in Tanzania 7 kg, while it was zero in Ethiopia and 2 kg in Mozambique. Catches from both marine fisheries and from aquaculture have increased in recent years. Major producers of marine catches in 2002 included South Africa (719,000 MT), Namibia (586,000 MT), Ghana (349,000 MT) and Angola (245,000 MT), all of whom had increased their catches significantly over the previous ten years. Producers of freshwater fish included Tanzania (279,000 MT in 2002), Uganda (221,000 MT) and DR Congo (220,000 MT). Principal obstacles to the expansion of the fisheries industry relate to deficient infrastructure for transport, storage and cooling and primitive equipment.

4.4 Causes of stagnating agricultural productivity

African agriculture faces numerous challenges that diminish its capacity to catalyse broad economic growth, including:

- low internal effective demand due to pervasive poverty;
- unfavourable external markets, as African commodities face severe competition from subsidised produce from industrialised countries;
- low development of irrigated agriculture (only 3.5% of African farmland is irrigated compared to 33.5% in Asia and 11.4% in Latin America), increasing vulnerability to climatic risks;
- limited use of improved farm inputs, including mechanisation, use of improved seeds, fertilisers (consumption of fertiliser in SSA is around 13.4 kg per ha arable land, which is by far the lowest for any region in the world: the corresponding figure for Asia is 173.7 kg and for Latin America 92.4 kg);
- inadequate rural infrastructure (transportation, markets, storage, energy, credit, water management), which increases transaction costs; and
- poor governance and corruption, translating into weak policy and regulatory mechanisms and institutional weaknesses.

As outlined in Section 2.4, these impediments are further compounded by climate change, rendering the overall food security situation quite serious.

The agricultural successes in SSA have been largely local and, for that reason, have not had sufficient impact on food security, poverty alleviation and employment on the national and continental scale. In the past, the complex and heterogeneous farming systems in Africa have been addressed through a relatively linear and fragmented approach to research and development, where complexity was simplified into one or two key elements for which solutions were sought through the classical reductionist scientific process. This approach often had significant success at local level but failed to achieve broader results.

The reductionist approach was very successful in parts of Asia, where the Green Revolution took place. However, Africa lacks the characteristics that permitted the Green Revolution to achieve a pervasive impact, notably because of:

- the heterogeneity and diversity of farming systems and the importance of livestock;
- predominance of rain-fed agriculture as opposed to irrigated farming systems;
- lack of functioning competitive markets;
- the dominance of weathered soils with poor inherent fertility; and
- lack of conducive economic and political enabling environments.

4.5 Technology and research

The diverse African situation suggests that no single magic ‘technological bullet’ is available to improve African agriculture radically. Instead, Africa requires a comprehensive set of strategies that differ both in nature and extent among the many different types of farming systems and institutions throughout the continent. Thus, science for the benefit of African smallholder farmers needs to be contextualised in the complex social and technical circumstances in which the farmers operate. The acknowledgement that linear and fragmented approaches to agricultural and natural resource management have largely failed to have an impact on a broad scale has given way to more integrated approaches, such as integrated natural resource management, which treats interactions between components (such as water, pests and soils) to be as important as the components themselves. More recent evidence, however, suggests that integration of production components alone is not sufficient, as issues concerning markets and policies also need to be embraced.

Given population growth and increasing shortages of productive land, almost all increases in agricultural production in SSA in the future must come from further intensification of production on land that is presently devoted to agriculture. This is where agricultural research has a key role to play in developing new crop varieties and farming technology, as will be further outlined below (Section 5.5). Advances in technology, including biotechnology, will remain the primary source of growth in crop and animal production over the next decades. The gains in crop and animal productivity will result from improvements in plant and animal breeding and from more efficient and widespread use of improved farm inputs, such as chemical fertilisers and high yielding seeds. But the productivity gains from conventional sources are likely to come in smaller increments than in the past, and many such gains will be location-specific.

Further, development and research should aim at enhancing the capacity of rural people in SSA to adapt to changing conditions, rather than at delivering ‘finished’ technologies. The discussion in Chapter 2 suggests that climate change will have serious implications for an African agriculture that is already struggling to cope with increasing pressures.

4.6 Foreign trade

Overall, 16% of merchandise exports from SSA in 2001 came from the agricultural sector, up from 13% in 1990. Countries most dependent on agricultural exports included Tanzania (70% of all merchandise exports), Uganda (69%), Kenya (59%), Zimbabwe (47%) and Senegal (46%). World market price trends are strong for some export crops, declining for others.

Four examples are set out below:

- *Coffee*: Of the 553,000 MT produced by SSA in 2003, Ethiopia accounted for 136,000 MT, Côte d’Ivoire for 119,000 MT, Kenya for 63,000 MT, Tanzania for 46,000 MT

and Uganda for 40,000 MT. Coffee prices continued upwards during 2006 and are expected to remain firm.

