



Sustentabilidade
em Debate

Challenges and Opportunities to Climate Change Adaptation and Sustainable Development Among Tanzanian Rural Communities

Esther W. Dungumaro¹, Goran Hyden²

¹Institute of Development Studies
University of Dar es Salaam
E-mail: edungumaro@udsm.ac.tz

*Corresponding author

²Professor Emeritus, Department of Political Science
University of Florida

Recebido em 25.09.2010

Aceito em 03.12.2010

ABSTRACT

In more recent years climate change impacts have been obvious around the globe. This non-contentious reality has resulted in various global initiatives to reduce climate change impacts. However, differences exist in opportunities and capacity to adaptation. This paper, descriptive in nature, draws heavily from literature and also uses 2002 Tanzanian population and housing census to identify and discuss major challenges and opportunities to climate change adaptation and sustainable development in rural areas of Tanzania. Two groups are of focus; pastoralist herders and smallholder farmers. Analysis indicates that opportunities to climate change adaptation among rural community include their knowledge and experience. Challenges are centered on the pervasive poverty, rapid population increase and high illiteracy rates. Forces beyond their control including funds and governance also present definite limits to climate change adaptation. The paper suggests among others, the effective implementation of two top policies: education and social security funding.

Key-words: biodiversity, climate change, sustainable development, Tanzania.

Introduction

Climate change is perhaps the biggest environmental challenge of our time. Climate change effects are already evident in most parts of the world. The global concern regarding changes in climate that are threatening to transform the livelihoods of the vulnerable population segments is increasing. Climate change poses a serious risk to not only poverty reduction efforts but also threatens to undo the development achievements registered over the decades (URT, 2007). This realization suggests that climate change cannot be separated from development. When this critical linkage is considered, the challenges of climate change compounded by poor adaptive capacity are highly considerable. The challenges lead to changing theory and practice in the international development and conservation community on a continuous basis. These changes occur in response to experience gained with specific approaches but they are also the result of more imperceptible shifts in global norms and values. The shift from modernization in the 1960s to a “basic needs” approach in the 1970s, for example, illustrates this. This paper focuses on climate change adaptation, sustainable development and the poor – that we believe is central to much of the current discourse on international development and climate change. Issues of the poor were the key component of the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg; are an integral part of the Millennium Development Goals (MDGs); and, features in current poverty reduction strategies embraced by the World Bank and a majority of bilateral donors.

The present paper is set to identify and discuss major challenges and opportunities to climate change adaptation and sustainable develop-

ment. Our discussion will mainly be focused on three interrelated but not always easily compatible shifts in thinking about how to best adapt to climate change and achieve sustainable development. Factors that determine climate change adaptation are complex and diversified. Although such factors can be itemized they are imbedded into demographic, socioeconomic and political systems. In order to understand the opportunities that exist for the rural population to adapt to climate change and foster sustainable development, we focus on two shifts. These shifts can be summarized as follows: (1) *from the universal to the local* – a shift from knowledge based on objective science to one that incorporates indigenous wisdom and know-how; (2) *from top-down to bottom-up* – a shift that gives priority to popular participation over directive management and control. These are discussed in detail in the succeeding section.

Africa, where Tanzania is located, is characterized by a low adaptive capacity IPCC (2001). The high vulnerability of Africa and Tanzania in particular is attributed to a large extent to its low adaptive capacity due to deteriorating ecological base and high dependency on the natural resources to support livelihood UNFCCC (2006). Weak economy also impacts on the adaptation capacity since adaptation is closely related to levels of development. In this premise therefore the challenges to adaptation are characterized by development indicators such as income, life expectancy and educational attainment UNDP (2002). In Tanzania, these indicators are lower in rural than urban areas. Majority of the Tanzanian population live in rural areas (77%) and depend heavily on natural resources due to pervasive poverty and reliance on subsistence farming. Rural areas of Tanzania are also characterized by high illiteracy and fertility rates.

Tanzania is one of the countries faced with a vast number of predicament on issues related to the environment of which climate change is among them. This has persuaded the country to take a number of initiatives towards environmental management. Such efforts include the declaration of National Parks and protected areas that make a quarter of the total land and also the creation of special division in the Vice President's office that deals specifically with environmental issues. However such efforts are yet to register significant results. Climate change, adding to a number of challenges that the country face such as weak economy and population increase is bound to highly impact the entire population but mostly the rural poor.

The paper is organized into six sections. The first section provides the background; the second section covers approaches to understanding challenges and opportunities to climate adaptation and sustainable development. The third section presents challenges to climate change adaptation and sustainable development. The fourth section deals with opportunities. The fifth section presents challenges at two levels; to the scientific community; and to empowering the local community in adapting to climate change. The last section concludes the paper and presents the policy implications.

