



The Rationale and Capacity of Pastoral Community Innovative Adaptation to Climate Change in Ethiopia

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The Rationale and Capacity of Pastoral Community Innovative Adaptation to Climate Change in Ethiopia

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Abstract

This study was undertaken in Afar and Somali Regional States to assess the rationale and competence of pastoral community innovative adaptation to climate change impact. Focus group discussion (FDG), individual interviews and key informant interviews were held in selected areas in Afar region and Somali region. For cross triangulation, in depth interviews with ninety two respondents were held. The results indicate that Afar and Issa Somali Pastoralists are adapting to climatic changes through locally innovative ways including; changes in house construction materials, traditional early warning system, maximization of female animal herd, detecting and using changes in goat behavior to predict season forecast and also traditional water cooling system of drinking water. This research output provides a framework for addressing climate change problems faced by the Ethiopian pastoralists and assists them in realizing their potential to rise up to the challenge. It will also enable policy makers and NGOs to take an appropriate course of action in policy and programme development.

1. Introduction

Ethiopia's pastoralist community of ten million people occupies over 60% of the country's land mass which is semi-arid lowland and dominated by the livestock economy (UNOCHA, 2007). The main pastoral communities are the Somali (37%), Afar (29%) and Borana (10%) living in the Southeast, Northeast and Southern parts of Ethiopia respectively (ANRS, 2010). Ethiopian pastoralists raise a large portion of the national herd, estimated at 42 percent of the cattle, 7 percent of the goats, 25 percent of the sheep, 20 percent of the equines and all of the camels (PFE, IIRR and DF, 2010).

Over the years, records show that rangelands for pastoralists have experienced marked by drastic events such as environmental degradation and climate variability which are contributing to recurrent drought, rainfall declines, loss of livestock and shrinking rangelands that exceed those predicted by models of future climate. But, despite all these challenges, similar studies have revealed that concern and adaptation to climatic events is not a completely new idea in these areas. The fact that the communities in this region have survived with a fast population growth rate is an indication that they have developed indigenous mechanisms and strategies to cope with those harsh conditions (Nyong, 2007). This knowledge on how local populations, cope with previous droughts has the potential of providing important guide to addressing current and future climatic changes.

The climate of the pastoral lands in Ethiopia is characterized by scarce absolute rainfall which falls unreliably and within short rainy seasons, and which is often of limited availability for human use. High temperatures during rainy seasons ensure that much of the rainfall is lost in evaporation, and intensive rainfall results in floods. Arid and semi-arid areas that serve as the source basis for the livestock production system known as pastoral production system in Ethiopia are facing enormous threat (Kassahun et al., 2008).

The National Adaptation Programme of Action (NAPA) provided analysis of rainfall variability and trend in Ethiopia (NAPA, 2007). Baseline climate was developed using historical data of temperature and precipitation from 1971–2000 for selected stations. Analysis of year-to-year rainfall variation over the country expressed in terms of normalized rainfall anomaly averaged from 42 stations shows that the country has experienced both dry and wet years over the last 55 years. The trend analysis of annual rainfall shows that rainfall remained more or less constant when averaged over the whole country. However, the recent years are the warmest, compared to the early years. The data reveals that there has been an increasing trend in the annual minimum temperature over the past 55 years. Temperature has been increasing steadily by about 0.370C every ten years (NAPA, 2007).

Very little is known about the rationality of local adaptation mechanisms because of insufficient documentation and awareness (Macchi et al 2008, Pandey 2006, and IPCC 2007a). However, there is a slow but growing recognition of local adaptations to the changing environment in terms of efficiency, effectiveness and sustainability (PROLINNOVA,2008). Recognition of local adaptation is seen as an entry point to strengthen the resilience of local people to climate change. This implies that local innovation for climate adaptation needs to be assessed together with the environmental and socio-economic conditions. This dynamic process helps also to avoid the trap of romanticizing local practices. It also implies that the present scanning of local innovation is only partially addressing the complex and diverse issues of adaptation

to climate change. The aim of the paper is to document effective indigenous and innovations for climate change adaptation used by pastoralist in Ethiopia whilst examining the rationale rationale and capacity of pastoral community innovative adaptation to climate change impact in Ethiopia. A better understanding of pastoralists` perceptions of climate change, ongoing adaptation measures, and the decision making process is important to inform policy maker, so that they may promote successful adaptation on pastoralist livelihoods.

1.1 Objectives

The overall objective of the study is to assess the rationale and capability of pastoral community innovative adaptation to climate change in Ethiopia.

The specific objectives are to:

- Understand the perceptions of climate change in different pastoral communities in arid and semi-arid areas of Ethiopia;
- Identify, describe and document effective indigenous and innovations for climate change adaptation used by pastoralists.
- Identify local practices that lessen the impacts of climate changes ;
- Make policy recommendations for enhancing behavioral changes & Building climate change resilience.

