A PLATFORM FOR STAKEHOLDERS IN AFRICAN FORESTRY

NAMAS AND NAPAS IN EASTERN AFRICA

AFRICAN FOREST FORUM WORKING PAPER SERIES

VOLUME 2

ISSUE 20 , 2014

 African Forest Forum P.O. Box 30677 00100 Nairobi GPO KENYA Tel: +254 20 7224203 Fax: +254 20 722 4001 Website: www.afforum.org

Correct citation: Harrison, O.K. 2014. NAMAs and NAPAs in Eastern Africa. African Forest Forum, Working Paper Series, Vol. 2(20), 55 pp.

Cover photo: African Forest Forum

NAMAs AND NAPAs IN EASTERN AFRICA

Harrison Ochieng Kojwang

Table of Contents

List of Tables

List of Figures

List of Box

Acronyms and Abbreviations

AFF	African Forest Forum
CDM	Clean development mechanism
CGIAR	Consultative Group of International Agricultural Research Institutions
CO_2e	Carbon dioxide equivalent
COMESA	Common Market for East and Central Africa
COP	Conference of the Parties
EAC	East African Community
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Programme of the World Bank
FIP	Forest Investment Programme of the World Bank
GHG	Greenhouse gases
Gt	Gigatons
IBLI	Index-Based Weather Insurance scheme
ICPAC	IGAD Climate Prediction and Application Centre
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IGAD	Intergovernmental Authority for Development in Eastern Africa
ILRI	International Livestock Research Institute
IPCC	Inter-governmental Panel on Climate Change
KWh	Kilowatt hour
KWh	Kilowatt hour
LDC	Least developed country
LPG	Liquefied Petroleum Gas
LULUCF	Land use, land use change and forestry

MPCI	Multiple-Peril Crop Insurance scheme
MW	Megawatt
MWh	Megawatt hour
NAMA	Nationally appropriate mitigation action
NAP	National Action Plan on Climate Change
NAPA	National adaptation programme of action
NO2	Nitrous oxides
REDD	Reduced emissions from deforestation and forest degradation
REDD+	Reduced emissions from deforestation and forest degradation, enhancement of carbon stocks and sustainable forest management
SADC	Southern African Development Commission
SFM	Sustainable Forest Management
TEFC	Totally Enclosed Fan Cooled Motors
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

CHAPTER 1 NAMAs and NAPAs in Eastern Africa

GENERAL

The countries covered under the eastern African region are Burundi, Ethiopia, Eritrea, Kenya, Rwanda, Somalia, Sudan, South Sudan, Tanzania and Uganda. Issues pertaining to South Sudan being the youngest of the eastern African countries are generally covered under Sudan for the time being.

With particular reference to climate change, it is a fact that the importance of the need for action is now well recognized in the region, because of the threats climate change carries to all the countries, and their individual and collective vulnerability to its adverse effects. Countries also recognize their responsibility to reduce greenhouse gas emissions that aggravate climate change and its effects, and the crucial need to implement adaptation measures that will help them cope with its vagaries. This paper addresses two climate change initiatives popularly known as Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programmes of Action (NAPAs), both of which have their origins in decisions taken at the negotiations of the United Nations Framework Convention on Climate Change (UNFCCC).

THE ORIGINS AND RATIONALE FOR NAMAS AND NAPAS

The call for developing countries to prepare NAPAs was decided at the seventh session of the Conference of Parties (COP 7), held in Marrakesh, Morocco in 2001. The decision (Decision 27/CP.7) known as “Guidance to an entity entrusted with the operation of the financial mechanism of the Convention, for the operation of the least developed countries fund” had the following main tenets:

a) that as a first step, to provide funding from the LDC Fund to meet the agreed full cost of preparing NAPAs, given that the preparation of NAPAs will help build capacity for the preparation (of) national communications under Article 12, paragraph 1 of the Convention;

b) to ensure complementarity of funding between the LDC Fund and other funds with which the operating entity is entrusted;

c) to ensure the separation of the LDC Fund from other funds with which the operating entity is entrusted;

d) to adopt simplified procedures and arrange for expedited access to the Fund by the least developed countries, while ensuring sound financial management;

e) to ensure transparency in all steps relating to the operation of the fund;

f) to encourage the use of national and, where appropriate, regional experts;

g) to adopt streamlined procedures for the operation of the fund.

In addition to the above the envisaged characteristics of the NAPAs were that, they would be easy to understand, be action-oriented and country-driven and would set clear priorities for urgent and immediate adaptation activities as identified by the countries

Like NAPAs, nationally appropriate mitigation actions (NAMAs) came out of decisions of the Conference of Parties, precisely as e Bali Action Plan of 2007 during the 13th Conference of Parties (COP 13) (UN, 2007), which called for appropriate mitigation actions to be taken by developing countries, to be supported and enabled by the provision of support from developed countries in terms of technology transfer, finance and capacity building. Both actions and support should be subject to the requirement of being measurable, reportable and verifiable. From available literature (Teng 2009, Muller 2009, Zhakata 2009), there is a divergence of opinion between developed and developing countries on the interpretation of how NAMAs should be treated. For instance, developed countries would like to have NAMAs measured, reported, verified and even be credited, while developing countries see NAMAs as actions by countries, some of which are unilateral and supported by own funds that should not be subjected to external verification and should not be used as an off-set mechanism to meet emission reduction commitments by developed countries. Teng (2009) has concluded that "*the extent to which countries will implement NAMAs will depend on the effective support provided by developed countries in terms of financial resources and transfers of technology. The most urgent thing to start a NAMA is not an MRV system or a discussion on the definition of NAMAs, but a support mechanism with ready support which can be used to start actions now*". On the same issue, southern Africa feels that developing countries should take actions to reduce their emissions but with the support of developed countries as stated in the Bali Action Plan and has singled out the renewable energy and energy efficiency policies as central to such an effort and feels that "*expanding access to renewable energy and energy efficient technologies should be the key strategy for engaging developing countries in mitigation efforts*" (Zhakata 2009).

This paper describes the current strategic and practical steps taken by countries in Eastern Africa in the context of nationally appropriate mitigation actions (NAMAs) and national adaptation programmes of action (NAPAs). It begins with consideration of the policies, institutional arrangements for and management of climate change, and ends with a discussion on what improvements could be made and a focused discussion on the role that forest management will play in both adaptation and mitigation of climate change and a possible role of the African Forest Forum in the process.

CHAPTER 2 Policies, institutional arrangements and management of climate change in Eastern Africa

Virtually all the countries of Eastern Africa ratified and or acceded to the United Nations Framework Convention on Climate Change (UNFCCC) and its protocol – the Kyoto Protocol – in the 1990s. Each of the countries of the region has a designated Focal Point for programmes and activities relevant to the UNFCCC and has submitted at least one national communication to the UNFCCC thereby confirming their commitment to fulfilling their obligations under the Convention. In addition, some of the countries have developed and are in the process of implementing Clean Development Mechanism (CDM) projects while others have enrolled in the programme to Reduce Emission from Deforestation and Forest Degradation and Enhancement of Forest Carbon Stocks (REDD+) to fulfill their obligation under the Convention and the Protocol. Ethiopia, Kenya and Tanzania are, for instance, participating in the Forest Carbon Partnership Facility of the World Bank and or the UN-REDD Programme and have indeed received funding to implement 'REDD+-readiness' activities.

In terms of management and institutional arrangement, each of the countries has designated a Focal Point for the UNFCCC, and also established National Climate Change Committees to advise on and oversee implementation of climate change activities, including formulation of national climate change mitigation and adaptation strategies. In countries such as Ethiopia, Kenya (Box 1) and Tanzania the national climate change committees are inter-ministerial / multi-stakeholder in nature. In these countries, National Climate Change Secretariats have additionally been established to undertake day-to-day running of climate change issues and to provide support to the National Climate Change Committees. Most of the countries have also established Designated National Authorities to vet and approve CDM projects and a multi-stakeholder National REDD+ Steering Committees to guide the development and implementation of REDD+ strategies.

In addition to the National Communications that have been outlined, countries have also proposed Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programme of Actions (NAPAs). Countries such as Ethiopia, Kenya and Tanzania have also developed national climate change strategies. Kenya, for instance, has put in place the National Climate Change Response Strategy while Ethiopia and Tanzania have, respectively, developed the Climate Resilient Green Economy and National Action Plan on Climate Change (NAP). These strategies – or blue-prints - on climate change have further

outlined the countries' NAMAs and NAPAs including management and institutional arrangements to realize them. The strategies have also called for mainstreaming of climate change in all sectors of the countries' economy and national policies and development plans. Indeed, in Tanzania, climate change has been integrated in all sectors of the economy and the country's national development strategies, while Kenya and Ethiopia are in the process of mainstreaming climate change in national development programmes and policies. The remainders of the Eastern African countries are also in the process of developing their national climate change strategies and or action plans as summarized in Table 1.

Box 1. Management and Institutional Arrangement for Climate Change in Kenya (Source?)

Kenya signed the United Nations Framework Convention on Climate Change (UNFCCC) on 30th August, 1994 signifying her intention to join the international community in tackling climate change. The country mandated the Ministry of Environment and Mineral Resources (MEMR) to oversee climate change issues and to act as the Focal Point for the UNFCCC. To its credit, MEMR coordinated the development and publishing of the National Climate Change Response Strategy (NCCRS), which was released in May 2010. An Inter-Ministerial Committee on Environment (IMCE) – comprising of representatives from key ministries/ departments, research and academia, non-governmental organizations and the private sector – is in charge of coordinating climate change issues.

The IMCE has created eight technical sub-committees on priority areas, one of which is the National Climate Change Activities Coordination Committee (NCCACC). The NCCACC has the main objective of providing advice on the implications of commitments under the UNFCCC and other international agreements related to climate change. The National Climate Change Coordinating Office under the Directorate of Environment in MEMR acts as the secretariat of NCCACC. The Kenya Meteorological Department (KMD) acts as the IPCC focal point in the country while the Kenya Forest Service (KFS) has been designated as the body responsible for REDD+ in Kenya. The National Environment Management Authority (NEMA) acts as the principal instrument of government in the implementation of all policies relating to the environment. In addition, NEMA hosts the country's Designated National Authority (DNA), which is responsible for analyzing and approving CDM projects. The Climate Change Coordination Unit (CCCU) at the office of the Prime Minister plays a supervisory role, and has become the new champion of Climate Change initiatives in Kenya.

From the foregoing, it is evident that Kenya has a complex network of institutions that act on Climate Change issues. Despite the large number of entities involved in climate change, there is a lack of clear mandates and responsibilities as regards different aspects of climate change resulting in duplication of efforts and conflicts in implementation, which could be a deterrent to the implementation of the proposed NAMAs and NAPAs.

Table 1. Summary of institutional, management and technical capacity to implement NAMAs and NAPAs in East African countries

Issue or Challenge	Country						
	Burundi	Eritrea	Ethiopia	Kenya	Rwanda	Tanzania	Ouganda
Presence of clear climate change policies or policies that promote implementation of Climate Change Action Plans	No	No	Yes	Yes	No	Yes	No
Have designated Institutions to oversee implementation of CC mitigation and adaptation strategies	Yes, some under development	Yes, some under development	Yes	Yes	Yes	Yes	Yes
Presence of technical knowhow and appropriate technologies	No	No	Not clear / No	Somehow	No	Somehow	No / Not clear
Availability of technical capacity / qualified researchers, scientists and technicians	No	No	No	Yes/ Somehow	No	Yes/ Somehow	No
Institutional capacity on climate research and weather forecasting, disaster risk assessment, etc	Yes, but limited capacity	No	Yes, but limited capacity	Yes	Yes, but limited capacity	Yes	No
Climate data collection, processing and dissemination	No	No	Yes, but limited capacity	Yes, but limited	limited	Yes, but limited	No
Has adequate financial and material resources to implement mitigation and adaptation strategies	No	No	No	No	No	No	No
General awareness on climate change, its causes and impacts	No	No	No	Moderate	No	Moderate	No
Climate change mainstreamed in all sectors of the economy, national policies and development plans	No	No	In process	In process	No	Yes	No

PROPOSED NAMAS

In discussing NAMAs, it is important to note and understand that emissions of greenhouse gases (GHG) in the Eastern African region mainly come from six key sectors namely, energy, transport, industry, agriculture, waste and land use, land use change and forestry (LULUCF). In line with their commitment under the Convention to institute strategies to curb GHG emissions, East African countries have outlined and or proposed several strategies to reduce emissions from these six sectors. The proceeding section examines GHG emissions from each of the sectors and outlines the options proposed to reduce the emissions. A summary of the proposed NAMAs is presented in Table 1.

Energy sector

Many countries of the region have identified the energy sector as a major and dominant source of emissions of GHG, especially CO_2. In Kenya, GHG emissions from the energy sector amounted to 4,522.45 Gg of CO_2 in 1995 (Republic of Kenya, 2002). These emissions came from burning of imported fossil fuels. In the Sudan, GHG emissions from the energy sector stood at 35,945 Gg in 1995 (Republic of the Sudan, 2003). In Ethiopia, total CO_2 emissions from sectors other than land use and forestry stood at 2,596 Gg in 1994. According to Ethiopia's Initial Communication to the UNFCCC, 88% of these emissions came from fossil fuel combustion in the energy sector. In Rwanda, the energy sector was the second largest emitter of GHGs after agriculture, accounting for 18% of all emissions in 2005 (Republic of Rwanda, sine datum). With increasing importation of increased quantities of petroleum products for energy production (see Figure 1), GHG emissions from the sector is expected to increase markedly. In Eritrea, the energy sector, especially combustion of fossil fuels, accounts for 28 % of the total CO_2 emissions. In Tanzania, the energy sector was the third largest emitter of GHGs after land use and forestry and agricultural sectors, accounting for 12% of total national GHGs emissions in 1990.

A number of measures have therefore been proposed by Eastern Africa countries to reduce emissions from the energy sector. Fuel wood remains the dominant source of primary energy used in the Eastern Africa region, followed by fossil fuel and electricity. Virtually all the countries have proposed to reduce fuel wood consumption through the introduction of more efficient biomass burning technologies. Rwanda, for instance, plans to reduce the amount of fuel wood used for energy from 90% (2002 baseline) to 40% (Republic of Rwanda, sine datum). The country also plans to substitute (fossil) fuel with Kivu Lake methane gas and to substitute 25% of firewood used in institutions with biogas. Another strategy to reduce emissions from the energy sector is energy transformation, which includes the use of furnaces of high energy performance in institutions. Figure 2 shows the

baseline emissions and projected reduction in emissions that will accrue from reduction in demand for fuel wood, energy substitution and energy transformation in Rwanda.