1. Understanding opportunities to climate adaptation and sustainable development

1.1 From the Universal to the Local

Conservation and development issues have long been a prerogative of international scientists and experts. In the 1960s and 1970s the assumption was that universally applicable designs of

specific policy interventions were not only desirable but also possible. The idea that local or indigenous knowledge may be important for success and that it may be even more relevant than mainstream scientific knowledge is an assumption that has gained ground in recent years many thanks to pioneers like Robert Chambers and his collaborators (1989). This assumption is particularly important in light of climate change effects that are evident in people's lives. The rural poor do not want to destroy the ecosystem that gives them both protection and sources of livelihood. They see their interaction with nature as a give-and-take exercise. Their interest is as much in renewal as it is in extraction Redford and Schmink (1992).

The importance of indigenous knowledge to climate change adaptation is increasingly recognized both at international and national levels. However, there are several barriers to successfully incorporating local knowledge into effective problem solving. One is that such knowledge is typically informal and not standardized in theoretical formulas or hypotheses. It is difficult to get a handle on, yet in specific context it is such knowledge that may make the difference between failure and success. The local people are the ones who know what works better in their own environment. A second barrier is the limited relevance of scientific know-how to day-to-day problems facing poorer segments of the population, especially in the rural areas. As much of the experience with efforts to improve agricultural productivity suggests, innovations come in packages that are too cumbersome and/or expensive to poor farmers Leonard (1977). A third barrier can be found in the structures of development organizations. Many are bureaucratic agencies with few, if any, incentives for incorporating local knowledge. Further-

more, these organizations have limited potential for diffusion of knowledge originating in alternative settings such as farming or herding communities. As a result, as Gupta (1999) argues, communication among scientists, policy-makers, public policy analysts and the common people in society is fraught with ambiguity, anxiety and, sometimes plain confusion.

Indigenous Knowledge (IK) has become a more commonly used concept in recent years largely thanks to a range of non-governmental organizations and social movements that have demonstrated its relevance to problem-solving in the conservation and development field, especially among poorer segments of the population. So successful has the campaign for greater respect for IK been that the World Bank is now one of the most enthusiastic sponsors of projects aimed at identifying relevant such knowledge and its successful application. These efforts have resulted in a small but growing literature on farmers as informed innovators. Excellent examples of local innovations and discoveries among African farmers include crop breeding, grafting against pests, water harvesting, soil management and conservation Chaiken (1998), Ndoum (2001) and Nwokeabia (2001). A World Bank brief linking agricultural innovations to knowledge sharing in Africa reports that the informal agricultural sector in Nigeria, mostly using indigenous methods and techniques, has an estimated worth of about US\$ 12 billion, providing income for an estimated 81 million people World bank (2006).

Making sense of local knowledge in climate change and development requires, among other things, the need to disaggregate the concept of the “poor” in relation to natural resources. It is deemed important to firstly discuss the means to supporting livelihood in order to offer an understanding of their adaptation to climate change. Not

all poor people of the world are the same. They differ in terms of livelihood and location. An increasing number of the world’s poor live in urban areas. We will leave them out of consideration here, even though they have a connection to natural resources and are impacted by climate change effects. The rural poor are sufficiently complex and large in numbers. In order to make the discussion focused, we also exclude tenants on large commercial farms or plantation workers, because they do not own the means of production and have little control over their own environment. We also exclude here any references to fishermen since their condition differs from those of agriculturalists and herders.

Two groups of poor concern us here¹. The first are the pastoralist herders, many of whom can be found in Africa. The Maasai of East Africa is one case in point, the Somali in the Horn of Africa another. The second are smallholder farmers. They are sedentary agriculturalists, but often living in close interaction with nature hence highly vulnerable to climate change. They are typically among the most natural resource-dependent of all tillers of the land. Their socio-economic status may vary somewhat, but what they all share in common is that they own their land.

Although both two groups are highly dependent on what nature can provide for them, their own footprints in the landscape vary, but are generally light. To the extent that they have contributed to climate change, it has generally been because of increasing pressure from forces beyond their control. Because they are poor and generally behaving in a re-active fashion, their attempts at adaptation and innovation are often at the expense of the very resource endowment on which they rely.

Pastoralists, having become confined mainly to semi-arid or arid lands, maintain their li-

velihood by moving their herds of animals according to shifting resource availability in their ecosystem. Measuring their impact on the environment has for a long time been a controversial issue. Do they overgraze their land? What is the carrying capacity of the land they use? International development agencies like UNESCO, UNEP, FAO, and the World Bank maintained for a long time that the heavy grazing by pastoralist herds of animals reduced species diversity and in the long run destroyed also the ecosystem UNESCO/UNEP/FAO (1979), World Bank (1984), Homewood and Rodgers (1987). Work by scholars like Lamprey (1983) and Sandford (1983), however, indicate first of all the difficulty of measuring what is seasonal variation as compared to detrimental impact from grazing. The savannah systems in Africa that many pastoralists depend on for their living are remarkably variable and capable of renewing themselves. Yet, with pastoralists being increasingly forced to subsist on more limited stretches of land due to incursion from agriculture and other activities, one cannot ignore the fact that the risk of loss of biodiversity is likely to grow in the future. Species of plants and animals as well as the ecosystem at large are both in danger of suffering losses.