- *Cotton*: This is mainly a smallholder crop with great potential for expanded production in response to price changes, and as a result farm prices have fluctuated widely since 2003. In 2003, SSA produced a total of 1,078,000 MT of which Mali produced 229,000 MT, Côte d'Ivoire 144,000 MT and Benin 117,000 MT.
- *Cocoa*: The output from SSA of 1,995,000 MT in 2003 is dominated by the Côte d'Ivoire (1,158,000 MT) followed by Ghana (392,000 MT) and Nigeria (241,000 MT). Prices are expected to remain firm because of a supply deficit in the world market.
- *Sugar*: SSA produced 2,516,000 MT in 2003, of which South Africa accounted for 1,004,000 MT, Mauritius for 492,000 MT, Ghana 275,000 MT and Swaziland 180,000 MT. This is mostly a plantation crop with low employment effects. Sugar prices reached their highest level ever in 2006, mostly because of a global supply deficit.

Some four-fifths of agricultural exports from SSA reach the EU. The announcement in early April 2007 by the EU that it will eliminate all remaining quota and tariff limitations on access to the EU market by the Africa, Caribbean and Pacific group of countries covered by the Cotonou Agreement starting from 1 January 2008, with a transition period for rice and sugar, is therefore of great significance.¹¹

However, some argue that the real impediments to exports from SSA lie elsewhere, principally in the lack of infrastructure. In Mozambique, there are only 141 km of paved roads per million inhabitants, in Uganda 94 km, while the corresponding figures for France is 12,673 km and for South Africa 1,402 km. Yet, the European Commission has pointed out that governments and donors sharply reduced the share of resources allocated to infrastructure during the 1990s. Between 2005 and 2015, SSA needs to spend some 5% of its GDP on infrastructure investment and a further 4% on operations and maintenance, an additional expenditure of US\$ 20 billion per year, to sustain a growth rate of 7%. Transport costs in SSA are high, averaging 14% of the value of exports, compared to 8.6% for all developing countries. Better infrastructure will therefore be of crucial importance not only for exports to be competitive but also for improved access to food aid in emergencies and is a prerequisite for accelerated growth.

4.7 Employment

Agriculture is the dominant economic sector in SSA, but because of its subsistence nature contributes much less to the economy than to employment, as shown in Table 4 below.

Population growth in rural areas in combination with the low returns to the traditional small-scale farming practices, improved communications and the allure of cities is prompting a decline in employment in agriculture, but at low rates.

Even in those countries, such as Kenya, Zambia and Zimbabwe, where urban areas are relatively more developed and where industry is relatively more important measured by its contribution to GDP, the share of the economically active population in agriculture is still as much as 60% or more. The countries with the lowest GDP per capita are also those with

11. However, the subsidies to agriculture in Europe the US continue unabated, creating what Africans can rightly call unfair competition in the world market. In addition, tariff escalation at every stage of processing and a variety of non-tariff obstacles, such as certification of non-use of chemical inputs, in practice deprive African countries of the potential to increase earnings from agricultural exports.

TABLE 4: ECONOMICALLY ACTIVE POPULATION IN AGRICULTURE AS SHARE OF TOTAL ECONOMICALLY ACTIVE POPULATION IN SELECTED COUNTRIES (PERCENTAGES)

Country	1979–81	1989–91	1999–2001	2003	2004
Burkina Faso	92	92	92	92	92
DR Congo	72	68	63	62	61
Ethiopia	89	86	82	81	81
Kenya	82	80	75	74	74
Mozambique	84	83	81	81	80
Tanzania	86	84	80	79	79
Zambia	76	74	69	68	67
Zimbabwe	72	68	63	61	60

a high rate of employment in agriculture. For example, the exceedingly low level of industrialisation of Ethiopia (13% of GDP, the lowest in SSA) and urbanisation (15%, again one of the lowest in SSA) explains the lack of economic opportunities outside agriculture. This situation forces a dominant share of the economically active population to depend on low-yielding peasant agriculture and remain at the mercy of the weather for their sustenance.

Basic challenges for sustainable development in Ethiopia and other SSA countries are therefore creating employment opportunities outside agriculture while, at the same time, promoting productivity increases in the sector, essentially to better diversify rural economies. The complexities of doing this seem so far to have confounded governments and aid donors alike.

4.8 Foreign aid

A paradoxical aspect of the situation facing agriculture in SSA is the declining interest of donors, as ODA for agriculture has fallen rather dramatically from 11.4% of total bilateral commitments by DAC donors in 1983–84 to 3.2% in 2003–04. External assistance to agriculture in SSA decreased by 17% from US\$ 3.7 billion in 2002 to US\$ 3 billion in 2003. ODA is increasingly allocated for budget support in keeping with the so-called Paris agenda, or channelled towards the social sectors, where the impact on MDG targets can be readily traced (education, health, water supply and sanitation), while the complexities and difficulties facing African agriculture seem to deter donors.