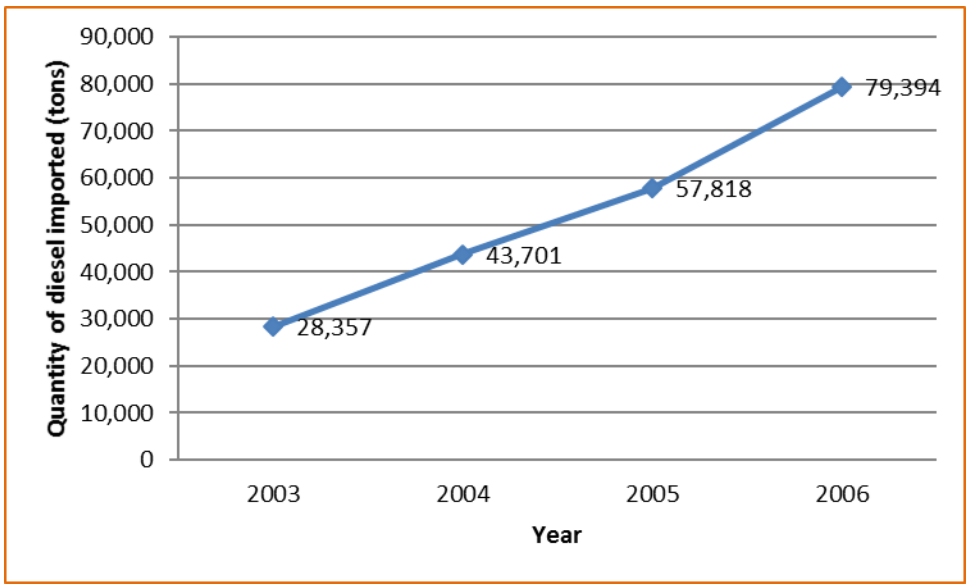

Figure 1. Trend in importation of diesel in Rwanda between 2003 and 2006 (Source: adapted from Rwanda 2nd National Communication to the UNFCCC)

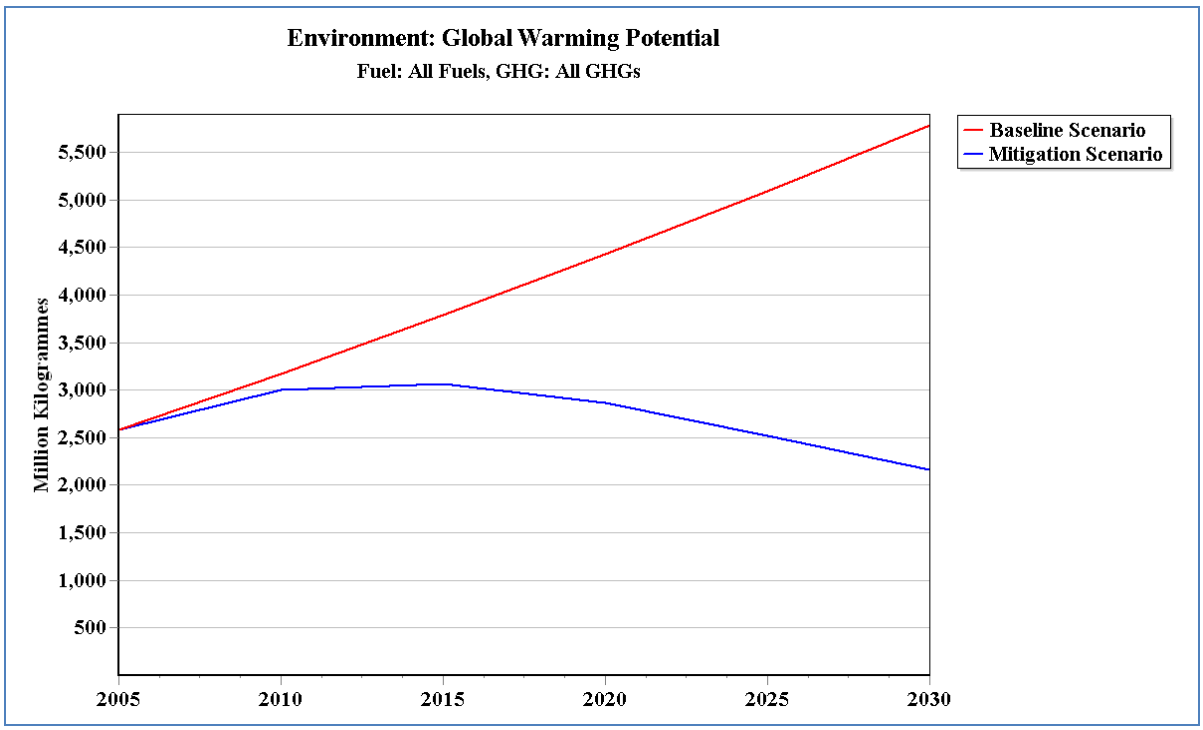

Figure 2. Emissions (CO_2e) reduced through reduction in energy demand and energy transformation in Rwanda (source: Rwandese 2nd National Communication)

In Ethiopia, Kenya and Uganda, rural electrification programmes have been launched to increase use of electricity by rural households and thereby reduce firewood consumption. In its National Communication to the UNFCCC, Uganda had, for instance, planned to increase rural electrification from 1% to 10% by 2012 (Republic of Uganda, sine datum).

To tackle the prevalent household energy problems, all countries have proposed and are implementing programmes to distribute improved household and institutional cook stoves and enhance the supply and distribution of kerosene and LPG. Such programmes have, for example, been launched in Eritrea, Ethiopia, Kenya and Rwanda, among other Eastern Africa countries. Ethiopia plans to replace open fires and rudimentary stoves with stoves that use only half as much fuel wood. Ethiopia intimates that this will lead to a reduction of 50 Mt CO_2e annually by 2030. Thus, the Ethiopian government plans to deploy 9 million more efficient cook stoves by 2015 (Federal Democratic Republic of Ethiopia, 2011). Eritrea plans to introduce energy efficient devices in cooking, cooling and lighting. This will include the introduction of efficient wood stoves for cooking; introduction of solar heating and cooling devices and; increasing lighting efficiency through the use of fluorescent in place of incandescent lamps, a strategy that has been proposed by virtually all other countries of the region. A simple calculation in Eritrea showed that the CO_2 reduction potential per improved stove is 0.6 tons per year (The State of Eritrea 2001).

Introduction and promotion of energy conservation measures including rehabilitation of old energy generation, transmission and distribution systems have also been proposed. In Eritrea, the Asmara and Massawa transmission systems were rehabilitated in the early 2000s. Eritrea estimated that the completion of rehabilitation would reduce technical energy losses in transmission and distribution by at least 50%. Assuming that oil fired stations produce about 0.7 tons of CO_2/ MWh generated, this reduction in technical loses was expected to achieve CO_2 emission reduction of 21,000 tons every year (The State of Eritrea, 2001). Similarly, the Eritrean Electric Authority (EEA) had increased capacity from 35 MW in 1991 to over 70 MW by 1996. The commissioning of the Hirgigo Power Supply Project increased electricity generation capacity by a further 84 MW by 2001. The new generation facility consumes around 170 grams of heavy fuel oil per kWh of electricity generated compared to an average consumption of about 220 grams of diesel or light fuel oil for the older system. By 2001, introduction of this efficient system was expected to reduce CO_2 emissions by an estimated 45,000 tons.

Tanzania, too, plans to install 230 MW of combined-cycle power plants instead of simple cycle gas turbines to enhance efficiency. The country plans to adopt clean thermal technology for electricity generation. This will involve converting simple cycle thermal power plants located in Dar es Salaam to combined cycle which will run on the Songo Songo natural gas, thereby resulting in a switch from using industrial diesel oil to natural gas (United Republic of Tanzania, 2003). The combined cycle plants have relatively high fuel combustion efficiencies, estimated at about of 57%, and which compares favorably to 35 -

40% for the simple cycle plants. Additionally, combined cycle plants have short lead-time and very low emission levels of NO_2 since the exhaust gases consist, typically, of 3.0 to 3.5 ppm CO_2 (by volume), corresponding to 0.4 kg CO_2/ kWh (United Republic of Tanzania, 2003).

Development and expansion of renewable energy technologies, including wind, small hydro, biogas, solar and improved charcoaling technologies have also been proposed. In this respect many solar PV systems with an average capacity of over 400 kW have been installed in the rural areas of Ethiopia. Ethiopia is already producing 90% of its electricity from renewable energy sources (Federal Democratic Republic of Ethiopia, 2011). As part of its Climate Resilient Green Economy, Ethiopia plans to exploit its vast potential for hydro, geothermal, solar, and wind power to increase power production capacity five-fold by 2016, and double it to 67 TWh, by 2030 (Federal Democratic Republic of Ethiopia, 2011).

Kenya has put in place a policy that requires new buildings to install solar water heaters, a policy which has been received well by developers. In Uganda, some 10,000 solar units had been installed by 2001. In Kenya, some 80,000 solar units had been installed in rural areas by 1997, and has been continuing since. In Eritrea**,** many solar PV systems with an aggregate capacity of over 500 kW have been installed in the rural areas including in 25 health centers, 60 water pumps and 70 schools (The State of Eritrea, 2001). Eritrea estimates that some 1.6 tons of CO_2 is abated for each kW of renewable energy technology installed (The State of Eritrea, 2001).

Formulation of new energy laws, regulations and standards to reform and regulate the energy sector and encourage competition and efficiency have been identified as possible policy and regulatory measures. Tanzania has proposed to use energy pricing policy to stimulate the efficient development and utilization of renewable and less-emitting forms of energy and to introduce regulations and standards to safeguard the environment and property against the misuse of energy and accidents. In Kenya, the ministry of energy is currently developing a legal notice that will require all institutions and businesses using more 200 tons of fuel wood to install improved stoves. Given the high dependence of Eastern African countries on imported fossil fuels for energy, the implementation of these measures will not only reduce GHG emissions but will also reduce their oil imports and free resources for other socio-economic developmental activities. As Figure 3 shows, the implementation of a range of strategies has already seen GHG emissions from fossil fuel consumption decrease in Eritrea.

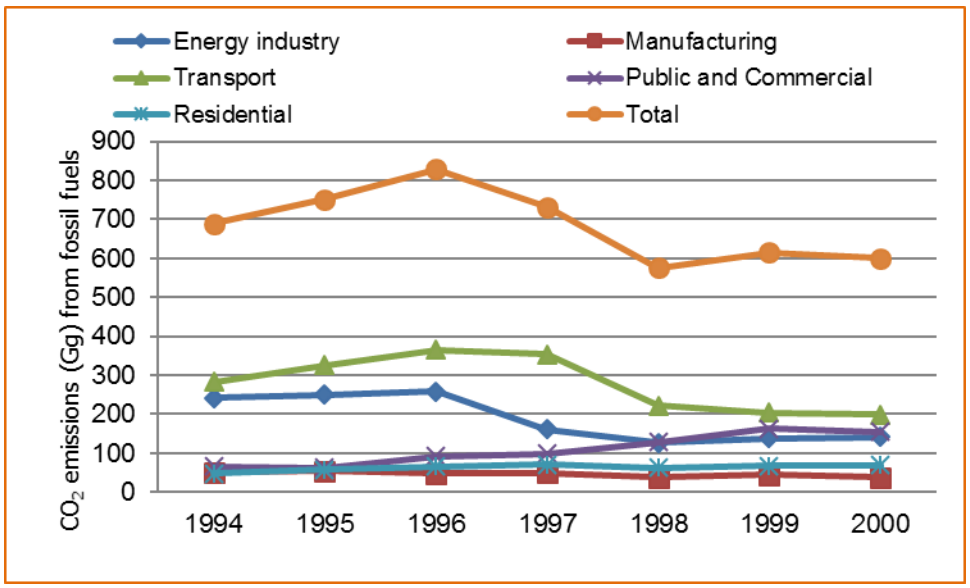

Figure 3. Trend in CO2 emissions (Gg) from fossil fuel combustion by sector in Eritrea (Source: The State of Eritrea, 2001).

Transport

Road transport remains a major mode of transport in Eastern Africa. Given the improving economic situation and expansion of the middle class in the region, importation of vehicles (both private and public) has been increasing (Figure 4). This transport system consumes significant quantities of fossil fuels, thereby being a major source of GHG emissions. In Kenya, motorized transport accounted for 56% of the total fossil fuels consumed in 1994 (Republic of Kenya, 2002). In 1994, the total CO_2 emitted from the road transport was about 283 Gg. In Eritrea, the transport sector accounted for 41% of the total fossil fuel consumed in 1994 (The State of Eritrea, 2001). In Uganda, the bulk of gasoline and gas oil is consumed in the transport sector, making the sector the largest emitter of GHG emissions. Using the bottom-up methodology to estimate CO_2 emissions from petroleum products, Uganda estimated that 709 Gg of CO_2 were emitted from a total carbon content of 195.07 Gg in 1994 (Republic of Uganda, 2002).