Smallholder farmers are posing greater risk to biodiversity than the other category. This should be no surprise. They are just so many more than pastoralists or indigenous peoples foraging in the tropical forests. Thus, even though the environmental hazard caused by a single farmer may not exceed that of an individual pastoralist, as a collectivity, smallholder farmers pose a greater risk for two main reasons. The first is the threat that they pose to non-domesticated species as sedentary agriculture expands. The second is the threat to agro-biodiversity that

follows from use of new agricultural technologies.

The range of agro-biodiversity that has existed in these settings for generations is also at risk through the pressures to which farmers are exposed as a result of growing involvement in the market. Although improved varieties of local seeds have been developed and are used, e.g. among rice growers in West Africa, the temptation to rely on new type of seeds subjected to modification in laboratories has increased because they have the promise of significant gains, at least in the short run Goldman (1996). In situations of increasing poverty, many farmers have responded to this promise and engaged in agricultural technologies that demand higher energy and resource use. Their choice means a growing threat to diversity both in species and genetic material used on the land.

Our treatment of the poor does not imply that they are merely 'helpless victims' of processes beyond their control. They possess agency, even if it is often within limited parameters. The challenge at present, therefore, is to find better ways of working with the poor to help them overcome the limitations on their ability to adapt to climate change in a realistic manner with their interest and perspective in mind. This will require continued attention to how they may be induced to apply their knowledge in ways that help build sustainable systems of farming. As the example of Nigeria above illustrates, indigenous knowledge continues to flourish in the informal sector outside mainstream knowledge and policy action. The challenge remains how the indigenous and informal can be brought together with the universal and formal systems of knowledge. Many international agencies still have a long way to go towards such reconciliation.

1.2 From Top-Down to Bottom-Up

The international development community continues to be dominated by bureaucratic agencies. These are part of the U.N. system or are the extended arm of governments in donor countries. These agencies are typically wedded to corporate goals that require fulfilment regardless of circumstances. It is this fixation on goal achievement that they make these agencies such awkward players in a field where trial and error, and reinventing the wheel rather than transferring “best practices” from one location to another are the best prescriptions for success. These are agencies that are intrinsically top-heavy and wish to take action in a directive fashion, i.e. top-down.

Two things have happened since the 1990s causing a shift toward a more participatory approach to development and conservation, i.e. bottom-up. One is the emergence of new actors in the global arena. Some are private enterprises that see the possibility of making money from indigenous plants. Others are environmental activist organizations concerned with conservation. The latter are often directly involved with local community-based organizations working on a variety of environmental issues including climate change. The other thing that has happened is the interest in empowering the poor. Decentralization and participation are being propagated not just for purposes of informing and consulting the poor but for the sake of making them stakeholders in development and conservation processes. This field, therefore, has become crowded and is now occupied by organizations with rivalling and often contradictory objectives. A new “conservation and development politics” has emerged.

Scientists or conservation officials in multilateral or bilateral bureaucracies can no longer assume that their professional domain is immune

to political intervention or interference. Many lament this trend and few are ready to adjust to it. Yet, what is going on right now is a process in which politics dominates. This means that the basic parameters of the conservation discourse have also been changing. Conservation is no longer a concern driven only by its own professional or scientific considerations. It is tackled, in a participatory fashion, as an integral part of ‘development’. While the two were initially treated as opposites on a spectrum, the new conservation politics focuses on the task of bringing the two closer together under the umbrella of ‘poverty alleviation’.

2. Challenges to climate change adaptation

2.1 Poverty

Pervasive poverty impacts on adaptive capacity. This is because poverty limits the means to cope with and adapt to climate change effects. Lack of employment in rural areas and continued reliance on subsistence agriculture are among the many factors behind deeper poverty in rural areas of Tanzania. As a result, majority engage in non-farming activities that have detrimental effect to the state of the environment. Their engagement does not necessarily help them walk out of poverty but help them to support livelihood. Table 1 presents incident of poverty in Tanzania, clearly showing that poverty levels are higher in rural than urban areas. In recognition of prevailing deeper poverty the country is implementing national strategies such as MKUKUTA² and the Vision 2025 to reduce poverty. The overall goal of the government is to reduce the proportion of Tanzanians living in poverty by improving their access to quality pu-

Poverty Line	Year	Urban Areas	Rural Areas
Food	1991/92	15.0	23.1
	2000/01	13.2	20.4
	2007	12.9	18.4
Basic Needs	1991/92	28.7	40.8
	2000/01	25.8	38.7
	2007	24.1	37.6

Table 1. Incidence of Poverty in Tanzania

blic services. Development strategies are important for poverty reduction, ensure sustainable development and increase adaptation capacity of the rural population. However, other strategies such as social security are equally important to ensuring that the poor are able to deal with climate change effect.