5. Vulnerability and adaptation strategies

The prescriptions for development in SSA are manifold and well known. In many SSA countries, economic growth has accelerated in recent years. Still, it will be increasingly necessary to review development strategies in light of the implications of climate change and the need to make adaptations.

5.1 Mainstreaming climate change adaptation

The foregoing text paints a worrying picture of African vulnerability of huge and growing proportions. SSA is already struggling with desertification and land degradation, deforestation, increasing water scarcity and stagnating crop yields. Population pressure brings with it shortages of arable land, settlement of marginal lands resulting in accelerating soil erosion and expansion of urban slums as people migrate from rural areas to the cities in search of sustenance. Then there is the economic vulnerability that results from stagnating agriculture and dependence on primary commodities for export revenue at the mercy, in many cases, of world market prices.

That is the present picture. But to that should be added what all, or almost all, now agree the future has in store in terms of a hotter and drier climate as well as more extreme weather systems. That is a change variable that impacts on everything else, from the livelihoods of the rural poor to the prospects for agricultural exports and water supplies to the cities. In the wake of the fourth IPCC assessment report and, perhaps more importantly, the exceptionally warm recent years, attitudes to climate change are fast changing in the rich countries and the development agenda is being revised to take into account symptoms of vulnerability and adaptation strategies. This is overdue, because many of the signs of climate change are already present.

The impacts outlined above of climate change in Africa are likely to undermine seriously economic development, deepening poverty and conceivably contributing to further conflicts and social strife. Mainstreaming climate-change adaptation measures into sustainable development and taking into account climate change risks, while paying special attention to the role of water (Section 3.1), will therefore be particularly important in coming years. IPCC points out that, “sustainable development can reduce vulnerability to climate change by enhancing adaptive capacity and increasing resilience. At present, however, few plans for promoting sustainability have explicitly included either adapting to climate change impacts or promoting adaptive capacity”. A recent report noted that actual spending to date on adaptation projects in world’s most vulnerable countries “borders on the derisory” and called for efforts on a completely different scale.

It is true that there is still a debate about climate change and its impacts. The limitations of the predictions regarding Africa were emphasised at the outset of this paper. But for two reasons it is increasingly important to adopt a precautionary principle and act on the basis of the IPCC estimates. First, there is no better and more widely agreed information available. And second, the costs of inaction could later prove to be very high.

5.2 Adaptation requirements

Since the climate is changing and climate variability is expected to increase in frequency and intensity, current coping strategies may not be considered sufficient adaptation in the future.

Far more work is needed if adaptation itself is to be seen as a dynamic, continuous and non-linear process. The requirements include the following:

- *Better forecasting and early warning systems* will be a prerequisite for adaptation, particularly to predict and prevent the effects of floods, droughts and tropical cyclones, as well as for indicating planting dates to coincide with the onset of the rainy season and predicting whether there will be disease outbreaks in areas prone to epidemics.
- *Education and awareness creation* on climate change among governments, institutions and individuals should be a necessary step in promoting adaptation to climate change.
- It will be necessary to better *link research to decision-making* with an emphasis on getting research findings to the right target groups, linking research to existing local knowledge of climate-related hazards and involving local communities in adaptation decision-making.
- *Capacity building* will be needed to ensure SSA involvement in the further development and refinement of the modelling work underlying predictions of climate change and to provide the necessary human resources to research institutions to design and facilitate adaptation strategies.
- In addition, the area of *good governance* should be mentioned. When societies strain under the additional burdens caused by climate change, continued efforts must be made to improve governance practices.
- *Civil society* is under-funded and weak in many SSA countries and yet is a potentially important development partner whose active participation will be necessary to build broad-based support for adaptation strategies.

It is evident that the need to adapt societies to climate change gives rise to a whole agenda of actions, many of which build on what has been done to date, but with several new priorities. EU member states are urgently giving increased attention to climate change in their development cooperation programmes in light of the high profile recently afforded that subject by the EU. Paradigms come and go in the area of development, and it will be necessary for donors and SSA countries to agree on priorities and the steps to promote adaptation while retaining what works and remains important in previous strategies. Ways of doing this will doubtless dominate much of the development debate in years to come.

