



## Climate Change in African Drylands: Adaptive Livelihood Options<sup>1</sup>

### Land Degradation in Drylands in Africa

Home to over 2 billion people living in some 100 countries, drylands cover more than 40% of the earth's surface.<sup>2</sup> In Africa, 43% of land is estimated to fall within the drylands, where approximately 325 million people reside, and these numbers are growing faster than the global average (UNSO 2002). While not as arid as deserts, drylands are characterized by low and erratic precipitation, high temperatures and high rates of evapo-transpiration.

In spite of their environmental sensitivity, and despite the prevailing negative perceptions of drylands in terms of economic and livelihood potentials, these ecosystems have supported human populations for centuries. Today some of the world's fastest growing urban centers are located in these regions, such as Cairo, Cape Town, and Kano. Many rural dryland dwellers make their living through the production of livestock and rain-fed/irrigated agricultural crops. Drylands also provide a habitat for a variety of plant and animal species, and wildlife-based tourism generates significant income for national economies. Furthermore, semi-arid woodlands are an important source of biomass for fuel and construction.

Inhabitants of drylands in Sub Saharan Africa (SSA) have learned, over the millennia, to cope with variable inter and intra seasonal rainfall and the risks of weather-related shocks. However, as a result of high poverty rates, changing socio-economic and political circumstances and demographic growth, traditional coping strategies are becoming insufficient in reducing people's vulnerability. In the recent past, some 25%, or 320 million hectares, of the already fragile resource base in African drylands have further been degraded, often referred to as 'desertification', by unsustainable land uses, such as over-grazing, over-cultivation, illegal and excessive fuel wood collection and poor irrigation practices,

compounded by poorly conceived policies and ineffective governance (UNEP 2006).

### Projected Climate Change Impacts on Food Security in SSA

The likely impacts of climate change will add to these existing stresses and exacerbate the effects of land degradation. Increased temperatures levels are expected to cause additional loss of moisture from soil, reduced and more intense rainfall and higher frequency and severity of extreme climatic events, such as floods and droughts. These factors are already leading to a loss of biological and economic productivity and putting drylands population at risk of short- and long-term food insecurity.

There is considerable variability and uncertainty in climate change projections. Nevertheless, there is a reasonable agreement from a suite of different models that Africa is one of the most vulnerable continents to climate change and variability. The IPCC 4th African Assessment Report (2007) estimates that by 2020 between 75 and 250 million people are likely to be exposed to increased water stress, and rain fed agricultural yields could be reduced by up to 50% in Africa, if production practices remain unchanged.

*Inter alia*, drought-prone areas are particularly deemed to suffer complex, localized impacts of climate variability/change. In the Sahel, for instance, changes in temperature and rainfall patterns have reduced the length of the vegetative period and make it difficult to continue the cultivation of traditional varieties of long and short cycle millets (Rosenzweig et al. 2007). Given the social, legislative, market and weather-based sources of vulnerability already prevailing in the region, reduction in agricultural productivity and land area suitable for agriculture, even if slight, would cause large detrimental effects (IPCC 2007, Dietz *et al* 2004).

## **Adaptation Opportunities for Dryland Agro-ecological zones in SSA**

How can the impacts of land degradation be better abated and controlled, and food security and sustainable livelihoods be ensured in SSA drylands in the face of climate change? The answer lies not only in climatic elements but also in the adaptive as well as mitigative capacities of affected populations and on the nature and extent of the measures adopted. Drylands communities in SSA already have a long record of spontaneous adaptation to climate variability; yet more intensive and extensive adaptation exercises than is currently occurring are required, including the supporting policies. This is especially important since it is estimated that, by 2080, the proportion of arid and semi-arid lands in Africa is likely to increase by 5-8% (IPCC 2007).

While the drylands in SSA are predominantly inhabited by pastoralist and agro-pastoralists, agro-ecological settings are marked by a variety of livelihood orientations, reflected as different combinations of food security/livelihood challenges and conceivable climate adaptation responses. The adaptation options presented in the appendix thus represent an illustration rather than an exhaustive list. Centralized interventions that fail to recognize such spatial heterogeneity of drylands and location-specific interaction of socioeconomic and biophysical processes may limit the effectiveness of a particular adaptation option.

It is also important to note that many of the proposed and piloted adaptation measures are applicable across the agro-ecological zones, with different degree of required intensity, offering opportunities for learning and replications among locations. In response to the current wave of decentralization in Africa, for instance, local knowledge sharing and networking efforts have been increasingly promoted. In Benin, for example, co-operation among farmers, researchers, community leaders and meteorologists has improved farmers' access to climate-related information and provided new opportunities to share and up-scale good farming techniques and practices. Such initiatives have been proven to be a powerful mechanism not only to catalyze change at a scale which would not otherwise be possible, but also to strengthen community cohesiveness and protect traditional

indigenous knowledge for responding to climate viability.