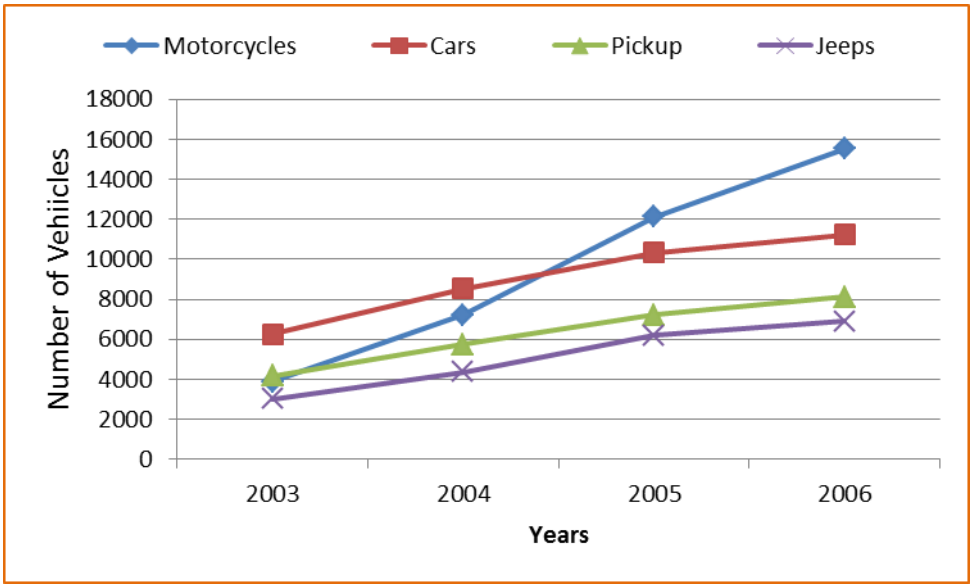

Figure 4. Trends in import of selected vehicles in Rwanda (Source: Adapted from Rwanda 2nd National Communication to the UNFCCC)

Thus, many countries of the region have proposed measures to reduce emissions from this sector. These include:

i) Promoting and encouraging mass transport

Promotion of mass transport especially in public transport through use of buses which save fuel and have bigger passenger capacity has been proposed by all the countries. The big buses shall be linked to buses with lower capacity driven on secondary roads. Tanzania has proposed the use of 50-100-seater buses during peak hours and 20-50-seater buses during off-peak hours, and the introduction of urban light rail systems and public sub-urban rail systems (United Republic of Tanzania, 2003). Other measures proposed by Tanzania include enhanced sea transport for freight and route rescheduling and reduced rolling load. Uganda is encouraging the use vehicles with lower energy consumption intensity with respect to transportation capacity. Thus, the country proposes to replace mini-buses with buses/coaches that have higher passenger capacity.

ii) Promotion of non-motorized transport such as bicycles

Promotion of non-motorized transport has also been identified as a major strategy to reduce GHG emissions from the transport sector by Eastern Africa countries. In Kenya, the Intermediate Technology Development Group has designed a multi-purpose bicycle which is already in use in western Kenya. The Kisumu Innovation Centre and the Kenya Network for Draught Animal Technology are exploring technologies for use of animal power on firms. Countries have also proposed to promote such non-motorized transport as bicycles through establishment of pedestrian and bicycle lanes and bicycle parking bays. Tanzania, has

proposed enhanced use of pipeline transport for oil and gas transportation, establishment of restricted lanes for push/pull carts, bicycles, and special walkways and foot bridges, and bicycle lanes (United Republic of Tanzania, 2003).

iii) Policy and regulatory measures

A number of regulatory measures have also been proposed. Uganda has proposed the introduction of suitable taxation measures to limit fuel consumption. Kenya is implementing a programme of annual inspection of all vehicles to ensure that all vehicles on her roads are in 'road-worthy' condition (Republic of Kenya, 2002). Uganda plans to create incentives for procurement of efficient and mass transit vehicles and to ensure compliance with vehicle emissions standards (Republic of Uganda, 2002). Rwanda aims to enhance improvement in vehicle technical checkups including measuring direct GHG emissions from vehicles (Republic of Rwanda, sine datum). Additionally, the country has proposed regulation of the quality of imported vehicles to take into account the year of manufacture, mileage and other technical characteristics. Eritrea has proposed to promote more efficient vehicles and to ban old and outdated vehicles from her roads (The State of Eritrea, 2001).

The COMESA, EAC and Northern Corridor Agreements also provides that vehicles entering another country's territory must comply with all the environmental and related regulations of that Country. These Agreements will also promote national cooperation in transport policy formulation and fuel taxation measures in the region and ultimately lead to reduced emissions of GHGs from the transport sector.

Industry sector

The Eastern Africa region does not have a massive industrial sector. However, increased economic activity and growth over the last decade has occasioned a surge in industrial activities especially in manufacturing, building and construction, food and beverage, and agrochemicals. This has resulted in increasing emissions from the industrial sector. For instance, despite its relatively small-scale and underdeveloped nature, the industrial sector in Eritrea accounted for 7% of the oil products and around 40% of all electricity consumed in 1994 (The State of Eritrea, 2001). In Kenya, CO_2 emissions from the industrial sector stood at 990.1 Gg in 1994 (Republic of Kenya, 2002). Thus, the countries of the Eastern Africa region have identified the industrial sector as significant source of GHG emissions.

Countries have proposed and are implementing several measures to curb emissions from this vital sector. In Tanzania, cement production, pulp and paper manufacturing are among the key industrial sectors that emit large quantities of GHGs into the atmosphere (United Republic of Tanzania, 2003). Tanzania has proposed a number of strategies to reduce emissions from these sub-sectors and other industrial processes. In cement manufacture, strategies proposed include installation of automatic control systems to reduce the amount of fuel use and improve production efficiency, installation of CO_2 recovery systems,

substitution of natural gas for fuel oil in power production plants and production of blended cements such as pozzolanic cements, blast furnace slag cement, and Portland cements in order to reduce the amount of fuel used for calcination and the amount of lime used per unit of cement produced. In Ethiopia, modernization of cement production to achieve higher efficiency is expected to result in an annual reduction of 16 Mt CO_2e by 2030 (Federal Democratic Republic of Ethiopia, 2011).

Another sub-sector that contributes significantly to GHG emissions in the industrial sector is pulp and paper manufacturing. To curb emissions from this sub-sector, Tanzania proposes efficiency improvement, optimization of recovery boilers to reduce the amount of lime and energy used, and to enhance recovery of CO_2 from calcinations by the absorption of CO_2. As outlined in the Tanzania's National Communication to the UNFCCC, strategies to be employed in other industrial sub-sectors include improvement of efficiency in existing plants through maintenance, improved steam production and management, improvements in motor drive systems and cogeneration (United Republic of Tanzania, 2003). Other strategies proposed by Tanzania include installation of modern boilers to achieve efficiencies of between 90% and 95%; improving power factor correction to an acceptable level of 0.9, which will lead to GHG emissions reduction of up to 43%; replacing 'Totally Enclosed Fan Cooled' (TEFC) motors with efficient motors, resulting in power savings of up to 15%; improving thermal efficiency of furnaces to between 55 and 60% and; switching from coal, heavy fuel oil and industrial diesel oil to natural gas (United Republic of Tanzania, 2003).

In Kenya, too, fuel switch has been proposed. Some Kenyan hotels and lodges have already switched from diesel-powered engines to solar energy. Kenya, like other countries in the region, has also proposed refinement and modification of combustion processes. Some tea factories in Kenya have, for instance, modified the old wood-fired locomotive boilers. This has seen efficiency increase from 16 – 20% to 33 – 40%, resulting in a reduction in fuel wood consumption of up to 50% (Republic of Kenya, 2002). Kenya also plans to replace the old wood-fired boilers with more efficient boilers. Some of the tea factories have installed small hydro along nearby rivers. Indeed, small hydro power plants are being launched and or revived along the major rivers especially in the Mt. Kenya region that is endowed with many rivers.

Additionally, the Kenya Association of Manufacturers has implemented a project to enhance energy conversion and efficiency in the industrial sector since 1992. In its 1st National Communication to the UNFCCC, Kenya intimated that this project has resulted in an 8% saving on annual fuel oil consumption. This has seen consumption of fuel oil in the industrial sector reduce from 254,443 tons in 1992 to 207,298 tons in 1997 (Republic of Kenya, 2002). Thus, Kenya proposes continued improvement in energy conservation and efficiency in the industrial sector. A similar project, financed by the Global Environment Facility was launched in 2000. Cogeneration is also being promoted in Kenya especially in the sugar

and agro-food-chemical sectors. The Mumias Sugar and Agro-Chemical Food Companies are today generating electricity for their own internal consumption and selling the surplus to the national grid.

Land use, land use change and forestry (LULUCF) sector

Environmental and land degradation remain a major challenge in the Eastern Africa region. Deforestation and forest degradation and land use change are a major source of emissions. In Tanzania, the land use and forestry sector is the biggest source of GHG emissions and accounted for 87% of all emissions in 1990 (United Republic of Tanzania, 2003). In 1990, the sector emitted 56,664 Gg of CO_2 into the atmosphere and only sequestered 3,745 Gg of CO_2, thus being a net emitter of CO_2. In Sudan, too, emissions from the forest sector exceed sequestration. In 1995, emissions from the Sudanese forestry sector were estimated at 28,174 Gg of CO_2 while removals stood at 13,138 Gg of CO_2 (Republic of the Sudan, 2003). In Eritrea, CO_2 constitute the largest portion of GHG emissions. Most of the CO_2 emissions come from the LULUCF sector, which accounted for 70 % of the total absolute CO_2 emission in 1994 (The State of Eritrea, 2001). In Ethiopia, emissions of CO_2 from the forestry sector emanate from on-site and off-site burning and decay of above ground biomass, which stood at 12,510 Gg of CO_2 in 1994 (Federal Democratic Republic of Ethiopia, 2001). Under business-as-usual, the sector is expected to contribute 25% of all emissions from Ethiopia by 2030 (Federal Democratic Republic of Ethiopia, 2011).

It should be noted, however, that in some countries of the region, forests are net sinkers of carbon. In Kenya, for example, forests are a net sink of CO_2 (Republic of Kenya, 2002). Ethiopian land use and forestry sector is also a net sink of CO_2. While the sector emitted 12,510 Gg CO_2, the forests were a net sink of some -15 063 Gg of CO_2 (Federal Democratic Republic of Ethiopia, 2001). However, despite being a net sink, Ethiopian land use and forestry sector remain a major source of CO_2 emissions. In Burundi, too, land use, land use change and forestry (LULUCF) remains the largest emitter of GHG. In 2005, the land use and forestry sector accounted for about 50% of the the total national CO_2 emissions (Republic of Burundi 2010). According the Republic of Burundi (2010), by 2050, emissions from forest exploitation will be 6,529.93Gg CO_2e, wood transfer will be 2,887 Gg of CO_2e, while that from changes in land use will be 5,488 Gg CO_2e. Given the huge contribution of the land use and forestry sector to overall national GHG emissions, Eastern Africa countries have proposed several strategies to reduce emissions from the land use and forestry sector. In Burundi, measures in place include technological options such as use of BITI oven, which will permit a saving of at least 43% of the wood weight used; and the use of charcoal hearths, which will lead to 20% saving on fuel wood consumption (Republic of Burundi, 2010). In Ethiopia, adoption and use of more efficient stoves is expected to reduce forestry-related emissions at a rate of 50 Mt CO_2e emissions a year by 2030 (Federal Democratic Republic of Ethiopia, 2011). In Eritrea, afforestation and forest

protection have been launched and by 2000, some 200 000 hectares of forests had been brought under permanent enclosure in Eritrea (The State of Eritrea, 2002). The country has since 1991 planted over 56 million seedlings of different species on deforested areas, covering an area of more than 16 000 ha of land (The State of Eritrea, 2002). Ethiopia plans to bring 17,000 ha of degraded forests under protection and natural regeneration over the next 30 years (Federal Democratic Republic of Ethiopia, 2002). Tanzania plans to expand the area under industrial plantation to reduce pressure on natural forests and supply the much needed timber and allied products. Under the Tanzania Forestry Action Plan, the Sao Hill forest plantation will be expanded to 60,000 ha and developed further to supply timber and pulp. A half of the area will be planted with Pine and Cypress for saw logs while the other half will be planted with Pine for pulpwood (United Republic of Tanzania, 2003). Table 2 shows areas scheduled for plantation expansion and development in Tanzania.

Table 2. Forests planned for possible expansion in Tanzania (Source: United Republic of Tanzania, 2003)

Name of the Forest	Main Species	Existing Forest Area (Hectares)	Possible Extension of Planted Area (Hectares)
Meru	Eucalyptus	3,482.30	821
Training Forest	Eucalyptus	660	25
Usa	Loliondo. Grevillea	944.9	50
West Kilimanjaro	Grevillea	3,966.90	646
North Kilimanjaro	Pins (grumes)	3,809.20	1,000
Shume	Eucalyptus	1,515	131
Magamba	Acacia noir	849	243
Longuza	Teck	1,608.10	2,850
Kwamkoro	Maesopsis. Mtambara	647.4	400
Ukaguru	Teck	965.5	68
Mtibwa	Teck	999.5	768
Ruvu	Cassia	617	2,662
Rondo	Mvule. Teck	1,915	6,000
Matogoro		864.5	11,281
Kawetire	Eucalyptus	871.9	25,000
Kiwira	Eucalyptus	1,243.30	300
Rubare		94.6	11
Rubya		1,098.2	3,300
Ruhindi		3,209.3	7,800
Total		2,8701.6	6,2592

In addition to the above measures, three of the Eastern Africa countries namely, Ethiopia, Tanzania and Kenya have joined the Forest Carbon Partnership Facility of the World Bank for 'REDD+ Readiness' support. These countries have reached different stages of the REDD Readiness process. Already, Ethiopia is reported to have achieved a net removal of 15,063 Gg of CO_2 through afforestation and reforestation initiatives (Federal Democratic Republic of Ethiopia, 2011). In addition to REDD+, Ethiopia has already established one of the world's largest afforestation and reforestation CDM projects. According to the Climate-Resilient Green Economy of Ethiopia, the Restoring the Great Rift Valley's Lush Green Forest at Humbo CDM project was registered under the UNFCCC in December 2009. The project is aimed at restoring 2,700 ha of degraded land, replanting the Mt. Humbo forest, and reducing threats to drinking water from erosion caused by flooding and landslides (Federal Democratic Republic of Ethiopia, 2011). The project is expected to result in the sale of over 338 000 tons' worth of carbon credits by 2017, and to sequester over 880,000 tCO_2e emission over a 30-year (Federal Democratic Republic of Ethiopia, 2011). Tanzania so far has the most advanced REDD+ Programme in the region. Box 2 provides an outline of Tanzania's national REDD+ Strategy.

Box 2. Result areas of Tanzania's proposed national REDD+ Strategy

With substantial funding support from Norway and after the approval of their RPP in 2010, Tanzania produced a draft REDD+ Strategy in 2011. The strategy which is still under discussion and review at the date of this report has articulated 10 result areas, their respective strategic objectives and the relevant activities necessary to meet their respective objectives. A summary of the result areas and the strategic objectives are provided herein.