5.3 Investment in infrastructure, including energy and transboundary water

The lack of modern infrastructure as a major constraint on African exports and development was referred to in Section 4.6. This is also the view of the EU, which in October 2006 approved the Europe-Africa Partnership on Infrastructure as one of three main elements of its new strategy for Africa.¹² The purpose of the partnership is to contribute to sustainable economic growth by building regional markets and promoting trade by supporting the establishment of cross-border infrastructure: road and railway transport, ports, transboundary water resources, energy and ICT networks. While it may be debatable whether transport and ITC networks belong in the natural resources sector, energy and transboundary water resources certainly do.

12. The other two are (i) good governance, peace and security and (ii) actions in areas that tackle the MDGs directly, such as health, education and a safe environment.

The Partnership will have a trust fund administered by the European Investment Bank to which the EC will make a large contribution and to which EU member states are invited to contribute, several having already done so. It is expected that the trust fund will reach at least € 1 billion.

As set out above, there is high potential for energy production in SSA but it is inefficiently realised. The EU Partnership on Infrastructure will seek to promote increased national and cross-border energy investment, cooperation and trade to improve the reliability and affordability of and access to electricity. The five power pools existing in Africa will be strengthened. Better connectivity will enable more widespread rural electrification. However, more initiatives are needed, in addition to the Partnership on Infrastructure and in collaboration with civil society organisations, to promote renewable energy sources, mainly solar and wind, in remote locations in which electricity is not yet available.

At the World Summit on Sustainable Development in 2002, the EU launched the EU Energy Initiative to better catalyse EU action in this sector. A fund of € .22 billion was later created under the 9th European Development Fund to support energy projects in ACP countries.

5.4 Raising agricultural productivity: adaptation strategies by smallholders

Farmers in SSA have for years been practising coping strategies in adapting to recurring droughts. In Senegal and Burkina Faso, locals have improved their adaptive capacity to drought by using traditional pruning and fertilising techniques to double tree densities in semi-arid areas. Other similar strategies include:

- diversification of herds and incomes, e.g., the introduction of sheep in place of goats;
- reliance on forest products as a buffer to climate-induced crop failure in climatically marginal agriculture areas;
- more emphasis on community forestry to promote the use of ecosystem goods and services as opposed to reliance on agriculture, again in climatically marginal areas;
- manipulation of land use to adapt to more sustainable practices, e.g., shift from live-stock farming to game farming;
- replacing cash crops with more drought resilient varieties of food crops;
- promoting home gardens and sheep fattening;
- in coastal zones, better fisheries management, including closed-season control agreements and establishment of marine reserves; and
- strengthening the institutional framework, including attention to land tenure legislation.

An example of a success story in the application of similar approaches is given in Box 9.

While many of these adaptive strategies are already happening, governments will need support to make them more widespread and sustainable. This will require an inventory, supported by research, of what works and where, training of extension workers and definition of appropriate interventions.

These will need to be supported by increases in external development aid to the agricultural sector. Donors should adopt a new approach to supporting agricultural development based on the exigencies arising out of climate change and the need to adapt farming practices.

Box 9: Success in combating desertification in Burkina Faso

Agricultural rehabilitation in the Central Plateau of Burkina Faso (1980–2002) was achieved through soil and water conservation, crop and livestock systems improvement and increasing the organisational capacity of villages. Approximately 100,000 ha have been contour-bunded to reduce water run-off. Soil fertility has been restored to tens of thousands of hectares of degraded land using the *zai* technique of digging holes to retain manure and water in the plant root zone. Increased fodder supply enabled increased livestock numbers, in turn increasing manure supplies for raising soil fertility. Due to water harvesting, groundwater recharge improved significantly, wells that used to run dry in the dry season now provide water year-round, an effect that cannot be explained simply by rainfall variations. Farmers report substantial productivity gains and enhanced family food security. Villagers perceive substantial reduction in the frequency of poverty in their communities, and reduced out-migration. Good governance throughout the period was essential for success, and the 1994 devaluation of the CFA franc increased livestock values, helping motivate farmer investments.

Source: Winslow, Mark et al, 2004

5.5 Raising agricultural productivity: the role of research

Climate change will give agricultural research a key role in adaptation strategies. It will be necessary to develop more heat-resistant cultivars, new techniques for crop management, including shorter growing seasons or early maturing crops, ways to shade crops and animals, while making maximum use of available water resources, including dissemination of drip irrigation techniques for smallholder farming conditions. Improved farm management regimes under drier farming conditions will need to be identified, including planting of drought-resistant crops, reduction in farm and herd sizes, improved water exploitation methods, etc. Full use must be made of biotechnology to develop more heat-resistant and drought-tolerant crop varieties and increase the genetic yield potential of major food crops by at least 40% over the next three decades. There are already success stories in that area, such as the work in SSA of the CGIAR-institute CIMMYT on drought-resistant wheat and maize.

