

Chapter 2

Improving Livelihoods in Semi-arid Regions of Africa Through Reduced Vulnerability to Climate Variability and Promotion of Climate Resilience

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Abstract Climate change is expected to be one of the major threats to sustained economic growth leading to extended poverty in semi-arid regions of sub Saharan Africa (SSA). The areas of highest vulnerability are the health sector, food production, biodiversity, water resources, and rangelands. Climate change will likely create increasingly high temperatures and dry conditions across much of the globe in the next 30 years, especially along large parts of Eurasia, Africa and Australia. Many of the world's most densely populated regions will be threatened with severe drought conditions. It will likely have a profound and negative impact on livelihoods of many rural and urban communities, which could lead to changes in land use. It is estimated that the Eastern regions of Africa will experience reduced average rainfall (although some areas may experience increased average rainfall) exposing agriculture to drought stress and a rise in temperature. The situation will be worsened by the interaction of multiple stresses factors occurring at various levels, which will negatively impact agricultural productivity.

Keywords Climate change • Arid semi-arid lands • Key interventions

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Introduction

Climate change is expected to be one of the major threats to sustained economic growth that will lead to extended poverty in sub Saharan Africa (SSA). The situation is similar to other semi-arid regions of Asia. The areas of highest vulnerability are the health sector, food production, biodiversity, water resources, and rangelands. Climate change will likely create increasingly high temperatures and dry conditions across much of the globe in the next 30 years, especially along large parts of Eurasia, Africa and Australia (Cooper et al. 2013). Many of the world's most densely populated regions will be threatened with severe drought conditions. It will likely have a profound and negative impact on livelihoods of many rural and urban communities, which could lead to changes in land use. Smallholder farmers provide up to 80 % of the food in developing countries, manage the majority of the farmland, and many live in some of the most vulnerable and marginal landscapes that experience unpredictable rainfall patterns. Drylands occupy 41 % of the earth's land area and are home to 2 billion people. About 50 % of the world's livestock is supported by rangelands, and some 44 % of cultivated areas are in dry lands. However, more than 12 million hectares of arable land are lost to land degradation and desertification every year and the rate is rising as a result of climate change (van de Steeg 2012; www.unccd.int 2012). Land degradation affects 40 % of the earth's surface and damages the livelihoods of some 2 billion people living in dry lands, especially women and youth. Land degradation in dryland regions is a driver of climate change. Yet the linkages between climate change and dryland degradation have so far scarcely featured in climate change policy debate. Desertification and land degradation are reducing the capacity to sustain ecosystems and human livelihoods. Despite this, dry lands in semi-arid regions still play a major role in global agriculture production.

Agriculture directly depends on climatic factors for crop and livestock production. Agricultural practices are also indirectly affected by landscape and environmental changes brought about by climate change. It is the SSA countries whose economies heavily depend on agriculture (cultivation of crops and livestock production) and forestry that are particularly vulnerable to climate change and variability, and will bear about 80 % of the effect (Mandelson 2006). Several industries and investments in SSA are agro-based. Declining agricultural output is likely to affect value chains. Though of smaller magnitude, a reduction in agricultural GDP can affect the rate of industrialization and the overall development process of many SSA countries and constrain creation of non-farm rural and urban employment opportunities through backward and forward linkages to service and manufacturing sector activities (Hanmer and Naschold 2000; Kanwar 2000; Kogel and Furnkrantz-Prskawetz 2000).

It is projected that several ecosystems will experience a number of climate related stresses. It is estimated that especially the Eastern regions of Africa will experience reduced average rainfall (although some areas may experience increased average rainfall) exposing agriculture to drought stress and a rise in temperature

(Cooper et al. 2013). The situation will be worsened by the interaction of multiple stresses factors occurring at various levels. For example heat and drought stresses often occur simultaneously. Combined, these affects will negatively impact agricultural productivity. According to the Secretary General of the UN, Ban Ki-Moon, Continued land degradation—whether from climate change, unsustainable agriculture or poor management of water resources, is a threat to food security, leading to starvation among the most acutely affected communities and robbing the world of productive land (Pender et al. 2009).