Result Area 1: REDD+ baseline scenario, monitoring, reporting and verification framework established. Examples of Strategic objectives:

- To determine a national baseline scenario and reference emission levels by December, 2011.
- To establish a national monitoring, reporting and verification system by December 2011
- To establish an integrated methodology to quantify REDD+ and other forest benefits such as biodiversity, ecotourism, and water catchment related to payment for environmental services by December, 2012.

Result Area 2: Financial mechanisms and incentive schemes established.

Result Area 3: All stakeholders are engaged in the REDD+ implementation process.

Result Area 4: All REDD+ schemes are well coordinated.

Result Area 5: All fund based financing options are well understood.

Result Area 6: Governance mechanism for REDD+ in place.

Result Area 7: Training programme and Infrastructure for REDD+ developed.

Result Area 8: Current knowledge and scientific understanding of the target forests and adjacent communities improved through research.

Result Area 9: An effective information and knowledge communication system on REDD+ issues developed.

Result Area 10: REDD+ strategy options for addressing drivers of D&D developed.

Focus on REDD+ and other forestry activities for mitigation in selected countries

In addition to the information on Tanzania's afforestation targets in table 2 and its REDD+ Programme summarized in Box 2 above, the East African Region also has formal REDD+ Programmes in their early stages of development. A few of those in Kenya and Ethiopia are summarized including other forest management programme with mitigating effects on climate change

REDD+ in Kenya

In Kenya activities in its proposed REDD+ Strategy suggest a bias towards mitigation, as articulated under its four candidate strategy options, which are:

- *Improved governance of the forest sector*: This elaborates subsidiary legislation, capacity building, supporting community-private sector partnerships in mitigation programmes and technology adoption, capacity building of CFAs, enforcing and incentivizing adherence to management plans, and strengthening the National Environmental Tribunal as well as civil society.
- *Reducing pressure to clear forests for agriculture*: This entails improving capacity for local authorities and community forestry associations (CFAs) and incentive based benefit sharing and joint management schemes, in addition to alternative income generating activities, among which non-wood forest products are targeted.
- *Promoting sustainable utilization of forests*: The main components of this strategy option are to develop and promulgate subsidiary legislation or regulations to effectively support the implementation of the 2005 Forest Act, promote fuel efficient charcoal making and use, fuelwood plantations, agroforestry and improved management of woodlands.
- *Promoting enhancements of carbon stocks*: This will be achieved through concerted advocacy and awareness, increased tree planting, enhanced farm forestry extension, incentivizing private sector investments in commercial tree planting in partnership with communities, promoting sustainable forest management, protection to enable forest regrowth, supporting the official target of forest cover to increase to 10% of total land cover.

REDD+ and other forestry programmes in Ethiopia

Ethiopia's REDD+ Readiness Preparation Proposal (RPP) encompasses past experiences in forestry which have been aimed at reducing deforestation and improving management thereof. This will include a wide range of different REDD+ activities, including Pilot projects,

Afforestation / Reforestation, Participatory Forest Management, restoration and conservation approaches. The better management of previous plantations, and support for bamboo growth and use and intensified agroforestry, will also be pursued. In addition existing forestry programmes, which are relevant to mitigation, are described herein.

Plantation forestry: Plantation forests-by 2003 covered about 230,000 ha and were dominated by exotic species - *Eucalyptus* and *Cupressus lustanica* - and their management to meet industrial needs, is seen as an important strategy for reduced pressure on indigenous forests, as is the promotion of bamboo, which is also a recognized carbon crop.

Agroforestry: This is already being promoted and will also be promoted within a REDD+ programme, to provide a number of products such as bamboo poles, shade trees for coffee, bee-keeping and livestock fodder.

'Area Enclosures': Such closures are normally in deforested or degraded areas protected specifically to enable natural forest regeneration and is an approach which Ethiopia has adopted and has been promoting. These area enclosures cover a wide range of land in Ethiopia in vulnerable environmental areas and, for instance, they cover eight percent or 400,629 ha of land in the Tigray region (Lemenih and Woldemarian, 2010) and in northern Ethiopia, area closures and cutting and carrying fodder are usually integrated. It has been claimed that the resulting increase in animal dropping by the homestead is used for making compost as soil conditioner and improvements in agricultural production, and this makes the area closure attractive.

Protected areas of natural forest, National Parks: These cover state-owned Forest Priority Areas, National Parks, Game Reserves, Sanctuaries and Controlled Hunting Areas. Of these, areas that are designated as National Forest Priority Areas cover 2.8 million ha of natural forest, and have as principal objective to protect and conserve biodiversity. However, their boundaries are routinely breached and a number are heavily degraded, hence a new dual strategy is to have multiple use with buffer zones and core protection areas. The buffer zones would be created in areas where forest dependent people are established, and they would focus on conversion to Participatory Forest Management programmes with formalized local control, sustainable forest management, and benefit sharing between government and communities. Protection efforts would then be concentrated on core biodiversity rich areas such as Forest Reserves, National Parks, Reserves and Controlled Hunting Areas.

CDM project areas related to plantations/reforestations (Federal Democratic Republic of Ethiopia, 2011): Ethiopia has one project registered under the Clean Development Mechanism (CDM) and this is located in the Humbo area (UNFCCC registration Dec 2009, area, 2 728 ha); and three other potential projects in the Abote, Ada Berga, and Sodo

areas. An additional afforestation / reforestation based CDM project, covering an area of 20,000 ha, which has been earmarked in the Amhara Regional State, is under discussion.

Participatory forest management: This involves the devolution of forest management through participatory forest management (PFM) and by 2008 a total of 140,857 ha, covering 0.2 % of forests and woodlands, was under such management. In general, these programmes have potential in addressing deforestation and degradation, provided that the issue of leakage is addressed.

Other strategies include REDD+ Pilots, a National Bio-Fuel Programme, Rural Electrification and fuel efficient stoves.

Agriculture sector

The agricultural sector is also identified as a source of significant quantities of GHG emissions. In Ethiopia, the agricultural sector was the largest emitter of GHGs in 1994, accounting for up to 80% of the total greenhouse gas emissions (Federal Democratic Republic of Ethiopia, 2001). Under business-as-usual, the sector is expected to contribute 45% of total emissions from Ethiopia (Federal Democratic Republic of Ethiopia, 2011). In Rwanda, agriculture accounted for 78% of emissions from all sectors excluding land use and forestry. In Eritrea, CH_4 emissions from enteric fermentation of livestock and manure management stood at 65Gg in 1994 (The State of Eritrea, 2001). In the Sudan, GHG emission in the agricultural sector is mainly through methane (CH_4), estimated at 1,713 Gg for the year 1995, 95% of which emanated from livestock enteric fermentation (Republic of the Sudan, 2003). In Burundi, some 26,830 Gg of CO_2e emissions come from the agricultural sector, with 97% of these emissions coming from agricultural soils. Methane emissions from enteric fermentation, rice cultivation and manure management amounts to some 535.56 Gg of CO_2e (Republic of Burundi, 2011).

Countries have outlined a number of measures to reduce emissions from the agricultural sector. Tanzania has proposed reduction of methane and carbon emissions through better practices in fertilizer application, rice cultivation, and soil management to reduce organic carbon loss from cultivated land. In the livestock sector, the country has advanced better husbandry, including better breeding and feeding practices as key emission reduction strategies. In Burundi, composition and utilization of cattle feed and intensification of improved animal husbandry practices have been identified as possible mitigation options. These are expected to reduce emissions in these areas by 75% and 36.6% respectively, while improved management and composting of manure is expected to reduce methane emissions by 1.05 % (Republic of Burundi, 2011). Burundi also expects that improved management of liquid manure through adoption of biogas technology will reduce methane emissions by 80%. In Ethiopia, higher livestock productivity through improved feeding

systems is expected to reduce emissions by 45 Mt CO_2e a year by 2030 (Federal Democratic Republic of Ethiopia, 2011).

Waste sector

Across the region, increased population coupled with increased industrial activity and changes in consumption patterns has resulted in increased generation of industrial, municipal, agricultural and household wastes. In Eritrea, the amount of municipal solid waste generated has been increasing, resulting in increasing emissions of GHGs (Figure 5, Table 3). In Kenya, increased socio-economic activities have, since the 1960s, increased the volume and complexity of wastes, with organic waste constituting the largest proportion. According to Kenya's First National Communication to the UNFCCC, the City of Nairobi alone generated 1,000 tons of municipal waste every day (Republic of Kenya, 2002). Organic wastes are a major source of GHG gas emissions. Emission from sewage forms the highest source of emissions, amounting to 207.94 Gg CO_2e, representing 93.87% of its total emissions of methane. In Ethiopia, GHG emissions from solid waste disposal on dump sites in Addis Ababa City and other urban centers and wastewater handling (both domestic and industrial) are the main sources of methane from the Waste sector. It is therefore no surprise that virtually all the countries of the region have identified wastes as a source of emissions.

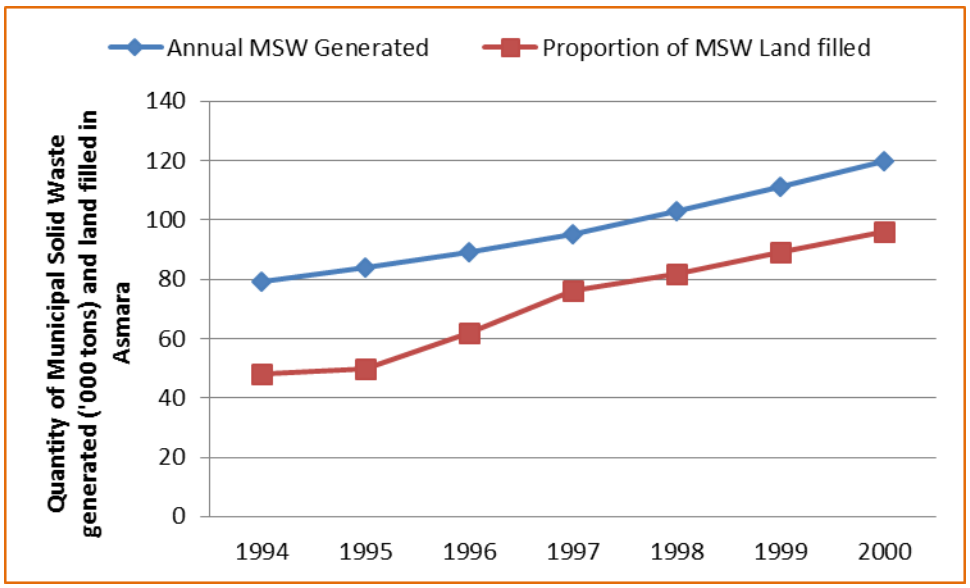

Figure 5. Annual Municipal Solid Waste (MSW) generated and land filled in Asmara, Eritrea (Data source: The State of Eritrea, 2002)

Table 3: Annual Municipal Solid Waste (MSW) generated, amount of land-filled ("000 tons), and CH_4 emissions from the Asmara, Eritrea, between 1994 and 2000 (Source: Adapted from State of Eritrea, 2002)

	1994	1995	1996	1997	1998	1999	2000
Annual MSW Generated	79	84	89	95	103	111	120
Amount of MSW Land filled	48	50	62	76	82	89	96
% of MSW Land filled	61	60	70	80	80	80	80
Total CH_4 Emission (Gg) from Annual MSW Generated	3.7	3.9	4.8	5.9	6.3	6.8	7.4
Amount of CH_4 Emission (Gg) from land-filled MSW	2.6	2.7	3.3	4.1	4.4	4.8	5.2

In order to reduce emissions from waste, the Eastern Africa countries have identified technological options such as composting of organic and or agricultural wastes, improved public waste disposal, waste re-use and recycling, and making of charcoal briquettes from organic waste. With these measures in place, Kenya, for instance, expects to achieve a slight reduction in GHG emissions. In Ethiopia, baseline methane emissions from solid waste disposal and waste water handling for the year 2010 were estimated at 12.73 Gg. Promotion of composting of solid waste in Ethiopia is expected to reduce methane emissions from solid wastes to 3.82Gg (Federal Republic of Ethiopia, 2002). Composting is particularly considered the most promising and reliable solid waste treatment measure for Addis Ababa City because 68% the waste is organic (Federal Democratic Republic of Ethiopia, 2002). Pre-treatment of municipal wastes before disposal and use of wastes such as polythene to generate energy have also been proposed. Similar strategies have been proposed by other Eastern Africa countries. Table 4 below provides a summary of the mitigation options that have been identified by the countries of East Africa to reduce emission from a variety of sectors.

Table 4. Summary of proposed climate change mitigation strategies by sector and country

Mitigation options by sector	Country						
	Burundi	Eritrea	Ethiopia	Kenya	Rwanda	Tanzania	Ouganda
Energy							
Advanced electricity generation technologies		√	√	√	√	√	√
Energy efficiency improvement		√	√	√	√	√	
Improved charcoal technologies	√	√	√	√	√	√	
Efficient biomass burning technologies	√	√	√	√	√	√	
Promotion of renewable energy technologies	√	√	√	√	√	√	√
Fuel switching e.g. from firewood to LPG, etc		√	√	√	√	√	√
Blending of gasoline with biodiesel			√	√		√	√
Expansion of hydropower		√	√	√	√	√	√
Regulations and standards and policy and economic incentives			√	√	√	√	
Transports							
Encouragement of mass transport		√		√	√	√	√
Tuning of vehicles				√			
Improved telecommunication to reduce commuting by vehicles				√		√	
Improved traffic management		√		√	√	√	√

Promotion of non-motorized transport		√	√	√	√	√	√
Inclusion of fuel-efficiency in driving school curricula				√		√	
Improved parking in major urban centers			√	√		√	√
Setting environmental standards for transit vehicles				√	√	√	√
Compulsory inspection for all vehicles, ban old and outdated vehicles		√	√	√	√	√	√
Agriculture							
Promotion of organic farming to reduce use of fertilizers	√		√	√		√	√
Discourage savanna and bush/ trash burning	√		√	√		√	√
Efficient use of animal waste e.g. use manure to make biogas	√		√	√	√	√	√
Industry							
Fuel switching				√	√	√	
Modification of industrial processes				√	√	√	
Energy efficiency / energy efficient technologies	√			√	√	√	
Co-generation and use of bio-ethanol (Mumias, Agro-Chemical)				√		√	
Waste							
Waste re-use and recycling	√		√	√		√	

Public awareness campaigns				√			
Composting of organic waste	√		√	√		√	
Treatment of municipal waste				√			
LULUCF							
Afforestation and reforestation	√	√		√	√	√	√
Forest protection		√		√	√	√	√
Establishment of forest reserve						√	

PROPOSED NAPAS

The Inter-governmental Panel on Climate Change (IPCC) in 1996 identified the sectors that are most vulnerable to climate change as agriculture, water resources, health, land use and forestry and coastal resources. The Eastern African countries have not only examined the vulnerability of these sectors to climate change but have also estimated the possible impacts of expected climatic changes on these sectors and their implications for food security and general national development objectives. As directed by the UNFCCC, the countries have also identified and proposed measures to reduce vulnerability of these sectors to climate change and possible adaptation strategies as outlined below.