By all accounts, agricultural research in SSA generates high returns on investment. According to one study, of a total of 21 studies in 15 countries the rates of return varied between 30 and 100% in over half of the cases. Yet such research is badly under-funded in SSA. The World Bank has suggested that spending on agricultural research should reach 2% of agricultural GDP to contribute effectively to national development, but in the early 2000s the average was only 0.54%, with only four countries spending more than 2%. The reasons for the under-spending on agricultural research in Africa include (i) flagging donor interest in agriculture (Section 4.7 above), (ii) weak local institutions with inexperienced management, (iii) shortage of skilled local staff and (iv) poor understanding by decision-makers of the contribution of agricultural research. Here there is much room for increased involvement by the donor community.

5.6 Water and sanitation

In this area, it is necessary to separate water resources management from water supply and sanitation, although both will need increasing attention. All water resources should be sub-

ject to integrated management (IWRM) according to the principle that water has several competing uses that need to be reconciled to enable sustainable exploitation of the resource. The WSSD in 2002 postulated that all countries should prepare national IWRM plans by 2005, but several in SSA have not yet done so. The utility of such plans is illustrated by the necessity for many countries to expand irrigated farmland but to do so keeping in mind other uses of water as a scarce resource. The EU Partnership on Infrastructure includes a component on transboundary management according to IWRM principles, a priority in SSA, with its many shared river basins, and can finance many necessary investments.

To address the perceived under-funding of the water sector in general and water supply and sanitation basic services in particular, the EU at WSSD launched the EU Water Initiative (EUWI) in order to pave the way for increased EU resources and improve coordination, and several EU member states give priority to this area in their bilateral aid programmes. Under the EUWI, the EU launched the ACP-EU Water Facility with € 0.5 billion from the 9th EDF to fund projects in this area, perhaps 90% of which are in SSA. The EC is now giving consideration to creating a second phase of the Water Facility under the 10th EDF. If a second phase is approved, it will welcome voluntary contributions from EU member states.

The sub-sector most in need of external support is sanitation, where the situation in SSA is particularly dire (Box 4). The UN General Assembly has declared 2008 to be the International Year of Sanitation, and it will be an occasion for giving special attention to this area.

6. Principal Actors and Sweden's role

This chapter provides a brief overview of the principal actors in the natural resource sector in SSA, external and internal to Africa. The perspective is on their suitability or otherwise as a partner for Sweden, and the chapter ends with suggestions for a Swedish role.

6.1 External and internal actors active in natural resources

African inter-governmental organisations. The African Development Bank (AfDB) is the strongest African institution in the area of natural resources. Its total disbursements in 2005 were US\$ 836 million, with some 7% of its total lending allocated to agriculture. The AfDB has created a Rural Water Supply and Sanitation Initiative (RWSSI), as part of which 14 new projects were approved in early 2007. There is a trust fund associated with the RWSSI, currently supported by France, Denmark and the Netherlands. There is also an African Water Facility linked to the AfDB, with a paid-up capital of € 60 million, for which additional support is being sought: Sweden is already contributing a modest amount.

The *New Partnership for Africa's Development* (NEPAD) in May 2002 launched its Infrastructure Short-Term Action Plan (i-STAP), which argues that bridging the infrastructure gap is key to interconnectivity, regional integration in SSA and economic growth. The EU Partnership on Infrastructure is based on i-STAP. NEPAD also has a water and sanitation programme and an action plan for the environment.

The *UN Economic Commission for Africa* (ECA) is essentially a forum for policy consultations for African governments and civil society stakeholders. It has a division on food security and sustainability that is concerned with "the inter-linked issues of the nexus of population, agriculture and environment".

The *African Union Commission* has departments of, inter alia, infrastructure and energy as well as rural economy and agriculture. The AU Commission is still new and is finding its way.

Of these four agencies, only AfDB has the capacity to implement development projects on the ground, while the others focus more on facilitation of joint actions by governments.

The sub-regional economic commissions. A wide variety of regional integration arrangements have emerged in Africa. Many of them have overlapping mandates and memberships, and the overall picture can be confusing. The primary purpose of the regional economic commissions is to promote cooperation and economic development through trade within the five African sub-regions. Their engagement in natural resources management therefore focuses on transboundary issues, particularly support for the management of Africa's many transboundary river and lake basins. Those particularly active in this area include the following:

- *The Southern Africa Development Community* (SADC), based in Gaborone, Botswana, has developed an important protocol on the management of shared rivers.
- *The Economic Community of West African States* (ECOWAS), based in Abuja, Nigeria, and with an office dealing with transboundary rivers based in Ouagadougou, Burkina Faso, is active in supporting river basin organisations in West Africa.
- *The East African Community* (EAC), based in Arusha, Tanzania, has created a Lake Victoria Basin Commission collaborating (and overlapping) with the Nile Basin Initiative.
- *The Intergovernmental Authority on Development* (IGAD), based in Djibouti and cov-

ering the states in the Horn of Africa, including the members of the EAC, was originally created to contribute to the fight against desertification and still sees itself as playing a role in that area. Its most important role, however, is to provide a forum for political consultations between the various warring countries and factions in the sub-region.