In addition, many policy makers in governments are unaware of this long-term climatic impact, often leading to land use changes. Governments have low or no adaptive strategies or capacity to make people aware of climate change and climatic impacts in the long-term. Climate change is expected to reduce yields of major crop staples and will condemn portions of currently cultivated land into unsuitable status for cultivation across many parts of SSA. It is estimated that yields of tropical grain crops are expected to be reduced by 5–11 % by the year 2020 and by 11–46 % by 2050 (Rosenzweig and Parry 1994; Schlenker and Lobell 2010; Blanc 2012), negatively impacting on the small scale farmers who solely rely on rain-fed agriculture for their livelihood. Projected GDP losses in SSA are estimated to range between 0.2 and 2 % by 2100 (Tol 2002). National adaptation and mitigation planning is urgently needed. In addition, low agricultural productivity has increased pressure on traditional grazing lands by expanding cultivation into rangelands. This has lead to more rapid degradation of rangeland ecosystems.

If the ultimate effect of climate change and variability is not attended to, it may contribute to political instability and migration, at both intra-and regional levels. A recent survey conducted by IFPRI with the support of World Bank identified migration as one of the major adaptation strategies among the communities in semi-arid environments (World Bank 2000; IFPRI 2010). A number of regions/sub-regions across SSA have just emerged from, or are experiencing conflicts. A new wave of ecological refugees will spark a series of conflicts among communities and complicating the development agenda of several SSA countries, if there is no action to reduce the effects of climate change now (UNFCCC 2007). A good baseline study to complement earlier efforts on the possible effects of climate change in vulnerable, poor countries is therefore urgently needed, before sustainable mitigation measures can be implemented that will stabilize or stimulate economic growth in the long-term.

Adaptation and mitigation strategies are two general responses to manage effects of climate change and variability. Although adaptation represents the best coping option against agricultural output reduction and hence resulting in improved livelihood of small holder farmers; mitigation actions will contribute to global efforts of greenhouse gas emissions reduction, sequestration of carbon as practical measures for climate change recovery, taking advantage of the carbon storage capacity of tropical environment and improving ecosystem services of the natural resource (FAO 2001; World Bank 2012). The African Development Bank (AfDB) for example has developed their Climate Risk Management and Adaptation (CRMA)

strategy which outlines key priority areas of intervention in order to manage the risks posed by climate change.

The goal as stated in the strategy document is “to ensure progress towards eradication of poverty and contribute to sustainable improvement in people’s livelihoods taking into account CRMA”. Specific objectives of the CRMA are to reduce vulnerability within the Regional Member Countries (RMCs) to climate variability and promote climate resilience in past and future Bank financed development investments making them more effective. This will then be used to build capacity and knowledge within the RMCs to address the challenges of climate change and ensure sustainability through policy and regulatory reforms.”

To achieve these objectives the AfDB considered supporting three areas of intervention namely:

- I. “*Climate Proofing*” investments to ensure that development efforts are protected from negative impacts of climate change, climate variability and extreme weather events.
- II. Support the development of *Policy, Legal and Regulatory Reforms* which creates an enabling environment for the implementation of climate risk management and adaptation interventions.
- III. *Knowledge Generation and Capacity Building* for local farmers, investors, extension agents, district executives or policy makers to help mainstream climate change and manage climate risks.

Over time, some SSA countries have also developed their climate change policy plans including National Adaptation Programme Actions and National Appropriate Mitigation Actions. Investments are needed in building up assets, implement recommended promising technologies/practices (e.g. water harvesting, storage, irrigation system, introduction of drought tolerant high yielding crops, value addition) and improving risk management capacity. As acknowledged by Stern (2006), the biggest threat climate change poses to economic growth is the use of inefficient mitigation and adaptation policies and practices (Stern 2006). To improve the efficiency of these actions, it is important that they are based on accurate spatio-temporal impact diagnosis, and supported by a greater public understanding of these strategies and individual roles.

Unfortunately significant gaps of knowledge exist on the most appropriate interventions to use. Many actors (government, agencies and investors) are asking what options exists and which should be implemented to improve the livelihoods of the rural poor. The bottom-line costs and/or benefits of these interventions need to be known if they are to be planned and implemented and investments sources to support their development. Therefore, there is need to continue grappling with ideas, as well as ways and means which can contribute towards improved incomes and livelihoods in semi-arid regions of Africa through reduced vulnerability to climate variability and promotion of climate resilience in development investments, enhancing biodiversity, increasing yields and lowering greenhouse gas emissions.