Agriculture sector

Agriculture remains a key pillar of the economies of Eastern Africa countries. However, the sector is being threatened by the changing climatic conditions. A rise in mean annual temperature accompanied by an increase in potential evapotranspiration has been projected over the region. In Rwanda, annual average temperature increase of up to 3.3^{o}C has been projected while models show that annual evapotranspiration will reach 1 351 mm by 2020, 1 432 mm by 2050 and 1 682mm by 2100 (Republic of Rwanda, sine datum). In Kenya, General Circulation Models (GCM) predict an increase in temperature of between 0.5^{o}C and 3^{o}C with a doubling of its emissions of carbon dioxide (Republic of Kenya, 2002). While GCM-based models for future rainfall scenarios over Kenya for 2030 show that the region extending from L. Victoria to the central highlands east of Rift Valley will experience an increase in rainfall of up to 20%, the remainder of the country will experience reduced rainfall (Republic of Kenya, 2002). In Tanzania, GCM models predict a rise in mean annual temperature of between 2 ^{0}C and 4 ^{0}C. The models also indicate that areas with a bimodal rainfall pattern will experience an increase in rainfall of between 5% and 45% while areas with unimodal rainfall will experience a 5 – 15% reduction in rainfall. Similar trends are predicted for the other East African countries.

In spite of the projected increase in rainfall in some parts of the region, these climatic changes will have profound adverse impacts on agriculture and natural resources upon which over 70% of the Eastern Africa population depends. In Rwanda, the changes are expected to result in the displacement of growing seasons A (September-November) and B (March-May), which will perturb sowing dates, lower yields, intensify crop diseases, and reduce irrigation water (Republic of Rwanda, sine datum). According to the Rwanda 1st National Communication to the UNFCCC, changes in distribution of rainfall and high evapotranspiration especially during the vegetative period will also limit the availability of suitable bio-climatic conditions for several important tree species and thereby result in a shift in species climate envelops.

Additionally, climate change has aggravated the occurrence and frequency of extreme weather events such as drought and flooding which have resulted in destruction of agricultural and livestock infrastructure. In Kenya, climate change has resulted in increased frequency and severity of El-Nino events. The 1999 El Nino rainfall, for instance, resulted in death of livestock due to increased incidences of such diseases as east coast fever, pneumonia in calves and lambs, foot rot and Contagious Bovine Pleura-pneumonia among others (Republic of Kenya, 2002). Other adverse impacts included destruction of livestock watering infrastructure such as dams, pans, water troughs and of livestock marketing infrastructure especially holding grounds and road networks.

Cognizant of the current and potential impacts of these climatic changes on the agricultural sector, many of the countries have put in place a range of measures to enhance the resilience of the sector. Introduction and development of drought, disease and pest resistant, early maturing and high-yielding crop varieties has been proposed and is being implemented by many countries of the region including Ethiopia, Kenya, Tanzania and Rwanda. The improved varieties of such crops as maize, sorghum and millet have already seen the countries realize improved yield in the face of reduced and erratic rainfall. In Kitui, Mutomo and Mwingi districts of Kenya, the use of improved crop varieties coupled with use of weather forecasts and agro-advisories have seen yields increase from 1-3 bags to over 6 bags per acre. In Tanzania, the adoption of improved variety of maize has increased yields from 2-3 bags/ acre to 20-40 bags/ acre. Livestock keepers have not been left behind as there has also been improvement in livestock breeds. Cross breeds of local and exotic livestock are common across the region and these have been adopted by many farmers. In a study examining adoption of improved livestock breeds and modern livestock management practices in Amhara, Ethiopia, for instance, Benin et al.(sine datum) found that 26% of people in 98 villages had adopted improved livestock breeds since 1991. However, adoption of improved livestock varieties by nomadic pastoralists across the region remains low.

Development of improved simple irrigation technologies including simple technologies for rain-water harvesting and water conservation technologies have been proposed by virtually all the countries of the region. Rwanda, for instance, plans to develop 156 ponds and 22 underground water storages to provide water for smallholder irrigation (Republic of Rwanda, sine datum). The country also plans to develop 45 360 ha of hillside land for irrigation by 2020. Rwanda also plans to reclaim 60 650 ha of marsh land for production of rice and other crops. Kenya's Ministry of Water and the National Irrigation Board have commissioned the construction of several dams across the country some of which have been completed. In Ethiopia, Kenya and Tanzania, simple water harvesting, such as rainwater diversion systems and 'Zai Pits', have been used to channel and concentrate rainwater on crop roots, resulting in improved yield. In Afar, Ethiopia, the development of a simple irrigation technology – Simple Gravity Diversion – implemented jointly by the Support for Sustainable

Development, herders, water users' association and donors resulted in diversified livelihoods (livestock and crop production), improved yields of maize and sorghum to 30-33 quintals per hectare, and led to development of about 50 000 different forest plantations. Fodder production also increased, resulting in increased availability of milk in the area. As a result, about 400 pastoralist households have permanently settled (see Ochieng and Carter, 2012).

Encouraging use of both low-emission organic fertilizers and farm yard manure including liming has also been advanced as a possible adaptation measure. Indeed, countries such as Kenya and Tanzania plans to provide economic incentives such as subsidies on improved planting materials, organic fertilizers and other farm inputs to enable farmers improve the fertility of their lands which is currently threatened with high erosion and leaching of nutrients. Kenya has recently waived / reduced import duty on fertilizers to make it more affordable to farmers and especially the smallholder farmers. Countries have also proposed to promote agroforestry and tree planting to provide nutrients and to act as windbreaks and thereby curb destruction of agricultural infrastructure.

Improved access to financial (micro-credit) and insurance services by framers and pastoralists has also been advanced. In Kenya, the International Livestock Research Institute (ILRI) has, for instance, partnered with UAP Insurance Company to provide Index-Based Livestock insurance to over 2 000 pastoralists in Northern Kenya. In Ethiopia, the government has partnered with a private banking company to extend Index-Based Livestock and Crop Insurance to hundreds of farmers (see Ochieng and Carter, 2011, Box 3). Tanzania, too has proposed to provide credit facilities to farmers and to strengthen farmer cooperatives to enable them access farm inputs and market their produce more efficiently and cost-effectively and reduce perennial post-harvest losses.

In the livestock sub-sector, improved husbandry practices and adoption of improved livestock varieties has been proposed. Kenya, for instance, plans to introduce zero-grazing technologies and to set aside resources for purchase of pastoralists' livestock just before the on-set of drought, floods and other extreme climate events. Tanzania has, on the other hand, proposed to introduce better husbandry practices and to optimize livestock production. The same practices have being proposed and are being implemented in other Eastern Africa countries especially Ethiopia which has made considerable progress in implementing adaptation strategies in the livestock sub-sector.

Box 3. Weather-Based Livestock and Crop Insurance in Ethiopia and Kenya (Source: Ochieng and Carter, 2012)

Recently, crop and livestock insurance has emerged as a strategy to help farmers and pastoralists cope with and adapt to increased drought and other stresses. In Kenya, the International Livestock Research Institute in collaboration with Cornell University, the BASIL I4 project of the University of California – Davis, the Syracuse University and the Ministry of Development of Northern Kenya has developed an Index-Based Livestock Insurance (IBLI) scheme. This scheme is now being implemented by Equity Bank, UAP Insurance and Swiss-Re as IBLI product to protect herder communities from drought-related losses in the arid and semi-arid lands of Kenya. By end of 2010, some 2000 households were benefiting from the scheme, with the value of livestock protected standing at USD 1 million. The value of premiums attracted stood at USD 77000.

In Tigray Province, Ethiopia, crop insurance has been developed to protect farmers from a range of weather and socio-economic stresses. The Nyala Insurance S.C – an insurance company – developed the Multiple-Peril Crop Insurance (MPCI) and the Index-Based Weather Insurance. The MPCI is a double-trigger scheme that insures farmers against a number of risks including inadequate and excessive rainfall, fire and transit risks. The Index-Based Weather Insurance (IBWI) on the other hand, insures farmers from only drought risk. In 2008 and 2009, some 947 pilot farmers belonging to Lume-Adama and Yerer Farmers' Cooperative Unions were insured for teff, wheat, lentil, haricot bean and chicken peas under MPCI contracts. The Index-Based Weather Insurance developed in collaboration with the World Food Programme covered 137 haricot farmers belonging to the Lume-Adama Farmers' Cooperative Union and 200 teff farmers in Kola Tenben woreda (Meherette, 2009) with the support of Oxfam America. While the social and economic impacts of these schemes have not been quantified, they hold great potential for protecting farmers against various stresses.

The Eastern Africa countries have also proposed to introduce and enhance disaster risk reduction and early warning systems to inform and advise farmers and pastoralists, and to introduce flood control measures. In Kenya, Ethiopia, Sudan and Tanzania, the use of weather forecasts and agro-advisories has enabled farmers adopt more resilient farming practices such as conservation farming and use of more suitable (improved) crop varieties, and realize improved yields (Mahoo et al., 2011). In Kitui, Mwingi and Mutomo districts (Kenya), for example, the Kenya Meteorological Department in collaboration with the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), the Kenya Agricultural Research Institute (KARI) and the local agricultural office generate seasonal weather forecasts in the form of a bulletin before the start of the rainy season. In addition to providing weather forecasts, the bulletin also advices farmers on which crops / varieties to plant, the tillage method to employ and the kinds of inputs to apply. The bulletins are disseminated to farmers through a variety of media including at open market places, radio and at local agricultural trade shows and fairs (ICRISAT, KARI et al., 2010). In Tanzania and many other areas, the use of mobile phones to disseminate weather information has also gained momentum. Farmers in Kitui reported that the use of forecasts and agro-advisories has enabled maize yields to improve from 2-3 bags/ acre to 6-8 bags/ acre (Kituyi

and Ochieng, 2011). These forecasts can also be used by other government departments (e.g. health, energy, water, etc.) to prepare and plan for any expected hazards and reduce the risk to vulnerable communities.

Rwanda too has proposed to establish an information system for hydro-agro-meteorological warning to allow for timely intervention. Through the Crop Intensification Programme, Rwanda intended to cultivate 150 000 ha during the growing season B by 2010. In the fish sector, Rwanda plans to protect aquatic areas and wetlands by prohibiting farmers from cultivating 50 m from lake shores and within 10 m from the banks of rivers to avoid sedimentation.

Water resources sector

The Eastern Africa region, especially the Greater Horn of Africa will experience increased evapotranspiration caused by increased warming of the atmosphere. The net effect of higher rates of evapo-transpiration, on water resources could mean that the region could become water-scarce, stemming from increased demand, despite indications that precipitation may increase (Hulme et all 2001). Indications that the region will witness reduced water supply are already being manifested in a number of countries. In Tanzania, climate change is projected to impact negatively on the three rivers with the most economic importance namely, R. Pangani, R. Ruvu and R. Rufiji. A 1.8-3.6oC increase in temperature in the catchment of River Pangani accompanied by variation in rainfall will reduce the annual flow of the river by between 6% and 9%, while a 2.1-4.3oC increase in temperature around R. Ruvu coupled with decreased rainfall in the coastal areas will reduce the river's annual runoff by 10%. These rivers supply water and hydro-electricity to major towns and thus a reduction in their flow will adversely affect socio-economic activities in Tanzania.

While Kenya had enough water to meet its development and domestic needs in the 1990s (National Water Master Plan, 1992; cited in Republic of Kenya, 2002), the country has realized reduced supply of water mainly due to poor distribution and unreliability of rainfall over most of the country. Kenya’s 1st National communication to the UNFCCC shows that while water resources in the Kenya are currently considered stressed, they are projected to be scarce by 2030 (Republic of Kenya, 2002). In Rwanda, the prolonged drought of 2004/2005 coupled with excessive drainage of the Rugezi marshland that feeds Burera and Ruhondo lakes contributed to the reduction in electricity generation from Ntaruka and Mukungwa power plants (Republic of Rwanda, sine datum). Electricity generation reduced from 12 MW to 3 MW for Ntaruka power plant while that of Mukungwa power plant reduced from 11 MW to 2 MW (Ibid). In Ethiopia, flow models applied on the Awash River Basin suggest that flow volumes could be reduced by 34% and 26% respectively (Federal Democratic Republic of Ethiopia, 2001). This trend of reducing river flows is witnessed in all the other countries of the region.

A number of adaptation measures have been proposed for the water sector. Uganda has advanced recycling of waste water, reduction in water demand through efficient use, minimization of water leakages and waste and promotion of water harvesting and storage at all levels as possible strategies. Tanzania plans to invest in new water-saving technologies and to change user practices. 'Demand-side' adaptation measures proposed by Kenya include changing demand for water, protecting water resources against risks and institutional options. These will include managing water demand through encouraging water-efficient irrigation and water pricing (Republic of Kenya, 2002). Additionally, Kenya proposes to introduce cheaper technologies for desalination of sea water for use in ships, hotels, etc.

Uganda, Kenya and Tanzania have also proposed harvesting of rain water and runoffs especially during the wet season and storage of the same for use during the dry season. Kenya, in particular, plans to introduce low-cost rainwater harvesting technologies. Uganda has proposed to improve use of ground water through increasing the number of boreholes in areas where ground water resources exist and water is safe (Republic of Uganda, sine datum). Kenya too plans to enhance protection and use of groundwater resources. Promotion of cheaper borehole-sinking technologies is top on Kenya's strategy to encourage use of ground water resources. Thus, the country has also proposed to provide subsidies for community effort to sink boreholes. In Tanzania, rainwater harvesting and groundwater development are already being implemented to supplement water supplies from rivers. Plans are underway to construct two reservoirs in the Ruvu basin. Additionally, Tanzania has advanced the development of ground water wells and provision of inter-basin water transfers especially water transfer from Rufiji Basin to Ruvu Basin (United Republic of Tanzania, 2003).