Similarly, existing land tenure arrangements and services have come under increased strain in many SSA counties, given the continued scarcity of natural resources coupled with growing demographic pressure, fuelling conflicts among dryland communities (Anderson 2008). The imperative at the policy level, therefore, is to improve dryland dwellers' property and access rights to a variety of pastures and water resources.

### **Barriers to Increased Adaptive Capacity**

Availability of potential adaptation measures cannot simply be translated into enhanced resilience of dryland communities to climate change. Empirical analysis demonstrates that there exists a complex web of challenges and barriers, both real and perceived, which undermine dryland dwellers' willingness and ability for climatic adaptation and up-scaling of good practices. At a community level, for example, some of the constraints observed can include socio-cultural rigidity and lack of availability or restricted access to credits, assets and other resources as well as alternative livelihood options in the locality.

At the institutional level, limited understanding of climate risks and vulnerabilities and lack of policy direction and regulatory guidance tend to account for the difficulty of coordinating the various government departments and other stakeholders as well as their narrow sectoral focus. Attitudes associated with uncertainty that regard climate change as inevitable or as an issue to be dealt with in the future were recognized as systemic impediments often encountered during the course of adaptation decision-making.

### **Conclusions**

Moving forward it is critical we understand and react to the challenges facing the drylands in Sub-Saharan Africa. The most vulnerable communities to the projected impacts of climate change inhabit the dryland areas and the implications are enormous, in particular large permanent migrations into cities and neighbouring countries. Practical adaptation measures including policies which will build the resilience of communities to climate change are more important than ever.

It is important that we remember that the means to food security in every community will vary from place to place. Household food security will be a function of what activities make up their livelihood and each agro-ecological zone will have separate challenges to maintaining food security in light of climate change and desertification. It must be understood that with increased climate change and desertification, it is expected that these zones are going to shift, causing many livelihoods to change and forcing the population in many cases to find alternative livelihoods.

Despite popular belief of a generally low adaptive capacity in Africa, communities can adapt and change practices if their ways of life are to continue. Whilst there are many limitations in drylands, drylands livelihood systems are inherently opportunistic. Introducing or upscaling adaptation measures outlined in this paper, many of which are not foreign to the affected populations, would be a start, but their effectiveness will depend on a judicious selection, an integrated approach and longer planning timeframes, together with an enabling policy environment which reinforces actions at local and higher scales.

**Food security** occurs when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life (FAO 2002). Household food security is rather complex, transboundary and multifaceted including biophysical, socio-economic, political, demographic, gender and other dimensions. In general, the level of food insecurity is measured by four key indicators, namely: availability, access, stability and utilization.

According to African Commission's Food Security Report (2005), 27% of the total population in Africa is undernourished; nearly half of the children of Africa suffer from stunting; and acute malnutrition (more than 10%) is observed in more than 15 countries. Africa currently seeks to cover its food insecurity by imports valued at some US\$20 billion annually, in addition to seeking food aid (AUC and NEPAD, 2006).

1. This brief is meant to inform development practitioners and policy dialogue. The perspectives presented in this brief do not necessarily represent a UNDP, UNEP, UNCCD Secretariat position. A full version of this discussion paper can be found on the CSD-17 website.

2. For the purpose of this paper, the term **drylands** refer to all terrestrial regions where the production of crops, forage, wood and other ecosystem services are limited by water (Millennium Ecosystem Assessment, 2005), which encompass all lands where the climate is classified as dry sub-humid, semi-arid and arid, exclusive of hyper-arid areas.

The brief is one of a two part set of UNDP-UNEP-UNCCD briefs for CSD 17. The other paper addresses Carbon in Drylands: Land Degradation, Climate Change and Carbon Finance.

The full paper from which this Brief is derived is available on the CSD-17 website and will also be available at: [www.undp.org/drylands](http://www.undp.org/drylands). For more information, please contact [eric.patrick@undp.org](mailto:eric.patrick@undp.org).