Key Interventions

- I. There is need first of all to quantify vulnerability to climate change, adaptation approaches by systematic monitoring across landscapes and identify barriers to successful mainstreaming of these adaptation measures in country national plans.
- II. This needs to be followed by developing, promoting and adapting site specific mitigation/adaptation measures for various crop-livestock land use systems
- III. Thirdly, development of Policy, Legal and Regulatory frameworks in order to create an enabling environment for the implementation, promotion and scaling of climate risk management and adaptation interventions needs to be emphasized.
- IV. Sub-Saharan Africa also needs to build Capacity to mainstream climate change and manage climate risks for various land use systems.

Expected Outputs from the Interventions

- I. Vulnerability to climate change, and climate change impacts quantified and mainstreamed in country national development, management and policy plans.
- II. Site specific adaptation and mitigation measures for various crop-livestock land use systems developed and promoted in arid and semi-arid areas
- III. Policy, Legal and Regulatory frameworks developed and promoted and scaled in order to create an enabling environment for the implementation of climate risk management and adaptation interventions.
- IV. Capacity to mainstream climate change and management of climate risks for various land use systems by national scientists, agriculturalist, environmental experts and policy makers developed.

Expected Outcomes of the Interventions

- I. Implemented country development plans embrace, adopt and mainstream climate change impacts at national and regional/county levels
- II. Improved incomes and livelihoods in semi-arid regions through yield increases in crop-livestock production systems, reduced crop and livestock losses and reduced greenhouse gas emissions as a result of implemented adaptation and mitigation measures for climate change.
- III. Action plans on climate risk management and adaptation interventions implemented in project countries.
- IV. Trained national scientists, agriculturalists, environmental experts and policy makers mainstream and implement climate change and management of climate risks for various land use systems in project countries.

Expected Impact

- I. Impact on livelihood: Improved household incomes and livelihoods, improved national GDPs. The ultimate beneficiaries are resource poor farmers and other members of the rural and peri-urban poor associated with the agricultural sector. These benefits will be realized through reduced vulnerability, raised adaptive capacity and higher income.
- II. Impact on food security benefits on rural and urban populations, and
- III. Impact on environmental health and carbon storage at both local on global public goods.
- IV. Although the notion of securing win-win-win outcomes for these dimensions is appealing (Global Donor Platform 2009; FAO 2009), we have to recognize the possibility of trade-offs among these dimensions (Campbell et al. 2009; FAO 2011).