Countries have also proposed protection of wetlands and catchment as possible adaption strategies in the water sector. Uganda plans to maintain optimal level of forestry cover within the catchment areas (Republic of Uganda, 2002). As outlined in the Tanzania 1st National Communication to the UNFCCC, Tanzania, too, plans to implement water conservation measures in all catchment areas (United Republic of Tanzania, 2003). Kenya plans to construct and maintain water storage structures including development of new dam sites and also to limit settlement in potential dam sites and other catchment areas (Republic of Kenya, 2002). The country also plans to increase protection against drought and flood hazard through maintenance of water infrastructure, effective flood and drought disaster management and limiting sand harvesting in river channels. In Ethiopia, adaptation options proposed for the Awash and Bay water basins control of pollution and conservation of water and use of river basin planning and coordination (Federal Democratic Republic of Ethiopia, 2001).

'Supply-side' adaptation options include changing structures, operational rules and institutional arrangements. Specifically, these measures include increasing flood defence,

building weirs and locks to manage water levels for navigation and modifying and or extending infrastructure to collect and distribute water to consumers (Republic of Kenya, 2002). In Uganda, while up to 15% of the total land area is covered by water, the distribution of water resources is not even. Thus, large parts of Uganda especially the North East is semi-arid and experience severe water shortages especially during drought (Republic of Uganda, 2002). Noting that increased runoff occasioned with increased rains will lead to erosion, sedimentation and contamination of water resources, Uganda has proposed to improve sanitation, ensure strict waste management and soil conservation. Kenya plans to build the capacity of water management institutions to consider not only demand and supply side interventions but also anticipatory and climate change adaption measures.

Forest and Land use sector

While forests have traditionally played critical ecological roles of protecting watersheds and fragile soils, maintaining biodiversity, environmental amelioration in addition to the supply of economic products, they nonetheless remain vulnerable to the vagaries of climate change. In commercial forestry for example, climate change could cause economic losses brought about by several factors such as increased moisture stress, pest attacks, increased disease virulence and changes in the productive geographical range of particular tree species, among many others. In practical terms, therefore, production forestry has reason to take climate change adaptation seriously. From another perspective, forest ecosystems, particularly natural ones with a diversity of species distributed over large ecosystems can be, in theory, expected to express ecological resilience and provide refuge to other plant and animal species that will be forced into dispersal from adverse climatic conditions. Forest ecosystems by their nature will play critical roles in adaptation, as much as we also recognize their vulnerability to climate change. This provides a powerful reason for the retention and sustainable management of large forest ecosystems.

In Ethiopia, the predicted 2.4-3oC increase in temperature and 5% decline in rainfall is expected to have adverse impacts on forests, including causing changes of forests from one type to another, shifts of forests from old to new habitats, reduction in forest coverage, fragmentation of forest life zones and disappearance of montane, lower montane wet forest and subtropical desert scrub (Negash, 2000; cited in Federal Democratic Republic of Ethiopia, 2001). In Rwanda, changes in rainfall distribution and increased evapotranspiration will limit the existence of bioclimatic conditions of three important tree species in the lower zones (Republic of Rwanda, sine datum). Climate change projections in Rwanda show that Pines will disappear in the highlands by 2100 (ibid).

A number of adaptation strategies for the forest sector have been proposed by countries. To reduce pressure on forests for fuel wood extraction, Eritrea plans to reduce wood energy demand by encouraging greater efficiency of wood energy conversion and utilization, and or

substitution of wood fuels by alternative energy sources. Increasing the efficiency of traditional open stoves from 10 to 15% is an essential part of this strategy. Development of institutional and household woodlots to provide for energy has been proposed by Ethiopia, Eritrea, Kenya and many other countries of the region. In Kenya, a school woodlot project has resulted in the planting of some 650 000 trees covering about 34.4 ha of forests which had by 2010 sequestered 12 000 tCO_2e (RETAP Evaluation Report).

Restoration, protection and rehabilitation of forests, using species of known or expected tolerance to prevailing environmental conditions, has also been identified as possible adaptation measures. Eritrea plans to introduce comprehensive rehabilitation and protection plans for the Mount Bizen and Semienawi Bahri forests. Kenya has launched a programme to reforest and restore the four major forest blocks namely the Mau, Mt. Kenya, the Aberdares and the Mt. Elgon. Already, over 20 000 ha of the Mau forest has been replanted. Ethiopia and Burundi have also identified restoration and protection of forests as viable adaptation strategies for the forest sector. Eritrea has, additionally, proposed to delineate and enclose certain forest areas within the Green Belt for the conservation of forest genetic resources and to encouraging natural regeneration. Ethiopia has proposed forest conservation including maintenance and preservation of untouched forest lands while Burundi has proposed conservation and preservation of forest resources. To reduce pressure on forests resulting from grazing, Eritrea plans to encourage farmers to maintain smaller herds that can be maintained by the carrying capacity of forest land pastures.

Health sector

The health sector has been identified in many countries as one of the sectors most vulnerable to climate change. Changes in climatic conditions are anticipated to result in increased incidences of vector- and water-borne diseases such as malaria, dengue and cholera. According the IPCC experts (IPCC 2007), the projected rise in temperature over the East Africa region will be accompanied by increases in malaria incidences. In Rwanda, malaria is the second leading cause of mortality. In 2007, malaria was responsible for about 23% of all deaths registered in Rwanda (Republic of Rwanda, sine datum). In Ethiopia, major malaria epidemics have occurred every 5-8 years since 1958 (Federal Democratic Republic of Ethiopia, 2001). In Kenya, the 1997/ 1998 El Nino rains resulted in increased incidence of the two most common vector- and water-borne diseases – malaria and cholera – which killed 2 705 and 2 525 people respectively (Republic of Kenya, 2002).

Countries have also proposed a number of adaptation strategies for the health sector including use of impregnated mosquito nets, eradication of mosquito breeding sites, and nationwide mosquito control to reduce incidences of malaria. In Rwanda, 58% and 64% of children and pregnant women respectively were sleeping under impregnated mosquito nets by 2009 (Republic of Rwanda, sine datum). Ethiopia has proposed to expand the use of

mosquito nets while Kenya has carried out a number of campaigns to promote the use of impregnated mosquito nets, adverts of which are common during prime-time news. Similar campaigns and programmes have been proposed and are being run in other Eastern Africa countries. Other countries have also advanced use of improved latrines and development of a culture of hand washing after using the toilet in households and all institutions to reduce the spread of such communicable diseases as cholera.

Increased and strengthened disease surveillance including utilization of climate and meteorological information in the planning of control of malaria and other diseases has been identified by Ethiopia, Kenya, Tanzania and Rwanda among other Eastern Africa countries. Following the high mortality occasioned by El Nino rains of 1997/ 1998, Kenya, for instance, established a National (Disaster) Operations Centre to coordinate activities related to natural disasters including disease outbreaks occasioned by sudden weather changes (Republic of Kenya, 2002).

A summary of proposed NAPAs by the countries of East Africa is in Table 5 and covers the key sectors agriculture, health, forestry and water.

Table 5. Proposed NAPAs by sectors in Eastern Africa countries

Stratégies d'adaptation proposées par secteur	Pays						
	Burundi	Erythrée	Ethiopie	Kenya	Rwanda	Tanzanie	Ouganda
Agriculture							
Early warning	√		√	√	√	√	
Seasonal weather forecasts and agro-advisories	√		√	√	√	√	
Early maturing, high-yielding and drought resistant crop varieties	√		√	√	√	√	√
Improved soil and water conservation technologies including rain-water harvesting and improved tillage practices	√		√	√		√	√
Water Resources							
Increase water supply, including through rain water harvesting	√				√	√	
Decrease water demand					√		
Manage demand and supply	√		√		√		
Subsidies for community effort to sink boreholes					√		
Introduction of cheaper borehole-sinking technologies					√		√

Enhancement of groundwater protection					√	√	
Introduction of cheaper technologies for desalination of sea water for use in ships, hotels, etc					√		
Encouraging low-cost rainwater harvesting technologies	√				√	√	√
Building capacity of institutions to develop both demand and supply side interventions and anticipatory measures			√		√		
Changing operational rules governing water resources			√		√		
Increased protection against drought and flood hazard					√		
Investing in alternative power sources					√	√	
Forests and Land Use Sector							
Afforestation and reforestation	√		√		√	√	√
Improved forest management			√		√	√	√
Reducing deforestation			√		√	√	
Management of timber products					√	√	
Replacing oil with forest products (bio energy)					√		
Improvement of tree species to increase biomass productivity and carbon sequestration			√		√		√

Health sector							
Risk mapping and hydro-agro-meteorological warning system			√		√	√	
Post-harvest handling and storage, processing and preservation					√		
Integrated pest and disease control measures			√		√		
Off-farm jobs in areas vulnerable to climate change					√		
Use of improved latrines					√		
Culture of washing hands after using the toilet, use of nets etc			√		√		
Capacity building in health sector			√		√		

CHAPTER 3 Extent and Gaps in the Implementation of NAMAs and NAPAs

EXTENT OF THE IMPLEMENTATION OF NAMAS, NAPAS AND OTHER NATIONAL PLANS AND PROGRAMMES ON CLIMATE CHANGE

Three of the Eastern Africa countries namely Ethiopia, Kenya and Tanzania have already developed national climate change strategies and have taken steps to implement their proposed climate change mitigation and adaptation strategies. Ethiopia is now in the process of implementing its Climate-Resilient Green Economy (CRGE). Already, the country has elaborated an institutional framework for implementation of the strategy and has put in place a robust participatory plan. A ministerial committee – the Ministerial Steering Committee comprising relevant ministries and senior officials from participating institutions – has been set up (Federal Democratic Republic of Ethiopia, 2011). The country has consulted with hundreds of stakeholders throughout the country to raise awareness on the strategy and has also begun enlisting public- and private-sector support for CRGE development initiatives and the development of investment plans (ibid). Initiatives to 'kick-start' implementation of the CRGE strategy including electric power generation from renewable sources, scaling up use of improved stoves, and increasing the efficiency of the livestock sector are already underway (ibid).

In addition to the Restoring the Great Rift Valley's Lush Green Forest at Humbo CDM project, Ethiopia is also developing a CDM fuel-efficient stoves project, which is almost complete (Federal Democratic Republic of Ethiopia, 2011). Studies are also under way to devise a similar project to support the reduction of emissions from the livestock sub-sector (ibid). Moreover, Ethiopia has also made considerable progress in developing and implementing REDD+. The country has developed a national REDD+ strategy which was approved by the Participant Committee of the FCPF in March 2011. The country has already received funding and is now in the process of implementing her REDD+ strategy (Ethiopia REDD+ Readiness Progress Fact Sheet, 2012).

Kenya too has made considerable progress in implementing the National Climate Change Response Strategy (NCCRS). Already, Kenya has elaborated an institutional framework for implementing the climate change strategy, REDD+ and CDM as detailed in section 2. On mitigation, the country has already put in place and started implementing several strategies. Kenya has expanded the development of renewable energy resources, including the

launching of the Ol Karia Geothermal II and the Sondu-Murui Hydropower plant. Recently, Kenya launched another geothermal power plant in Ol Karia and in addition has also expanded rural electrification and today many shopping centers in the rural areas are connected to the grid although local communities are yet to adopt electric power, while recognizing that Kenya's Rural Electrification Authority has stepped up the rural electrification programme. Kenya is also implementing a policy that requires all commercial buildings to install solar water heaters. A number of proposed adaptation measures have also being launched. These include provision of crop-livestock insurance, subsidies for improved seed and other farm inputs and increased weather forecasts and agro-advisories and dissemination of the same to farmers just before the on-set and during the rainy season.

As already noted, Kenya has also covered considerable ground on REDD+. The country has prepared and submitted her REDD+ strategy to the Forest Carbon Partnership Facility and has received funding for implementing the proposed strategies. The country is currently in the process of developing MRV system including the baseline emissions scenario against which future emissions will be assessed. Tanzania, too, has prepared and submitted her R-PP to the FCPF, which has been approved. Tanzania is currently piloting several REDD+ projects. Currently, some 9 REDD+ pilot projects in the forest sector are being implemented mainly by NGOs and research/ training institutions (United Republic of Tanzania 2009). A National Climate Change Steering Committee and a National REDD+ Task force (NRT) have been constituted to guide development and implementation of the REDD+ strategy and REDD+ pilot projects. On adaptation, Tanzania already has a Crop Monitoring and Early Warning System and a National Disaster Preparedness Committee. The Tanzania Meteorological Agency (TMA) issues daily forecasts and a ten-day and month bulletin to government agencies and all agricultural institutions (United Republic of Tanzania, 2003). Additionally, TMA issues early warnings on drought and expected weather hazards to agriculture.

Apart from the three countries, other Eastern Africa countries are yet to develop their climate change strategies and mainstream the same in their national and sectoral development plans. However, even these countries have already made considerable progress in implementing their proposed climate change mitigation and adaptation strategies. In Eritrea, for example, several measures have already been implemented to reduce emissions from the forestry and land use and energy sectors. Over 16 000 ha of deforested land has been reforested since 1991, some 75 772 km of terraces have been built for soil and water conservation purposes since 1994, and some 200 000 ha of land had been brought under the closure system by 2001 (State of Eritrea, 2001). In the energy sector, The Eritrean Electric Authority had increased electricity generation capacity from 35 MW in 1991 to over 70 MW by the end of 1996. Eritrea also launched the Hirgigo Power Supply Project which had boosted electricity generation capacity by a further 84 MW by the

end of 2001 (Ibid). Eritrea has also made progress in implementing adaptation strategies. In the water sector, for instance, over 75 concrete and earthen dams were constructed between 1992 and 1999. Additionally, over 1 000 km long check- dams were also constructed to protect these dams from silt accumulation over the same period.