African civil society. African civil society organisations should be seen as increasingly important development partners in coming years, and they will have important roles to play in involving local communities in the design and implementation of climate change adaptation strategies. There is a variety of such organisations in SSA, but many of them have a strongly local focus, few have the overview required to engage in policy dialogue with government and many suffer a lack of resources. They are often organised in networks that link them to sources of support in Europe or elsewhere. One example is the network of member organisations of the IUCN in the area of environmental conservation, another is the African Civil Society Network on Water and Sanitation (ANEWS), an organisation based in Kenya and collaborating with the British NGO WaterAid.

The private sector. A study commissioned by the EC in 2005 concluded that prospects for increased large-scale private sector involvement in water supply and sanitation in SSA were modest. The experiences of European water companies involved in public water and sewage utilities in SSA (and in many other developing countries as well) have not been encouraging. However, in a local context there should be room for increasing involvement of the private sector as a provider of goods and services related to water and sanitation, e.g., the manufacture of latrine slabs and pumps. In natural resource management, there is not much private sector involvement outside the tourism sector. On the other hand, there is obviously considerable and increasing private sector involvement in the development and exploitation of oil and minerals.

The IFIs and the UN. The *World Bank* in 2005 disbursed a total of US\$ 3.6 billion through the IDA, making it the largest provider of development assistance to SSA. The IDA funding commitment for 2007 is expected to reach US\$ 5.5 billion or 50% of IDA resources, a record. Of the World Bank's lending to SSA in 2003, about 25% was allocated to natural resources, including 8% to agriculture, 9% to energy and mining, 8% to water, sanitation and flood protection. These percentages have changed little since 1994.

The World Bank's key strategy for Africa – the three year Africa Action Plan – was launched in September 2005. It was recently reviewed and found to be “too wide ranging”, and as a result the number of focus areas was pared down from 14 to eight. Half of those are relevant to natural resources:

- Raise agricultural productivity
- Improve access to and reliability of clean energy
- Expand and upgrade road networks and transit corridors
- Increase access to safe water and sanitation

The World Bank's Energy Investment Framework is intended to increase private sector investment in promising clean energy technologies, and its use in SSA should be promoted.

The *European Investment Bank* (EIB) is the development bank of the EU and under the Cotonou Agreement is mandated to provide loans to projects alongside grant aid from the EC. For the period 2003–08, the EIB is expected to channel € 3.7 billion to projects in ACP countries, 80–90% of which is destined for SSA. The EIB has a focus on infrastructure, including water supply and sanitation, and provides various risk-sharing financing instruments to public or private sector projects operated on a private sector footing. The EIB is also responsible for the trust fund of the EU Partnership on Infrastructure to which it has contributed € 260 million to be used as loans.

The full range of *UN agencies* operates in SSA. The most significant of these is the UNDP, which in 2006 made disbursements of US\$ 193 million. In most countries, UNDP focuses on public administration and governance and is less involved in natural resources. The WFP in 2006 disbursed the equivalent of US\$ 338 for food assistance, mostly in the form of food, part of which was used to support soil conservation or road building projects. FAO plays an important normative role but is less involved in implementing development projects. IFAD provides soft loans for agriculture and rural development and in 2006 disbursed US\$ 111 million.

The UNFCCC operates the Clean Development Mechanism to promote renewable energy technologies, but Africa has been at a disadvantage in making use of this resource (Box 10).

Box 10: “Knowing which way wind blows: handful of nations get most subsidies”

The UN Clean Development Mechanism raises billions of dollars from rich countries and gives them to poor countries to curb emissions of global warming gases. It has grown from less than US\$ 100 million in payments to developing countries in 2002 to US\$ 4.8 billion in 2006. China captured US\$ 3.2 billion of that amount with India, Mexico, Brazil and Argentina taking most of the rest. Trailing far behind is Africa, which received less than US\$ 150 million in 2006.

Source: IHT, 9 May 2007

European Union. Under the EU Strategy for Africa adopted in 2005, overall European development aid to Africa is set to increase by about € 10 billion per year by 2010. In 2004 the EC disbursed US\$ 2.6 billion of ODA in SSA, making it the fourth largest donor after the World Bank, the US and France. Of total disbursements in 2005 by various EC financial instruments, including the EDF, 9.3% was allocated to natural resources, including 2.9% for water supply and sanitation and a mere 3.1% for agriculture, forestry and fisheries.