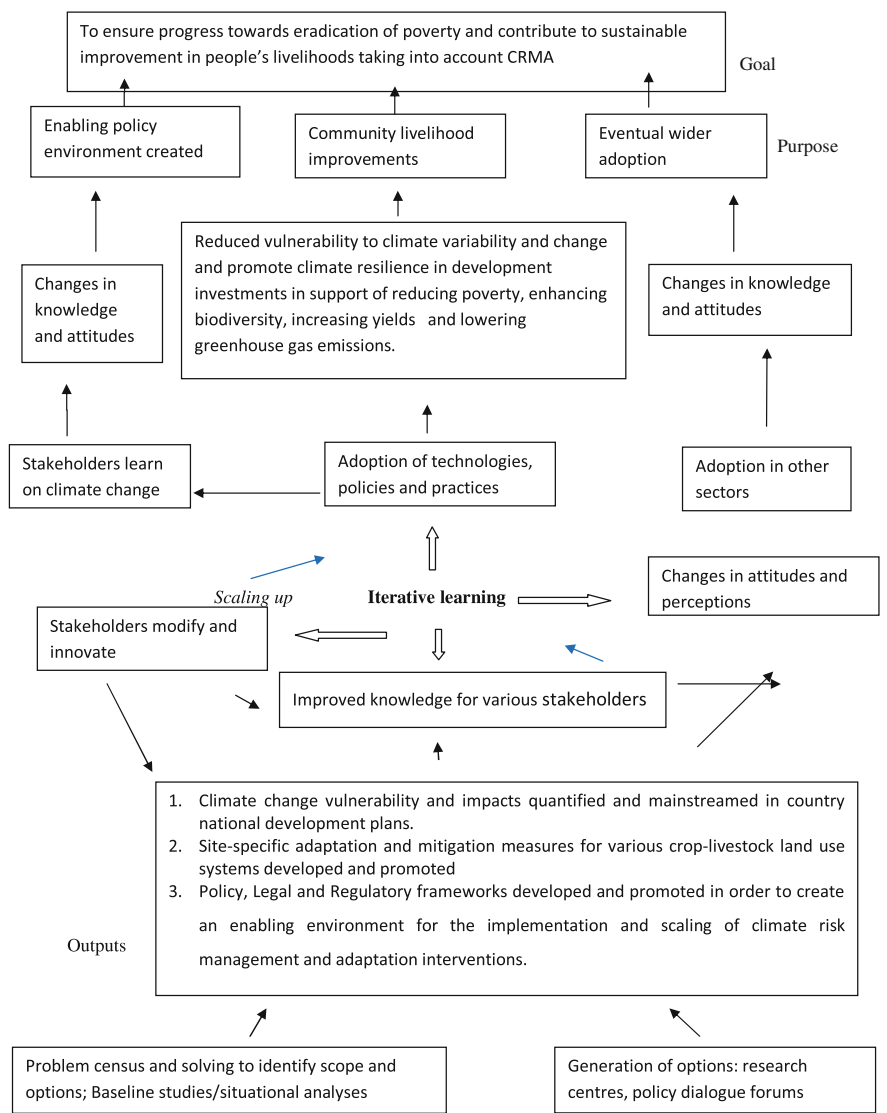
Proposed Theory of Change

Reduced vulnerability to climate variability and change and promotion of climate resilience requires development of investments in support of reducing poverty, enhancing biodiversity, increasing yields and lowering greenhouse gas emissions. This will be achieved through the following preconditions. Firstly, the projects should undertake a quantification of vulnerability to climate change, adaptation approaches and identify barriers to success mainstreaming of these adaptation measures in country national plans. This will include identifying key metrics of vulnerability in crop-livestock systems, rangelands, and agricultural systems. Secondly, the formulated projects will need to develop, promote and scale climate change adaptation and mitigation measures for various crop-livestock and land use systems in the arid and semi-arid areas. Thirdly the formulated projects will require to undertake activities that promote development of policy, legal and regulatory frameworks in order to create an enabling environment for the implementation of climate risk management and adaptation interventions. Finally the proposed projects will need to build capacity to mainstream climate change, manage climate risks for various land use systems as well as mainstream gender along selected agricultural product value chains.

Indicators for these preconditions which will be used to assess the performance of the interventions will be an inventory of vulnerable groups, adaptation approaches, and barriers to mainstreaming these approaches in sub-Saharan Africa. A wide range of climate change adaptation and mitigation measures will need to be promoted and scaled. These will include improved land use planning, improved agricultural practices that enhance soil carbon stocks, better livestock management, use of drought tolerant crops, improved irrigation and water use efficiency, and rain water harvesting. A set of policy documents will then need to be developed for the

participating countries from which action plans will be generated and implemented. Researchers, extension workers, policy makers and other relevant stakeholders will be trained and then subsequently use this knowledge and share it with other parties to achieve project overall goal. Training will include simulation modeling, greenhouse gas emission measurements, carbon stocks measurements, and participation in carbon credits market for participating countries.

Expected Impact pathway: This is explained in the diagram below.



Partnerships

Building strong partnerships will form an essential component of implementing projects using this approach. Essentially, this may be worked out as consortia with complementary partnerships in order to ensure the long-term impact of this initiative and provide the greatest opportunity for knowledge transfer. Partners will include, but are not limited to:

- I. Consultative Group of International Agricultural Research (CGIAR) Centres
- II. Non-governmental and community based organizations for rural development
- III. National agricultural research systems
- IV. Ministries responsible for National Adaptation Programmes of Action (NAPAs) and Nationally Appropriate Mitigation Actions (NAMAs)
- V. Regional clean development brokers
- VI. Climate change Units
- VII. Gender mainstreaming experts
- VIII. Private sector
- IX. Development partners

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