Tanzania, like countries have social security systems. However, its coverage is poor. More striking such funds do not cover those in the informal sector of which the rural poor belong. Therefore once the rural households lose their houses, livestock, food reserves and other household’s possessions, due to impacts of climate change it impossible for them to recover IPCC (2001); Blaikie (1994).

2.2 Population increase

Population increase in developing countries Tanzania inclusive significantly impact on the ability to climate change adaptation. Tanzania has a high population growth rate of 2.9 percent per annum URT (2002) that is brought about by high fertility and declining mortality levels. The population of Tanzania has continued to be primarily rural despite the fact that the proportion of urban residents has been increasing over time. Particularly important to the present theme, is the fact that the rural population segment depend heavily on agriculture, animal husbandry, forestry and fishery to support livelihood. All of these activities are dependent on the climate hence render the rural community at risk of climate change effects. It should be noted that Tanzania is simply a case in point and not the only country with inadequate adaptive capacity. The Intergovernmental Panel on Climate Change IPCC (2001) has emphasized that Africa is characterized by a low adaptive capacity.

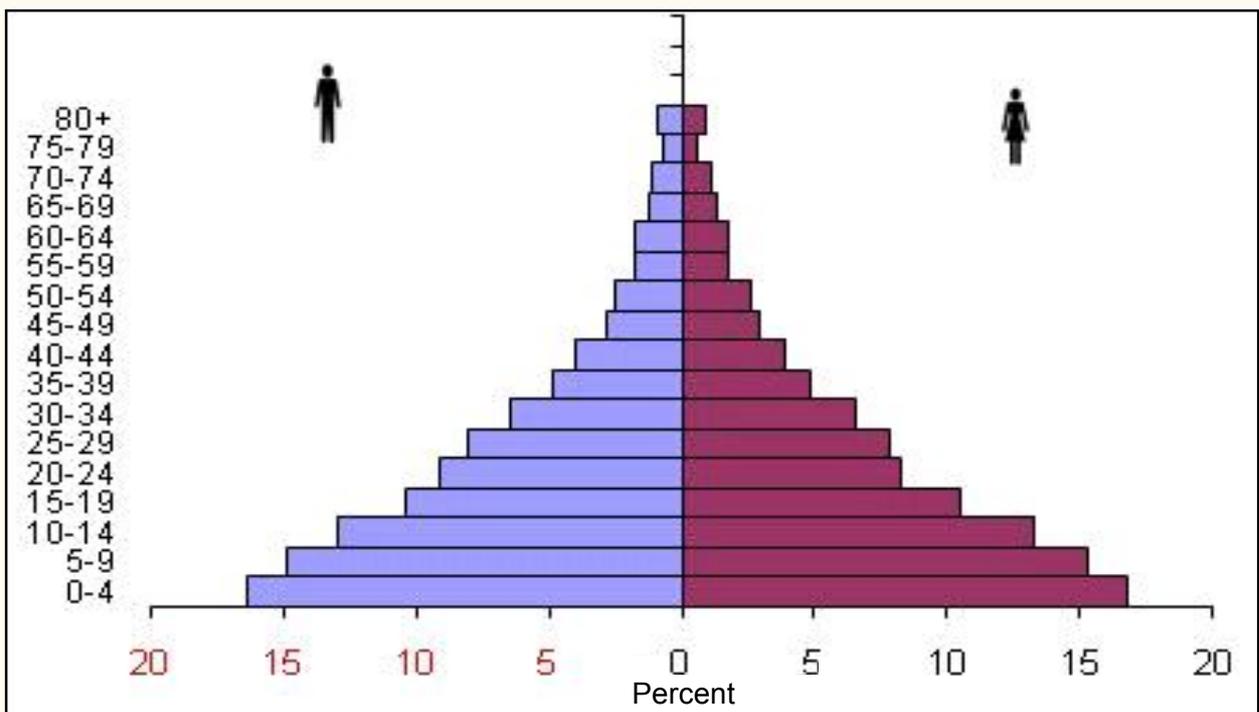


Figure 1: Population structure of Tanzania

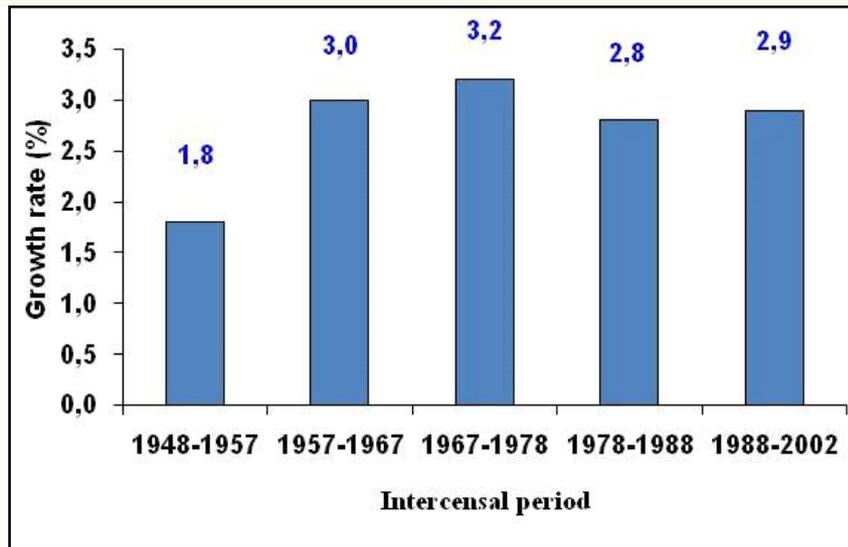


Figure 2: Population growth rate, 1948-2002³

Tanzania like other developing countries remains largely rural, with 77 percent of its population living in rural area while 23 percent are located in urban areas. Both fertility and mortality are still high and declining only slowly. This implies that the country’s “demographic dividend” is still a distant possibility. The country’s rapid population growth implies a doubling time of about two decades and a perpetually youthful population and a high youth dependency burden. All these add on the limits to climate change adaptation among the rural population who have been experiencing poverty over the years.