1.2 Organization of the Paper

This research paper is composed of five parts. The first part deals with an overview about the research objectives needs and the background of the research. The second part presents the literature review. The third part presents the research method and procedures. The fourth part presents research results and findings. The final section of the paper presents the conclusions and recommendations.

2. Literature Review

2.1 Pastoral Livelihood in Ethiopia

Pastoralism, the use of extensive grazing in rangelands for livestock production, is one of the key production systems in the world's dry lands. The most common categorization of pastoralism is by the degree of movement, from highly nomadic through transhumant to agro-pastoral (Roger, 2001). According to Amaha (2006), the dry lands of Ethiopia are dominated by rangeland based livestock production systems known as pastoralism and agro-pastoralism (partly involved in opportunistic cropping) and represent a significant sector of the national agriculture in the country. The Ethiopian Ministry of Agriculture estimates that pastoralists own 73% of the nation's goats, 25% of the sheep, 20% of the cattle and the entire camel population (Roy et al., 2007; Amaha, 2006). The livestock sector contributes about 40% of agricultural Gross Domestic Product (GDP), or more than 20% of the total GDP. However, this important livelihood is threatened by climatic events.

Degradations in biological and physical rangeland resources have become serious challenges, bearing negative impacts on the pastoral ecosystems, livestock production and livelihoods (Vetter, 2005). As a result, there are high livestock mortalities in most pastoral areas. Simultaneous outbreaks of livestock diseases are also common and spread along the drought fronts, aggravating the number of animal mortalities. Climate change and variability are said to be serious environmental issues for the sustainability of pastoral lands over the next 30 years.

2.2. Adaptation to climate change

In the climate change context, adaptation is commonly seen as a set of actions and decision making processes (Petheram et al., 2010; Nelson et al., 2007). Adger et al. (2009) stated that the goals of adaptation differ depending on 'who or what is adapting'. Adaptive capacity is usually defined as the ability of a community (or social system) to withstand environmental changes. Some authors underlined that a community with generally high adaptive capacity will be less vulnerable in the future than other communities to the potentially detrimental (and often unpredictable) effects of climate change (and other stresses) on their landscape and lives (Petheram et al., 2010; Pelling et al., 2008; Roncoli, 2006).

Most research on climate change has been dominated by studies in the physical and biological sciences aimed mainly towards prediction of effects (Petheram et al., 2010). Such studies based on hard science are vital, however, it can be argued that lack of attention to social aspects has often led to a rather limited analysis of adaptation which can underplay the complex relationships between people and their environment (Klein et al., 2007). Smit and Wandel (2006) noted that social conditions can provide practical understanding of the social ecological drivers and factors that affect a system's vulnerability, and the adaptive capacity of communities.

2.3 Local innovation to climate change

Local innovation refers to the dynamics of indigenous knowledge (IK) the knowledge that grows within a social group, incorporating learning from own experience over generations but also knowledge gained from other sources and fully integrated with local ways of thinking and doing (World Bank, 2005; Waters-Bayer, 2009).

The value of indigenous knowledge is now widely acknowledged, also in scientific circles, and studies of indigenous knowledge have led to better understanding of local practices in agriculture however, poor farmers are innovating in biodiversity management in order to increase their options to cope with variable environmental conditions and to exploit micro-environments (“niches”) in their agro-ecosystems (Abay et.al ,2009).

Pastoralists apply their indigenous knowledge through flexible natural resource-use techniques, which are elaborated, transformed and preserved by the interaction with the community. Indigenous system of information exchange are essential to find and use information and for normal updates of rangeland conditions, water availability and disease risk as well as temporary user agreements. The effective dissemination and sharing of information about indigenous knowledge is realized through agents such as herders, community leaders and elders. The co-ordination of strategies in natural resource use with other users ultimately depends on the social networks, developed within and among different user groups (Niamir-Fuller, 1999).

Pastoralists maintain and conserve their indigenous knowledge through indigenous institutions such as Medaa Aba. It is through a complex process which the institutions play a purposeful effort in providing security to the users and to uphold the chances of survival on the long run (Roe et al., 1998). In this context, the overlapping interests and clashes about natural resource use can be seen as a means of redefining the positions and the relations between and among the groups. The rights and responsibilities for access to the key resources are to be utilized and defended depending on the norms of the resources and the frequency of their use (Bonnet, 2000). From this, it can be argued that the importance of pastoralists’ indigenous knowledge for sustainable natural resource management depends on the ‘self-organizing’ capacity of pastoral groups based on the institutional adaptability of the pastoralists and the ecological resilience of the vegetation (Abel & Langston, 2002). Likewise, Ethiopian pastoralists have chained social-cultural systems for effective resource management and for sustainability of the long lived indigenous knowledge itself. The structure involves all members of the community irrespective of gender and age (Sabine, 2004).

Rangeland degradation is less understood by policy makers, development planners and researchers (Gemedo, 2004; Vetter et al., 2006), rather confused with desertification (Mortimore, 2009), and influenced by biases of western intellectuals (Ellis and Swift, 1988; Sandford, 1983). As a result, pastoral perceptions are overlooked (Gemedo et al., 2006; Katjiua and Ward, 2007), and the production system considered as ecologically unfriendly and unsustainable (Kassahun et al, 2008).