The most important financial instrument of the EC is the EDF. The 10th EDF will cover the period 2008–13 and provide a total of € 23.6 billion (as against € 13.5 billion of the 9th EDF for 2002–07). The bulk of these funds will go towards EC cooperation programmes in 76 ACP partner countries, about one-third of which give priority to natural resources in their allocation of these resources. The trust fund of the EU Partnership on Infrastructure will receive about € 600 million from the 10th EDF, to be used jointly with the EIB contribution and grant contributions from EU member states.

Bilateral donors. The largest bilateral donor to SSA in 2004 was the US, with disbursements of US\$ 3.4 billion, followed by France (US\$ 2.6 billion), the UK (US\$ 2 billion) and Germany (US\$ 1.1 billion). Most EU states give priority to water supply and sanitation, those with particularly large programmes in this area including France, Germany, the UK, the Netherlands and Denmark. Rural development and conservation of the environment are other priority areas of the EU member states, although agriculture has declined in recent years.

6.2 Sweden's role: some suggestions

There is a wide variety of options and opportunities for Sweden in the natural resources sector in SSA, but space limitations permit mention of only those that link with existing Swedish priorities and where Sweden can be said to have a comparative advantage. They are summarised below with reference to the preceding discussion.

The Stern Review issued in 2006 by the British government argued that a major reorientation of development cooperation will be required as a consequence of climate change (Box 11).

Box 11: Integration of adaptation strategies in development cooperation

"The poorest developing countries will be hit earliest and hardest by climate change, even though they have contributed little to causing the problem. Their low incomes make it difficult to finance adaptation. The international community has an obligation to support them in adapting to climate change. Without such support there is a serious risk that development progress will be undermined.

It is for the developing countries themselves to determine their approach to adaptation in the context of their own circumstances and aspirations. Rapid growth and development will enhance countries' ability to adapt. The additional costs to developing countries of adapting to climate change could run into tens of billions of dollars.

The scale of the challenge makes it more urgent than ever for developed countries to honour their existing commitments – made in Monterrey in 2002, and strengthened at EU Councils in 2005 and at the July 2005 G8 Gleneagles Summit – to double aid flows by 2010".

Source: Stern Review, 2006: The Economics of Climate Change, Executive Summary

A. Focus on climate change. The scientific evidence is now overwhelming: climate change is a serious global threat that demands an urgent global response. As noted in Box 11, the poorest countries are hardest hit. Development cooperation in SSA in the coming years will focus increasingly on climate-change adaptation strategies. Several donors are already revising their approach to take climate change into account. For example, the DFID White Paper 2006, "Eliminate World Poverty – Making Governance Work for the Poor", had a chapter on this subject, and within the EC the environment directorate is reducing its concentration on water in view of the demands said to arise from the climate change agenda.

Still, uncertainties remain. The precision of available climate models does not allow accurate predictions at the level of individual countries, or regions within countries, where long-term decisions involving infrastructure or agricultural production need to be made.

Given the information at hand, it is essential to foster a shared understanding of the nature of climate change and its consequences in order to shape behaviour and underpin national and international action.

Sweden can play an important role by taking initiatives to:

- jointly review with partners the accuracy of existing climate change predictions for SSA and for individual countries with a view to reducing lingering controversies and uncertainties;
- agree with partners on the principal adaptation strategies required;
- revise, to the extent required, existing development priorities in that light; and
- adjust Swedish development cooperation accordingly.

B. Retain many existing priorities. It will be important not just to introduce climate change as a new priority at the expense of existing ones, some of which may require even more attention in an adaptation perspective. Four stand out as particularly important in light of the preceding discussion:

- *Promote economic growth.* Sustainable economic growth will be as important as ever in a climate change perspective and will enhance the ability of countries to undertake the adaptation strategies necessary in different sectors of society (Section 2.10, also Box 11). The EU has chosen to promote growth in SSA by supporting the development of infrastructure to facilitate interconnectivity and trade, and there are opportunities for Sweden to engage in this programme (Section 5.3).
- *Provide water and, especially, basic sanitation services to the poor.* This area has been identified since the early 2000s as underfinanced and in need of increased attention by donors. Sanitation will be highlighted in 2008 by the international community as a particular priority. Sweden has an internationally recognised expertise in this area that could be more widely used (Section 5.6).
- *Raise productivity in African agriculture.* It is necessary to break the stagnation of African agriculture if a major food crisis is to be avoided in the years to come. This has been a mantra for many years and there are no easy or self-evident solutions. New and more innovative approaches are required, and Sweden may consider an initiative to hold consultations to explore them.
 - A first and necessary step is to reconsider the low priority given to agriculture in ODA and seek a shared understanding with other donors, partners and stakeholders on what would be required to change this situation (Section 5.4).
 - More should be done to support agricultural research in line with what has been said above in Section 5.5.
 - In partner countries where Sweden is already active in agriculture and rural development it may be necessary to revise current action programmes in the light of an analysis of climate change implications and to give more attention to disseminating experiences from local success stories, such as that cited in Box 9.
- *Curbing deforestation.* In Section 2.7 a reference was made to the importance of reducing deforestation as a substantial contributor to greenhouse gas emissions, Section 3.3.2 mentioned deforestation as a major problem in Africa. Afforestation programmes can help provide carbon sinks while generating local employment as well as

fuel wood. They may be reinforced by carbon-offset programmes supported outside official development cooperation. In addition, forestry is an area where Sweden has rich expertise and long experience of working in SSA.