ADEQUACY OF THE PROPOSED STRATEGIES TO REALIZE THE ENVISAGED OBJECTIVES

On the face of it, the proposed strategies appear to be ambitious enough to deliver the desired benefits especially reduction in greenhouse gas emissions and enhancement of resilience of the various sectors and local communities. In Burundi, for instance, the measures proposed appear to be enough. According to the Burundi 2nd National Communication to the UNFCCC, the proposed measures are expected to result in avoidance of 253 252 Gg of CO_2 emissions (Republic of Burundi, 2010). Considering that the agriculture sector emitted some 26 830 Gg of CO_2e, and is by far the largest emitter of GHGs being responsible for 91.4% of the total national emissions, it is reasonable to conclude that successful emissions reduction in the Agriculture sector will significantly reduce national greenhouse gas emissions.

Similarly, mitigation and adaptation measures proposed by Ethiopia appear sufficient, but this is simply because the country has no emission reduction targets. Ethiopia estimates that if all the identified emission reduction measures are fully implemented, she will limit emissions to the current levels in absolute terms and reduce per capita emissions from 1.8 to 1.1 t CO_2e, while achieving middle-income status by 2025 (Federal Democratic Republic of Ethiopia 2011). On adaptation, Ethiopia has already identified those sectors of the economy most vulnerable to climate change and outlined regional adaptation plans for the agriculture, health, water and energy, buildings, and transport sectors. As an example, Ethiopia is already pursuing large-scale afforestation and reforestation and is developing additional adaptation initiatives to increase climate resilience through support for natural ecosystems and a “green cities” approach to urbanization. These, in addition to other measures will greatly enhance resilience of the agricultural, forestry, health and other sectors and that of local communities. Similar mitigation and adaptation measures are seen in all the other countries. However, the slow pace in implementation of the proposed measures coupled with the fact that some countries are yet to develop their climate change strategies and mainstream climate change adaptation and mitigation measures into national development is likely to slow progress in the entire region.

CHAPTER 4 Influence of existing policies on the implementation of proposed activities

In virtually all the countries, proposed climate change mitigation and adaptation strategies are consistent with existing policies, which helps to promote the implementation of the new strategies. This is true for both the countries that have elaborated national climate change strategies and those that have not. In Eritrea – one of the countries that has not yet put in place a national climate change strategy or its equivalent – , for instance, the Energy Policy already promotes the development of economically and environmentally sound energy production technologies and rational use, implementation of appropriate energy pricing structures, diversification of energy sources to reduce the dependence on biomass and imported fossil fuels and modernizing and expansion of power generation and distribution systems (see The State of Eritrea, 2001). These are largely in tandem with the mitigation measures identified in the energy sector and will thus promote their implementation.

In Uganda, the provisions of Uganda's Vision 2025 – the country's development blueprint – and the Plan for Modernization of Agriculture (PMA) largely mirror the adaption strategies proposed for the agricultural and forestry and land use sector. For instance, both the Vision and PMA promote and encourage adoption of irrigation, provision of agricultural extension services, compulsory retention of strategic grain reserves by farmers and the state, improving productivity of agriculture through adoption of intensive farming technologies and encouraging off-farm employment which are integral parts of the adaptation strategies identified for the agricultural sector. Similarly, within the Uganda Health Policy, a Minimum Health Package has been formulated. Critical components of this Package include malaria prevention and control and environmental health and disaster prevention (Republic of Uganda, 2001), which also form the core of adaptation strategies proposed for the health sector in Uganda. It is also worthy to note that Uganda already has a Disaster Management and Preparedness Policy which will largely help in implementing the proposed disaster risk reduction and monitoring system. What is not explicit is the use of the best available technology, sufficient skills in monitoring and forecasting and how the results are fed back into policy development and programming. Other policies that will facilitate implementation of the proposed climate change mitigation and adaptation strategies in Uganda include the Forest Policy, National Water Policy, Energy Policy, Environmental Policy, Waste Management Policy and the National Wetland Policy, just to name a few.

In spite of the rosy picture presented above, there are also some policy gaps that could impede implementation of proposed NAMAs and NAPAs. Uganda, for instance, lacks a comprehensive land use policy. Because of this, inappropriate land use practices are being undertaken which could not only contribute to greenhouse gas emissions in the long term, but could also impede implementation of the proposed mitigation and adaptation strategies. The lack of clear definition of duties and mandates of the various government agencies in charge of implementing or overseeing various facets of the proposed mitigation and adaptation strategies and poor coordination between them could hinder faster implementation. An example of this is seen in Kenya where many government institutions are involved in implementation of climate change activities.

CHAPTER 5 Stakeholder involvement in development of climate change policies and mitigation and adaptation strategies

It is not clear whether and how different groups of stakeholders were involved in the development of National Communications to the UNFCCC. From the national communications, one gets a picture that some groups of stakeholders were consulted especially in the estimation of greenhouse gas emissions. In Ethiopia, for example, the data used for estimation of greenhouse gas emissions from the different sectors were obtained from relevant government agencies, multilateral and bilateral / development agencies and private sector organizations. These included the Ethiopian Rural Energy Development and Promotion Centre, Central Statistical Authority, Ethiopian Petroleum Enterprise, Food and Agricultural Organization (FAO), Ministry of Agriculture, Addis Ababa Health Bureau and the Addis Ababa Water and Sewerage Authority (Federal Democratic Republic of Ethiopia, 2001). While in Tanzania stakeholders' workshops on climate change issues were undertaken as one way of raising public awareness and receiving stakeholders' opinion during the development of the National Communication (see United Republic of Tanzania, 2003), in virtually all the countries, it is not clear whether civil society and local communities were involved in the development of National Communications.

In general, in all the countries that have formulated national climate change strategies or its equivalent and in those that are involved in REDD+ such as Ethiopia, Tanzania and Kenya, a variety of stakeholders were involved in the development of national climate change and REDD+ strategies. These ranged from key and relevant government agencies, research institutions and academia, civil society, the private sector and local communalities. In Ethiopia, the development of the Ethiopian Climate Resilient Green Economy involved consultation with hundreds of stakeholders. These consultations were undertaken to both elicit their views and to enhance their awareness on the new strategy (Federal Democratic Republic of Ethiopia, 2011). Ethiopia also carried out an extensive stakeholder consultation during the development of its REDD+ Readiness Proposal. These consultations, according to Ethiopia's R-PP (2010) included 2 national-level workshops, 7 regional-level workshops, 1 Zonal level Workshop, 9 workshops at Woreda (district) level and 9 community consultations with forest dependent peoples in Amhara, Oromia, Southern Nations and Nationalities, Tigray, Benshangul Gumuz, Gambella and Somali regions.

In Kenya, too, a range of stakeholders were involved in the development of the National Climate Change Response Strategy (NCCRS) and the National REDD+ Readiness

Preparation Proposal. In the development of Kenya's R-PP, regional consultations were carried out in all the ten forest conservancies. Several stakeholder groups were consulted including civil society organizations, forest dependent and adjacent communities, community-based organizations, women and youth groups, indigenous peoples (in particular the ogiek), private sector organizations including saw-millers and timber loggers, charcoal associations, agro-based industries including the tea, wheat, coffee industries, small scale farmers and the Kenya Private Sector Alliance among others (Republic of Kenya, 2010). Public agencies consulted included research institutions, government ministries and local authorities. It worthy to note that one of the consultations carried in Mau Conservancy was exclusively aimed at consulting the indigenous 'Ogiek' community, while the other was aimed at consulting local stakeholders (ibid).

In Uganda, consultations for REDD+ involved a wide range of stakeholders including forest dependent communities (timber dealers, hunters, Charcoal burners, Non-timber Forest products Users (Sand miners, herbalists, Handcraft artisans, and brick makers), collaborative forest management groups, Community Executive Committees and Local community leaders. For instance, Uganda has consulted the indigenous 'Benet' community that inhabits the Mt. Elgon forest on a REDD+ issues and to solicit their views and develop a common understanding on REDD+ (IUCN Uganda Country Office, 2010).

However, while a number of stakeholders have been consulted in the development of national climate change and REDD+ strategies, it is not clear whether the views of the different stakeholders especially the local and indigenous communities were taken into account. In Ethiopia, for instance, the Technical Advisory Panel (TAP) observed that the national REDD+ consultation workshops were limited only to key government agencies and in some instance some NGOs. The TAP further observed that woreda (district) and community level consultations were held with forest dependent people, but it is not clear how their voices were heard and their views incorporated on decision making and or the final R-PP. It is also not clear whether communities were able to raise their views since the issues to be discussed in the consultations were largely decided by the concerned government agency. In Kenya, while local authorities will play a role in the management of forests on trust lands, the TAP observed that it is not clear whether and how local government was represented at national level consultative meetings.

In Kenya, furthermore, guided discussions centered mainly on understanding REDD+ and the Government's position on it, factors that contribute to deforestation and forest degradation and ways of addressing them, increasing forest cover and increased carbon stocks, the REDD+ process in Kenya and stakeholders' expected roles and responsibilities in developing the REDD+ strategy (Republic of Kenya, 2010). There is no indication of how and whether local communities have been involved in discussions. Thus, ownership of the proposed NAMAs, NAPAs and REDD+ strategies by the local and indigenous communities and other stakeholders outside government remain an open question. Kenya, just like the

other countries involved in REDD+ have put in place a Stakeholder Consultation and Participation Plan to increase the inclusiveness, transparency and accountability of decision-making processes during preparation and implementation of her REDD+ strategies. However, it is also not clear whether the Consultation and Participation plans proposed by the countries will provide a forum for local and indigenous communities and the civil society to influence the implementation of climate change and REDD+ strategies.

CHAPTER 6 Factors influencing implementation of NAMAs and NAPAs

INSTITUTIONAL CHALLENGES

Institutional capacity for implementing climate change mitigation and adaptation strategies is wanting in all the countries of Eastern Africa. This is because climate change science requires additional skills which the majority of the countries in the region have not systematically responded to. In addition policies in climate sensitive sectors such as agriculture, water and health have not created the necessary demand on practical solutions to anticipated climate change threats.

Capacity at the Institutional Level

Firstly, while most of the countries of Eastern Africa have climate observatory centers, many of these institutions lack sufficient capacity to carry out climate and weather forecasting. Kenya, for instance, has a number of public and private climate observatory centers. The Kenya Meteorological Department has a network of observatories and rain gauge stations spread across the country. These stations have since 1896 collected information on a range of meteorological parameters including rainfall, temperature, evapotranspiration, cloud cover, sunshine, humidity, etc. (Republic of Kenya, 2002), which are all vital for climate modeling and forecasting. Additionally, the Kenya Bureau of Statistics, the Department of Resource Survey and Remote Sensing and the Regional Centre for Services in Surveying Mapping and Remote Sensing carry out observational and monitoring activities which gather information on vegetation indices, species distribution and variability, settlement patterns and socio-economic issues relevant to climate change. At the University of Nairobi, the Department of Meteorology has produced good scientist and does research on climate change modeling, but it is not clear how and whether its work influences climate change policies and strategies.

However, while the Kenya Meteorological Department has been collecting climatic data since the 1980s, the numbers of climate observatory stations have reduced due to lack of adequate financial and human resources for maintenance. Across the region, there is sparse distribution of surface and air observation systems, which make makes most forecasts grossly imprecise. In Kenya, for instance, most of the weather observatory stations are concentrated in the high potential areas, yet the ASALs experience serious climatic variability and are the worst affected by climate change. In Tanzania, the Tanzania Meteorological Agency has weather monitoring stations which comprise of 24 full

meteorological stations, 8 atmospheric chemistry stations, 13 agro-meteorological stations, 110 climate stations and about 1 400 rainfall stations (United Republic of Tanzania, 2003). These are against a background of a total national land mass of 942 345 sq. km. Given the increasing variability in weather parameters in the Eastern Africa region including Tanzania, it is probably an opportune time to review the number of weather stations.

In Ethiopia, the Climate Change and Air Pollution Studies Team is mandated to carry out research on climate change and its impacts and vulnerability of different sectors. However, the Team has only three researchers (Federal Democratic Republic of Ethiopia, 2001). Whether the three researchers have the requisite technical capacity to undertake climate research including greenhouse gas emissions assessment, monitoring and projections is an open question. Since Ethiopia has no stations for greenhouse gas emissions monitoring, it is also questionable whether the Team have the necessary facilities necessary for carrying out climate research and vulnerability assessments. Like Ethiopia, Tanzania and Kenya, too, lack equipment for monitoring greenhouse gases and its impacts (United Republic of Tanzania, 2003; Republic of Kenya, 2002). Some of the equipment available in the stations is obsolete.

In addition to the above, many of the proposed institutional structures are new and many do not have the requisite capacities and experiences to implement the mandates conferred upon them. Many of them also lack the requisite equipment to carry out the proposed strategies. In Kenya, for instance, lack of appropriate waste disposal and management equipment and logistics is a major deterrent to efficient waste management, thus curtailing implementation of mitigation strategies proposed for the sector

Capacity at the individual level

The capacity of staff charged with climate and weather forecasting and monitoring, and developing MRV systems in the Eastern African region is very low. In its National Communication to the UNFCCC in 2003, Tanzania, for instance, indicated that the Tanzania Meteorological Agency had 51 Class I meteorologists, 49 Class II meteorologists, 72 Class III meteorologists, 149 Class IV meteorologists, 3 engineers, 16 engineering and instrument technicians and about 160 support staff (United Republic of Tanzania, 2003). Given the low educational qualification of these personnel, it is questionable whether they have the technical capacity to undertake climate change monitoring, forecasting and climate data collection, analysis, modeling, and dissemination. Whether these personnel can undertake vulnerability assessment and devise appropriate response strategies and develop MRV systems is also an open question. Clearly, the region lacks trained weather forecasters, climatologist, oceanographers and climate change modelers. Because of inadequate capacity for early warning and disaster preparedness, the Kenyan health officials could not respond adequately to the effects of the El Nino rains of 1997/ 1998, leading to the death of

5 330 people (Republic of Kenya, 2002). The lack of technical capacity is therefore a major hindrance to the implementation of the proposed NAMAs and NAPAs in the region.