Challenges to rapid population growth are still highly considerable given the population projections as shown in Figure 3. Important demographic variables are posted in Box 1. It shows that HIV prevalence is high while life expectancy is low. This means the country’s population is at risk of losing younger people due to short life expectancy as well as HIV. A nation with limited human capital cannot adequately deal with various challenges of our time including that of climate change.

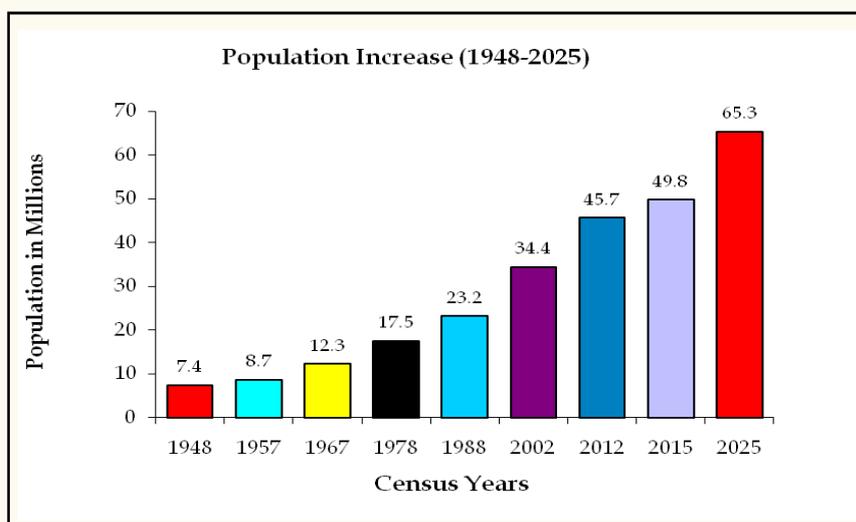


Figure 3. Population Projection of Tanzania

Box 1: Tanzania's Demographic Information

-Total population (2009 Projection)	-41.9
-Population growth rate	- 2.9%
-Population doubling time	- 20 years
-HIV prevalence rate	- 5.7%
-Maternal mortality ratio	-578/100,000
-Life expectancy	-50 years

2.3 Heavy reliance on natural resources to support livelihood

Agriculture remains Tanzanian's economic mainstay. Climate change such as increased temperature and reduced precipitation is bound to lead to overall reduction in agricultural productivity and yields. Predicted changes in climate will have significant impacts on Tanzania's rain-fed agriculture and food production. Warming will shorten the growing season and, together with reduce rainfall and water availability. Warmer climate can also increase crop losses caused by weeds, diseases and pests Paavola (2003). Rangeland is also likely to reduce livestock production hence threatening food security and intensify the risk of famine. Literature informs that over a billion people around the world are undernourished because they lack easy and consistent access to affordable food. Furthermore, climate change is already affecting the four dimensions of food; availability, accessibility, utilization and food system stability (Glanzt et al., 2009). Data presented in Table 1, suggest that rural areas of Tanzania are already suffering experiencing the mentioned impacts as over the years, food poverty has not been significantly reduced.