C. Renewable energy. Renewable energy technologies, principally wind and solar, should be developed and disseminated much more aggressively through applied research, appropriate support of the private sector and involvement of civil society. More use could be made of available multilateral mechanisms, for example the Clean Development Mechanism, and promoting their use in SSA (Box 10).

It is important to underline that renewable energy technologies should be promoted more forcefully *regardless of climate change*. The contribution of energy production in SSA countries to global emissions of carbon dioxide is in any event relatively modest.¹³ Significant socioeconomic benefits from the promotion of renewable energy technologies in SSA include reduction in the health hazards resulting from the current widespread use of biomass energy, the time saving for women and children involved in wood fuel collection (Section 3.2.1), the potential for providing energy in remote locations unconnected to the grid and the foreign exchange savings accruing to non-oil exporting countries from not having to import fossil fuels for electricity generation (Section 3.2.2). Besides, Swedish technology for modern use of biofuel, if suitably adapted, could prove valuable.

D. Collaborate increasingly with EU member states and institutions. The enhanced harmonisation between EU member states called for by the Paris Declaration¹⁴ has so far not really happened, as each state mostly prefers to promote narrow national priorities instead of subordinating them to common EU action. As the EUWI and the EUEI have shown, there are opportunities for doing more in this area with the objective of having EU member states acting in concert in a given sector in a partner country in order to improve aid efficiency. There are also possibilities for making voluntary contributions to EC financial instruments, for example the trust fund of the Partnership on Infrastructure (Section 5.3).

E. Focus on African civil society. African civil society organisations are increasingly being called upon to participate in a variety of donor-funded initiatives, but they remain insufficiently resourced to play an effective role, for example in the EITI (Section 3.4.2). Climate change adaptation will in many instances require comprehensive adjustments, for instance changes in agricultural production patterns or relocation of population groups, which cannot be effective in the absence of strong civil society involvement. Strengthening civil society organisations is therefore important not only from a general good governance perspective, but also to facilitate adaptation strategies.

F. Enhancing disaster preparedness. The point was made in Section 2.10 that few SSA countries possess the resources needed to prepare for the natural disasters, notably drought and floods, which may strike with increasing frequency as a result of climate change. Some countries, such as Ethiopia, where drought has become endemic, have with external donor support developed advanced early warning systems and a standing readiness to distribute

¹³ According to the IPCC, Africa contributed 7.8% of all greenhouse gas emissions as translated into carbon dioxide equivalents. However, less than that is from energy, other sources important in SSA including deforestation and agriculture.

¹⁴ The Paris Declaration on Aid Effectiveness, March 2005.

food aid to exposed regions, but others have not done much in this area. Partner countries may require assistance to prepare for natural disasters in a variety of ways, ranging from better meteorological forecasting to warehouses for pre-positioning food supplies. As a first step, Sweden may offer support to review existing plans to cope with natural disasters.

G. More attention to governance and human rights in the mineral-rich SSA countries.

As set out in Section 3.4.2, governance in many of these countries is abysmal and seemingly not improving. Sweden could argue that good governance in African oil-producing countries should be an element of EU energy policies. Sweden could also play a more active role in these countries, for example by helping to strengthen the EITI mechanism. Initiatives could be taken through consumer organisations in Sweden and in the EU to highlight the situation regarding poverty, democracy and human rights in some of the oil-producing SSA countries with a view to bringing pressure on multinational oil companies to contribute more to sustainable development in the countries where they operate.

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Africa is rich in oil and mineral resources, but has severe shortages of water and suffers from an accelerating pressure on its arable land and forests. Climate change is expected to cause major problems for African populations with increase of water stress and severely compromised agricultural production. Local food supplies will be negatively affected and, towards the end of the 21st century, sea-level rise will affect low-lying coastal areas. The report argues that the poorest countries are most vulnerable to climate change and that Africa is particularly exposed. Sweden should consider full integration of climate change adaptation strategies in its development cooperation with African partners. This will likely mean that some existing priorities will be further accentuated, such as needs to provide water and sanitation services to the poor, raising agricultural productivity, and curbing deforestation.

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