## Appendix: Livelihoods/Food Security Challenges and Possible Adaptation Measure by Dryland Agro-ecological Zone

	<b>Arid agro-ecological zone</b>	<b>Semi-arid agro-ecological zone</b>	<b>Dry sub-humid agro ecological zone</b>
<b>Livelihood challenges</b>	<p>This zone is characterized by low moisture availability and lack of vegetation cover owing to a combination of low annual rainfall (less than 500 millimeters), high potential evapo-transpiration rates and often shallow, saline and calcareous soil. With limited supplies of permanent pastures and water, nomadic and transhumant pastoral systems based on communal grazing are the dominant farming systems.</p> <p>Changes in rainfall patterns and growing pressure on land and associated land degradation have been adding to stress on the already vulnerable livelihoods of pastoralist societies. Increased aridity, climatic variability and hazards, such as prolonged droughts, often induce malnutrition and/or disease of livestock due to unavailability of sufficient fodder and deterioration in pastoral lands, which lead to reduced willingness of traders to purchase animals in poor conditions. Fluctuating market prices of livestock products and feed as well as overall shortage of commodities in turn affect pastoralists' food security markedly due to their high dependence on market exchange for acquiring staple foods. Competition and conflicts between pastoral communities and with other groups over scarce and scattered resources are also on the rise.</p>	<p>This zone receives 500-1,000 millimeters of rainfall annually with a growing period of 3 to 6 months. Dwellers are typically agro-pastoralists, while, with varying balance between drought-tolerant crops production and livestock rearing. Due to the poor soils deficient in nitrogen and phosphorus and limited precipitation, crop production is mainly for subsistence purposes, except some cash crops, with few resources devoted to livestock production. While agro-pastoralists still rely on markets for cereals and other products not produced domestically, they have higher flexibility in the sale of livestock, compared with arid zone.</p> <p>Conversion of rangelands to cultivated lands in areas that do not have an adequate level of provisioning and supporting services, notably water and soil fertility, and inadequate dryland irrigation and cultivation practices, has resulted in severe soil salinization and erosion (MEA, 2005). Climate change could further reduce water availability in the semi-arid ecosystem and in turn spur the spread of land degradation and reduction of primary production. Conflict already occurs between herdsman and farmers in semi-arid regions (IPCC, 2001).</p>	<p>This zone consists of savannah type vegetation which receives between 1,000 and 1,500 millimeters of rainfall annually with a growing period of 6 to 9 months. While mixed crop-livestock farming is partly practiced, the predominant livelihood is subsistence and smallholder agriculture, largely rain-fed. A wide array of food and forage crops are grown including maize, millet, sorghum, cassava, yam, groundnut, cowpeas and leguminous forages.</p> <p>Climate induced uncertainty associated with inter and intra seasonal rainfall variability remains a fundamental constraint to agricultural production. While empirical data are still limited, potential impacts of climate change are likely to make the situation worse with decreased rain, reduced soil moisture due to higher evapo-transpiration rates and increased heat stress associated with higher temperatures, on crops, pest, disease and weeds. These changes in scale effect – both in terms of time and space – will result in diminished yields and higher overall volatility, which trickles down to all aspects of food security chain from consumers, land owners, and all the way to landless farmers who make a livelihood on other peoples' farms.</p>
<b>Natural Resource Management Based Adaptation Opportunities</b>	<ul style="list-style-type: none"> <li>• Herd management</li> <li>• Home gardens</li> <li>• Rainwater harvesting</li> <li>• Soil and water conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Agroforestry</li> <li>• Conservation agriculture</li> <li>• Cropping pattern adjustment</li> <li>• Improved tree management and planting</li> <li>• Rainwater/groundwater harvesting</li> <li>• Soil and water conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Agroforestry</li> <li>• Better land management/Conservation farming</li> <li>• Fodder banks</li> <li>• Rainwater/groundwater harvesting</li> <li>• Soil and water conservation</li> </ul>
<b>Market Based Adaptation Opportunities</b>	<ul style="list-style-type: none"> <li>• Drought resistant/tolerant breeds (e.g. camel)</li> <li>• Diversification of livelihoods (e. g. honey production)</li> <li>• Eco-/cultural-tourism</li> <li>• Exchange of livestock for agriculture commodities and <i>vice versa</i></li> <li>• Livestock feed supplementation and fattening</li> <li>• Livestock products value addition (e.g. hides and skins)</li> <li>• Market access improvement</li> <li>• Management of livestock diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Agribusiness</li> <li>• Diversification of livelihoods</li> <li>• Drought-tolerant crop varieties</li> <li>• Eco-tourism</li> <li>• Market access improvement</li> <li>• Small-scale irrigation</li> <li>• Value addition (e. g. medicinal plants; handicrafts)</li> <li>• Zero grazing for livestock and dairy production</li> </ul>	<ul style="list-style-type: none"> <li>• Agribusiness</li> <li>• Diversification of livelihoods</li> <li>• High-yielding, drought-tolerant crop varieties</li> <li>• Introduction of aquaculture</li> <li>• Introduction of livestock holding</li> <li>• Improved agricultural techniques/inputs</li> <li>• Improved water management/irrigation</li> <li>• Value addition</li> </ul>
<b>Institutional Based Adaptation Opportunities</b>	<ul style="list-style-type: none"> <li>• Commercial cooperative mechanism</li> <li>• Conflict resolution and security reinforcement</li> <li>• Extension and education</li> <li>• Micro-credit</li> <li>• Migration</li> <li>• Pastoral passport</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial cooperative mechanism</li> <li>• Early warning mechanisms</li> <li>• Extension and education</li> <li>• Micro-credit</li> <li>• Migration</li> <li>• Market – based risk management: weather 'insurance'</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial cooperative mechanism</li> <li>• Extension and education</li> <li>• Micro-credit</li> <li>• Migration</li> <li>• Market – based risk management: weather 'insurance'</li> </ul>