3. Opportunities

Ability to move according to resources is an opportunity to climate change adaptation and

sustainable development. Pastoralists, having become confined mainly to semi-arid or arid lands, maintain their livelihood by moving their herds of animals according to shifting resource availability in their ecosystem. Pastoralists' ways of life enable them to adapt to weather and climate change by moving livestock according to the shifting availability of water and pasture (Brooks, 2006). Grounds for regarding this arrangement as an adaptive capacity are many, including the fact that not all societies are able to do that, secondly by moving to other places they allow resources to regenerate. Pastoralists also have a social capital, which is an important opportunity to adaptation. Herd splitting to friends or relatives is a social capital that is referred to. Pastoralists split herd into smaller groups and move them to different areas. Under the proposed bottom up approach explained in this paper, we suggest that it would be more effective to enable and strengthen the inherent adaptive capacity of pastoralists and finding ways to encourage their autonomous adaptation, rather than providing adaptation strategies for them.

As for the second group of interest in this paper (the smallholder farmers); these have home gardens, which allow them to not only diversify their diets but also livelihoods. Another opportunity is rainwater harvesting. This is uncommon practice in many rural areas of Tanzania. However, rainwater harvesting is an adaptation measure that allows farmers to have water for domestic, livestock and irrigation purposes. In addition, farmers also practice rain-fed or flood recession agriculture in order to spread risk.

* * *

4. The Challenge to the Scientific Community and empowering the local community

4.1 The Challenge to the Scientific Community

The challenge to the international scientific community in the context of climate change adaptation is twofold. The first is to encourage the growth of an integrative approach that deals with the fact that issues in climate change are more complex than a more specialized and analytically oriented science manages to grasp. The second is the increased relevance of local or indigenous knowledge that can be made to inform and enlighten scientists. Both of these processes have begun in a modest fashion but they need to be given more support to really have an impact on learning, public opinion, and policy formulation towards empowering the rural population to climate change adaptation.

There are growing references in the academic community to an emerging 'sustainability science'. It is a product of many initiatives, but it currently involves a network of prestigious institutions such the International Council of Scientific Unions (ICSU), World Academy of Sciences, Third World Academy, U.S. National Academy of Science, and Harvard University. This new approach reflects dissatisfaction with current ways of conducting research on issues relating to climate change and development. The Consultative Group on International Agricultural Research (CGIAR) lamented some years ago that there is no accepted research model, which embraces the physical, biological and human dimensions of long term agricultural sustainability CGIAR (1993). Biologists, geophysicists, social scientists, and engineers have slowly begun to realize that they

must come together in order to better understand the challenges that face our environment on a global scale, notably climate change. Sustainability science, therefore, implies an integrative science committed to bridging the barriers separating traditional scientific disciplines and the sector distinctions between interconnected human activities Kates (2001). Inside the CGIAR system, for instance, there is a more concerted effort to share knowledge among agencies on specific themes that affect the works of all of them (cf. Meinzen-Dick *et al* 2003).

Sustainability issues pose a big challenge to the scientific community and how it operates. "Normal" science focuses on investigating parts, and it emerges from traditions of experimental science where a problem narrow enough is chosen in order to form a hypothesis, collect data, and design tests to reject invalid hypotheses. Because of its experimental base, the chosen scale typically has to be small in space and short in time. It is no coincidence that this reductionist approach to research lends itself very well to corporations and government agencies responsible for making policy and adopting strategy, because the effect of particular interventions on the human and natural environment can be considered 'externalities' that need not be considered in the policy equation (Gallopin *et al* 2001).

4.2. The Challenge of Empowering Local Communities

Empowering local communities has become a widely embraced principle, especially among international NGOs, many of which rely on their ability to reach the poor for support from external sources. Several of these organizations are doing a fine job and are serious in their intentions of really making the poor more

capable of solving problems on their own and stand up to powerful individuals and institutions. From a governance perspective, however, there are two issues that are often overlooked even by the more dedicated of these organizations. One is how external funding is being provided to local actors. The second is who really decides on how money should be allocated and to whom.

The international development and conservation community rarely addresses the question of how money is being provided to potential beneficiaries. It is taken for granted that money is part of the solution, not the problem. Yet, much support for climate change adaptation or development in the past has gone awry because of inadequate attention to how money gets to the recipient. There are at least three easily identified shortcomings: (1) the amount of money provided, (2) the direct contractual agreement with the donor, and (3) the administrative load that follows from dealing with different donors.

In spite of complaints that foreign aid is declining there are often more money around in relation to a particular problem than is actually needed or warranted. This has a lot to do with the fact that the international community moves in unison from one issue to the next. Global conferences have been ways of mobilizing public attention and funding for specific causes, like Sustainable Development at the summit in Johannesburg. The Global Environment Facility (GEF) that was created after the Rio Conference in 1992 is a case in point. Large chunks of money were made available with little attention paid to feasibility, sometimes, even purpose. Much of it became patronage to particular country governments or other actors that were in good books with those administering the facility. This has undermined the credibility of much international funding for very important global objectives.

Donor insistence on signing individual contracts directly with each recipient is another common source of problem with the use of external resources. Each contract is the result of discretionary judgments by individual grant administrators whose knowledge of the local scene is often limited. There is no attempt to set one applicant side by side with others in a systematic fashion, thereby establishing a sense of which potential recipient stands the best chance of succeeding. Most grant decisions are made in isolation from each other. This means that there is no sense of competition among recipients. This is especially true for organizations that work away from the capital on issues that are hard to measure in quantitative terms.