Capacity at the Systemic level

At the systemic level, only Ethiopia, Kenya and Tanzania have formulated national climate change response strategies. While Tanzania has already mainstreamed climate change into her national and sectorial development plans, Ethiopia and Kenya are only beginning to do the same now. The rest of the countries of the region are yet to develop their national climate change response strategies – many of them are either planning, or have already started, to develop their strategies. However, virtually all the countries of the region, including those that are yet to develop their national climate change strategies have national and sectorial policies and programmes that support implementation of their proposed climate change mitigation and adaptation strategies (see above). As noted above, the duplication of mandates among institutions charged with implementing and overseeing different aspects of climate change and the poor coordination among them is likely to constrain implementation of the proposed NAMAs and NAPAs. Not dissimilarly, the lack of clear climate change policy / strategies and integration of the same in national and sectorial development plans is likely to constrain the implementation of the proposed NAMAs and NAPAs.

TECHNOLOGICAL FACTORS

In general, lack of adequate and appropriate technologies and technological knowhow is one of the factors constraining implementation of NAMAs and NAPAs. Inadequate climate forecasting and monitoring systems, lack of quality data and information, inadequate extension services, inappropriate technologies and policies and lack of economic incentives are some of the factors that have hindered adaptation in the agricultural sector. In Kenya, lack of appropriate waste disposal and management technology including modern equipment have hindered deployment of the proposed mitigation strategies. Another technological limitation has to do with technologies for weather / climate forecasting and projection, data collection, processing, storage and dissemination. The personnel of the institutions lack capacity in climate change downscaling tools and software such as APSIM. Implementation of mitigation strategies in the energy and industrial sectors is similarly constrained by lack of cutting-edge (renewable) energy production and efficiency enhancing technologies.

In general, one can also say that there is a slow rate of technological transfer and application of practical measures in climate sensitive sectors. Despite the existence of some technologies which are efficient, their transfer to countries that need them has been hindered by factors such as costs of acquisition and the control of such technologies by the

private sector in developed countries. The reluctance of developed countries to fund technology transfer to the extent that the threats of climate change would suggest, and the inadequate involvement of their private sectors in the same, are considered major drawbacks to climate change adaptation and mitigation in developing countries. As such technology transfer remains a topic of frequent debates at global negotiations on climate change.

From a practical perspective, climate sensitive sectors such as agriculture are not enjoying increased investments in climate sensitive or climate smart research and development as would be expected. For example one would have expected strong revivals in crop and animal improvement research in anticipation of the changing climates, but there is no evidence of significant increases in research funding that can be directly attributed to climate change in the forest sector.

FINANCIAL AND MATERIAL FACTORS

Across the region, implementation of proposed climate change mitigation and adaptation measures is hampered by lack of sufficient financial resources. In Kenya, for instance, high financial cost is one of the factors that have hindered adaptation in the agricultural sector. Ethiopia, like other developing countries, faces financial challenges in the implementation its climate change blue print. According to Ethiopia's Climate Resilient Green Economy initiative, capital constraints could lead to investments in conventional solutions that require a low initial expenditure but result in high inefficiencies, which makes them less sustainable than alternatives that cost more at the start but offer more economic, social, and environmental benefits in the long run. Ethiopia, estimates that if she were to pursue such a conventional economic development path – representing the business-as-usual scenario – greenhouse gas emissions would more than double to 400 Mt CO_2e by 2030 (Federal Democratic Republic of Ethiopia, 2011). This is a likely scenario in the event that Ethiopia fails to mobilize the requisite financial resources to adopt more efficient equipment and technologies.

CHAPTER 7 Discussion and recommendations

FACTORS CRITICAL TO THE ACHIEVEMENT OF ADAPTATION AND MITIGATION GOALS

Financial and material resources

This entails the mobilization of financial resources from bilateral and multilateral donor agencies, the Convention, and market-based mechanisms such as CDM, REDD+ credits (for pilots) and voluntary carbon markets. Tapping emerging forest related financial sources such as FIP, FCPC, UN REDD+, REDD+ Partnership is worthy of systematic pursuit by countries.

Countries should also set aside financial resources and provide micro-credit and economic incentives such as subsidies on fertilizers and improved seed, as is the case in countries such as Malawi, and crop and livestock insurance in Ethiopia and Kenya. The private sector should be mobilized to provide financial and insurance services to farmers since these are viable as demonstrated by Ethiopia and Kenya's experience with livestock and crop insurance.

Capacity for weather/ climate forecasting, downscaling and dissemination

Timely dissemination of quality weather data and information in the form of weather forecasts and agro-advisories, as done in some villages in Kenya, Ethiopia, Tanzania and Sudan have enabled farming communities to deploy more resilient agricultural process which have led to better yields. Strengthening and bolstering climate research and weather forecasting capacity is therefore necessary to facilitate the development of more reliable weather forecasts and effective early warnings and disaster risk preparedness systems. To achieve this, there is need for increased collaboration between farmers, agricultural officers/ researchers, extension officers and weather forecasters to enable implementation of adaptive soil/ water management practices and tillage practices.

There is also need to build capacity in the area of climate science, climate forecasting and modeling, climate change impact assessments; as is also the need to build capacity to downscale and use global models to suit local conditions. Increased linkage and

engagement with regional and international observatory systems such as ICPAC, East African Institute for Meteorological Training and Research, WMO, the Climate Information and Prediction Services could help acquire the necessary real-time data for climate and weather forecasting and learn new ways of disseminating weather forecasts.

Technology development and transfer

Improved access to appropriate technologies through south-south and north-south cooperation, linkage with national research and educational institutions, and regional and international research institutions such as ILRI, ICRISAT other CGIAR Centres are a critical factor on which more effort is needed.

Policy and institutional development and strengthening

In addition to financial resources, technical capacities for climate monitoring and forecasting and even improved access to appropriate technologies, countries require to deliberately develop climate smart policies that enable organized change in the way countries manage and add value to their natural resources. Such policies are what should guide investments and should have a long view and planning frameworks since it is that kind of long-term thinking that climate change work requires in countries and their institutions.

CURRENT AND POTENTIAL ROLE OF THE FOREST SECTOR IN CLIMATE CHANGE ADAPTATION AND MITIGATION IN EASTERN AFRICA

In Eastern Africa, forestry at the moment is primarily used as a mitigation mechanism, a conclusion supported by the number of countries that have formally joined REDD+ processes under either UN-REDD or the Forest Carbon Partnership Facility (FCPF) and also going by the number of afforestation and reforestation schemes that capture carbon among other functions.

Regardless of the future of REDD+ as a global climate change mitigation strategy, it seems that countries will increase value afforestation and reforestation as a climate change mitigation mechanism in their own countries. The beauty of that, is that it will enable the flow of other goods and services associated with forest cover, some of which can be the basis of small scale rural industries.

Along the coast of Eastern Africa the protection and enhancement of cover under mangroves could both play roles in mitigation through increased carbon storage and adaptation to rise in sea-level rise which would also provide keystone habitats to inter-tidal plant and animal communities.

Like most parts of the world the focus on forests is on their intrinsic ability for carbon sequestration and storage but much less on the need to adapt forest ecosystems themselves to climate change. However this is an area which is slowly getting recognition and will continue to do so as industrial plantations increase in this part of Africa

POTENTIAL ROLE FOR THE AFRICAN FOREST FORUM AND ITS AFFILIATES

In view of what this report has presented on nationally appropriate mitigation actions (NAMAs) and national adaptation programmes of action (NAPAs), a professional body such as the African Forest Forum could fulfill a number of roles to fill some gaps and also complement work done by countries and regions. A few of those roles are presented herein and briefly justified.

- Given its wide and growing membership in sub-Saharan Africa, the AFF, which has a strong membership from academics, practitioners and researchers, could fill a critical gap by encouraging members from the forest industry that would challenge academics and researchers into demand driven applied research.
- AFF is also well placed to prepare constructive and provocative ideas that can spur countries and regional bodies to take up the issue of technology transfer more seriously than is currently the case. A case in point is small scale manufacturing linked to SFM projects as a way of reducing rural poverty in exchange for, or alongside community supported SFM and afforestation / reforestation based programmes. Technology transfer is a critical area in which Africa is seriously under-performing and could do much better, given its endowment with wood and non-wood products.
- As it is already doing, AFF should continue to train and bring negotiators and scientists closer together prior to international climate change and forestry negotiations and discussion fora.
- Given its choice of climate change as one of its core programmes, AFF could serve its members well by preparing an annual series on the state of ‘forestry related climate change research and development breakthroughs’ in Africa. Such a series could be carried in one of the more influential publications, such as, Forests: A Journal of Forest Science (formerly Southern African Forestry Journal) and widely shared with individual countries, regional economic commissions, the United Nations Commission for Africa and other international bodies.
- The AFF can also strategically and opportunistically commission studies and issue papers that have the potential of bringing about transformative change in forest

management and value added manufacturing. These could be new research focus, new technologies, policy changes and other developments.

- Its current role of convening meetings of its members to discuss topical issues is productive and should continue and be a permanent feature in its programme portfolio.

References

Benin, S., Ehui, S. and Pender, J 2003. Policies for Livestock Development in the Ethiopian Highlands. Development and Sustainability, Vol 5: 491–510

Environmental Alert 2011. Final Report for Expanded Consultations for REDD-Plus Preparation Proposal for Uganda. Project No.: R-PP: EA/NFA 01/10

Federal Democratic Republic of Ethiopia (2001). Initial National Communication of Ethiopia to the United Nations Framework Convention on Climate Change (UNFCCC). National Meteorological Services Agency

Federal Democratic Republic of Ethiopia 2011. Ethiopia's Climate-Resilient Green Economy strategy.16 p

Federal Democratic Republic of Ethiopia 2011. Readiness Preparation Proposal (RPP): Federal Democratic Republic of Ethiopia. 127p

Federal Democratic Republic of Ethiopia 2012. Ethiopia REDD+ Readiness Progress Fact Sheet (2012). Country: Ethiopia. June, 2012

Hulme M, R. Doherty, T. Ngara, M. New and D. Litser 2001. Africa climate change: 1900-2100. Climate Research, Vol 17:145-168.

ICRISAT, KARI et al. 2010. Weather based agro-advisory for Kitui, March 2010.

IPCC 2007.Climate Change. Impacts, adaptation and vulnerability. Contribution to Working Group II to Fourth Assessment Report on the Intergovernmental Panel on Climate Change.Parry, M.L., Canziani, O.F., Palutikof, J.P; van der Linden, P.J. and Hanson, C.E. (eds). Cambridge University Press, Cambridge, UK. 976p

Kituyi E. and Ochieng, R.M. 2011. Towards climate-smart water management for African Agriculture: Lessons from CCAA supported projects. Discussion Paper, IDRC, Canada.

Lemenih, M. and Woldemariam, T. 2010. Review of Forest, Woodland and Bushland Resources in Ethiopia up to 2008. Unpublished Manuscript.

Mahoo, H. et al. 2011. Managing risk, reducing vulnerability and enhancing agricultural productivity under a changing climate (CCAA). Final Project Technical Report to IDRC

Meherette, E. 2009. Innovation in Insuring the Poor: Providing Weather Index and Indemnity Insurance in Ethiopia. International Food Policy Research Institute, Focus 17, Brief 8.

Available: http://www.ifpri.org/publication/providing-weather-index-and-indemnity-insurance-ethiopia (accessed 4/4/12).

Muller B. 2009. Mitigation actions of developing countries : NAMAs under the Bali Action Plan. In (K.H. Olse, J. Fenhann and M. Hinostroza eds) NAMAs and the Carbon Market. UNEP Riso Centre, CD4CDM. UNEP. Perspectives Series 2009, PP 23-31

Ochieng, R.M. and Carter S. (2012). Supporting African agro-pastoral systems to adapt to multiple stresses. Discussion Paper, IDRC, Kenya.

Republic of Burundi 2010. Executive Summary of the Second National Communication on TIC Climate Change**.** Ministry of Water, Environment, Land Management and Urban Planning, Bujumbura

Republic of Kenya 2002. First National Communication of Kenya to the United Nations Framework Convention on Climate Change (UNFCCC), Ministry of Environment and Natural Resources, Nairobi Kenya.

Republic of Kenya 2010. REDD Readiness Preparation Proposal for Kenya

Republic of Rwanda (sine datum). Second National Communication under the United Nations Framework Convention on Climate Change (UNFCCC). Ministry of Natural Resources, Kigali, Rwanda.

Republic of the Sudan 2003. Sudan's First National Communications under the United Nations Framework Convention on Climate Change. Volume I: Main Communications. Ministry of Environment and Physical Development. Khartoum, The Sudan

Republic of Uganda (sine datum). Initial National Communication of Ethiopia to the United Nations Framework Convention on Climate Change (UNFCCC)

Teng F 2009. Nationally appropriate mitigation actions: China’s experience and perspective. In (K.H. Olse, J. Fenhann and M. Hinostroza eds) NAMAs and the Carbon Market. UNEP Riso Centre, CD4CDM. UNEP. Perspectives Series 2009, PP 11-21

The IUCN Uganda Country Office (2010). Report on Consultations Undertaken among the Forest Dependent Communities in Mt. Elgon (Benet) on REDD. 26th – 29th July 2010

The State of Eritrea 2001. Eritrea’s Initial National Communication to the UNFCCC. Ministry of Land, Water and Environment, Asmara, Eritrea.

United Nations 2002. Decision 27/CP.7., FCCC/CP/2001/13/Add.4 Guidance to an entity entrusted with the operation of the financial mechanism of the Convention, for the operation of the least developed countries fund.

United Nations 2007. Bali Action Plan: Decision I/CP 13. http://unfccc.int/documentation/decisions/item/3597.php?such=jvolitex=/CP.13#beg.

United Republic of Tanzania 2003. Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), Vice Presidents Office, Dar es Saalam, Tanzania.

United Republic of Tanzania 2009 REDD Readiness Preparation Proposal (R-PP) for Tanzania, Submitted to the Forest Carbon Partnership Facility.

Zhakata W 2009. Nationally appropriate mitigation actions for developing countries: A perspective from southern Africa. In (K.H. Olse, J. Fenhann and M. Hinostroza eds) NAMAs and the Carbon Market. UNEP Riso Centre, CD4CDM. UNEP. Perspectives Series 2009, PP 33-45.

African Forest Forum

Contact us at:
African Forest Forum
P.O. Box 30677-00100 Nairobi GPO KENYA
Tel: +254 20 722 4203 Fax: +254 20 722 4001
www.afforum.org