The third problem stems from the administrative load that is the result of being tied into different donors. This is more pronounced in some cases than in others, but it is generally true that donor reporting requirements take away attention from local capacity building or empowerment. Whenever an organization is the recipient of money from more than one donor, this can easily become a barrier to further progress.

The second governance issue is who decides on what money goes where. The normal approach is for the donor agency personnel to decide unilaterally. There is no real check on how this allocation is made. It is taken for granted that it is the prerogative of the funding agency. Yet, this is, if not a recipe for failure, still a very questionable approach if the goal is sustainable development. Whether the ultimate objective is to protect biological diversity or anything else, we believe it to be a major shortcoming that no attempt is made to involve persons from the host country in the decisions to allocate money for

conservation or development. Donors have been far too conservative, even patronizing, in their approach to recipients of their support. We believe that in this respect the donors are as much part of the problem as they are the solution Hyden and Mukandala (1999). If sustainable development is taken seriously by the international community, its members must restructure their funding relations with recipients along the lines of politically autonomous funds that foster professionalism and build institutional capacity in more enduring fashion.

5. Policy implications

The paper presented challenges and opportunities to climate change adaptation and sustainable development. It been demonstrated that while challenges such as rapid population increase and pervasive poverty exist, opportunities also exist. They basically fall under the knowledge and experience of that the rural communities have. It is therefore recommended that any measures to assisting the rural population should build on what is in existence, workable and acceptable in their environment than imposing new strategies. Based on the challenges due to forces beyond their control the paper presents two important policies; the social security system and education. . Social security system should cover even those in the informal sectors including pastoralists and smallholder farmers in rural areas. This would greatly assist the poor farmers to deal with loses due to climate change impacts as well as increasing their capacity to adapt to climate change effects. The basis of our recommendation for education policy is that educational policies have multiple benefits for individual welfare, for social and economic welfare and for the environment. More educated people are in bet-

ter health and often contribute to greater environmental changes by facilitating access to information and the means to protect oneself. Empowerment through education has multiple benefits for people and the environment. It also has the potential to enhance the adaptive capacity.

The above two policies are critical in light of lack minimum coverage of climate change in the country's development plans other that those related to disaster management for droughts and floods. It was noted that climate change impacts do not adequately feature in the country's development vision, National Development Vision 2025 which informs and influences different strategic plans. Floods and droughts are the only climate change related effects, which featured prominently in the document. Countries as well as communities differ in their ability for coping with and adapting to climate change and its effects. It is tempting to suggest that we should reverse the maxim that has guided the environmental community for many years: "think globally, act locally!" We need to act more globally and think more locally. This does not mean another set of international conferences to deal with sustainability issues but rather a realization that the global actors – governmental, inter-governmental, and non-governmental – are part of the problem and not just the solution. They need to create an environment, which is conducive to addressing climate change adaptation and sustainability concerns more effectively. This article has focused on opportunities and challenges if anything, yet increase the prospects for tremendous gains in dealing with one of the trickier issues in climate change: how the poor can at one and the same time contribute to greater sustainability and also adapt to climate change. Scientists need to think more about how local knowledge and wisdom can be incorporated into cli-

mate change adaptation and sustainability. Donors, governments, and NGOs need to think how they can create a more enabling environment for their own interaction with the poor in terms of dealing with challenges of climate change and sustainable development. Those measures alone, while not panaceas would go a long way towards making poverty reduction and climate change adaptation more compatible and comprehensible to those stakeholders outside government and international agencies for whom they matter most.

References

- CHAIKEN, M.S. Primary Agriculture Care Initiatives in Colonial Kenya, **World Development**, v. 26, n. 9, p.1701-1717, 1998.
- CHAMBERS, R.; PACEY, A; THRUPP, L. (Eds.) **Farmer First: Farmer Innovation and Agricultural Research**. London: IT Publications. 1989.
- Consultative Group on International Agricultural Research (CGIAR). **The Eco-Regional Approach to Research in the CGIAR**. Report of the TAC/Center Directors' Working Group, CGIAR Mid-Term Meeting, San Juan, Puerto Rico, May 1993.
- BLAIKIE, P. **At risk: natural hazards, people's vulnerability, and disasters**. Routledge, London: 1994.
- GALLOPIN, G.; FUNTOWICZ, M. O; RAVETZ, J. Science for the Twenty-First Century: From Social Contract to the Scientific Core, **Science and Its Cultures No 168 (June)**. Paris: UNESCO, 2001.
- GOLDMAN, A. Pest and disease hazards and sustainability in African agriculture, **Experimental Agriculture**, v. 32, n. 2, p. 199-211, 1996.
- GUPTA, A. Science, Sustainability and Social Purpose: Barriers to Effective Articulation, Dialogue and Utilization of Formal and Informal Science in Public Policy. **International Journal of Sustainable Development**, v. 2, n. 3, p 368-371, 1999
- HOMWOOD, K.; RODGERS, W.A. Pastoralism, Conservation and the Overgrazing Controversy. In D. Anderson and R. Grove (Eds.). **Conservation in Africa**. Cambridge: Cambridge University Press, 1987.p 111-128.
- HYDEN, G; MUKANDALA, R. (Eds.). **Agencies in Foreign Aid**. London: Macmillan, 1999.
- Intergovernmental Panel on Climate Change (IPCC). **Climate Change 2001: Impacts, Adaptation, and Vulnerability**. Cambridge: Cambridge University Press. 2001.
- PAAVOLA, J. Vulnerability to Climate Change in Tanzania: Sources, Substance and Solutions, A paper presented at the inaugural workshop of Southern Africa Vulnerability Initiative (SAVI) in Maputo, Mozambique June 19-21, 2003.
- KATES, R. W. Queries on the Human Use of the Earth, **Annual Review of Energy and Environment**, v. 26, p. 1-26, 2001.
- LAMPREY, H. Pastoralism Yesterday and Today: The Overgrazing Problem. In BOURLIERE, F. (Ed.), **Ecosystems of the World 13, Tropical Savannas**. Amsterdam: Elsevier, 1983. p. 643-666.
- LEONARD, D.K. **Reaching the Peasant Farmer**. Chicago: University of Chicago Press, 1977.
- MEINZEN-DICK, R.; KNOX, A.; PLACE, F.; SWALLOW, B. (Eds.). **Property Rights, Collective Action, and Technologies for Natural Resource Management**. Hartford CT: Kumarian Press, 2003.
- NDOUM, D. M. **Dynamics of Agro-Ecological Knowledge among the Mafa, North Cameroon**. Netherlands: CML, University of

Leiden, 2001.

NWOKEABIA, H. **Why Industrial Revolution Missed Africa: A Traditional Knowledge Perspective.** Addis Ababa, Economic Commission for Africa. 2001.

CLAY, J. **Buying in the Forest: A New Program to Market Sustainably Collected Tropical Forest Products Protecting Forests and Forest Residents.** In: REDFORD, K.H.; PADOCH, C. (Eds.), **Conservation of Neotropical Forests.** New York: Columbia University Press, 1993.

SANDFORD, S. 1983. **Management of Pastoral Development in the Third World.** Chichester: Wiley, 1983.

United Nations Development Programme (UNDP). **Human Development Report : Deepening Democracy in a Fragmented World.** Oxford: Oxford University Press, 2002.

UNFCC. **Background paper on Impacts, vulnerability and adaptation to climate change in Africa.** Accra, Ghana, 21-23 September, 2006.

UNESCO/UNEP/FAO. **Tropical Grazing Land Ecosystems: A State of Knowledge Report. Natural Resources Research Series.** Paris: UNESCO. 1979.

United Republic of Tanzania. **Poverty and Human Development Report, 2009. Research and Analysis Group,** United Republic of Tanzania, Dar es Salaam, 2009.

United Republic of Tanzania. **National Adaptation Programme of Action.** The Vice President's Office, The Government of Tanzania, Dar es Salaam, 2007.

United Republic of Tanzania. **2002 Population and Housing Census, Volume II, Age and Sex Distribution. National Bureau of Statistics.** Dar es Salaam, Government Printers, 2003.

United Republic of Tanzania, **Poverty and Human Development Report 2003.** Mkuki and Nyota Publishers. Dar es Salaam, 2003.

World Bank. **Linking Agricultural Innovations to Knowledge Sharing in Africa. IK Notes No 88 (January).** Washington D.C.: The World Bank. 2006.

World Bank. **Biodiversity and Agriculture: Implications for Conservation and Development.** Washington D.C.: The World Bank. 1996.

World Bank. **Desertification and the Sahelian and Sudanian Zones in West Africa". Internal Document, West African Projects Department.** Washington D.C.: The World Bank. 1984

Notes

¹ We are the first to admit that the groups discussed below may be poor in a material sense, especially when compared to groups with a steady and sufficient income, but they are also rich in a cultural or social sense.

² Acronym of the National Strategy for Growth and Reduction of Poverty in Kiswahili.

³ Tanzania has conducted six population and housing censuses, two during colonial rule and four after the country gained her independence.

Esther W. Dungumaro: Educational Background: Demographer and environmentalist. Current affiliation: Institute of Development Studies, University of Dar es Salaam. City: Dar es Salaam

Country of residence: Tanzania

Email address: edungumaro@udsm.ac.tz

Goran Hyden: Educational Background: Political science. Current affiliation: Professor Emeritus, University of Florida. City: Gainesville.

Country of residence: United States of America

Email address: ghyden@polisci.ufl.edu