Research indicates that contrary to the assumption of herder irrationality and destructiveness inherent in most conventional range development projects, many indigenous pastoral management systems are rational, efficient, and sustainable (McCabe, 1990; Niamir-Fuller, 1999; Scoones, 1995). A result of these new understandings of pastoral systems, several researchers have sought to understand indigenous pastoral knowledge in order to develop successful pastoral development projects (Davis, 2005; Briggs et al., 1999; Fernandez-Gimenez, 2002). Here, the focus is on the current innovativeness of local people: not how their ancestors developed, but rather the current dynamics of indigenous knowledge: It focuses on how pastoralists took their own initiative to develop new ways of using and managing climate change impact on their livelihood. The outcomes of these innovation processes are local innovations developed by local people. These innovations may be technical and socio-institutional, including policy change at local level. According to Wettasinha et al 2008, successful process of local innovation leads to improve the lives of many people in the area.

2.4 Traditional society in global climate change policy

Traditional societies in many cases have built up knowledge over long periods about changes in the environment and have developed elaborated strategies to cope with these changes. However, traditional knowledge systems in mitigation and adaptation have for a long time

been neglected in climate change policy formulation and implementation and have only recently been taken up into the climate change discourse. Indigenous people, who have survived over long periods to many kinds of environmental changes, may have valuable lessons to offer about successful adaptations which could be vital in the context of climate change (Macchi et al., 2008).

The issues of indigenous people and their traditional knowledge systems are approached by global climate change policies and mechanisms including the UNFCCC; the Kyoto Protocol and the Clean Development Mechanism (CDM) and the assessment reports of the Intergovernmental Panel on Climate Change (IPCC).

All the documents mentioned above consent that the costs of climate change are going to be inequitably borne by developing countries and specifically poor, natural resource-dependent communities, and therefore stress the importance of monetary, knowledge and technology transfer from developed to developing countries for adaptation to and mitigation of climate change. However, only a few of these policy documents acknowledge or even mention the potential of local communities' own-coping strategies and adaptive capacity latent in their traditional knowledge.

It is striking that in the IPCC reports (2001 and 2007) the main emphasis has predominantly been on indigenous communities living in developed countries, i.e. in North America, Europe, Australia and New Zealand and the Polar Regions where they can count on at least some support from their governments, whereas the majority of indigenous people living in developing countries receive little government intervention.

2.5 Climate Change related National policies and program in Ethiopia

Ethiopia ratified the UNFCCC in May 1994 and the Kyoto Protocol in February 2005. Within these frameworks, Ethiopia prepared National Adaptation Programs of Action and identified priority areas for development interventions and adaptations. The country has also a number of environmentally oriented policies, strategies and action plans that directly or indirectly contribute to the objectives enshrined in the UNFCCC. Despite such developments, most development policy and strategy documents have hardly captured the threat of climate change.

The country has adopted a comprehensive environmental policy with the overall goal of promoting sustainable economic development through sound management and use of natural, man-made and cultural resources and the environment. Ethiopia is also playing an important role at regional and global area. The country through its prime Minister is in fact leading the Africa negotiation team in global warming and climate change agenda. This can be seen as the direct result of the concern and understanding of the environmental issues by the Ethiopian top leadership (ANRS, 2010).

3. Research Methodology

3.1 Study Areas

The study was conducted in the Afar and Somali Regions of Ethiopia, specifically in Awash Fentale from Afar and Shinile zone from Somali Region. The two regions were selected due to different system availability and pastoralism is the predominant livelihood activity. In both study areas, animals play a central role in all walks of life; cattle, goats and camel in particular, have a special place that goes beyond the production of meat and milk. The main pastoral communities in Ethiopia are the Somali (37%) and Afar (29%). Their asset and aesthetic values as a form of saving and social dignity, respectively, has a great importance in their cultural system (ANRS, 2010).

3.1.1 Afar Regional State

The Afar region has one of the largest pastoral groups in the horn of Africa. Their settlement distribution covers the borders of the three countries of the horn: Ethiopia, Djibouti and Eritrea. In Ethiopia, the Afar region is organized as one of the nine autonomous Regional States. Afar National Regional State (ANRS) is located in the great East African Rift Valley in the north-eastern part of the country. It borders Eritrea to the northeast, Tigray, Amhara, Oromia, and Somali Regional States to the north-west; south-west; south, and south-east respectively, and Djibouti to the east (as shown with the green star in Figure 2).

Awash Fentale is one of the districts (weredas) in zone three of the Afar national regional state, and it is divided into six sub districts (kebeles). The Awash town is the capital of the wereda and is located 230 Km from Addis Ababa. The total area is 1089 km² and has an altitude range of 750- 1050 metres above sea level. The agroecology of the area is arid and home to huge state-owned irrigation schemes, private farms and Awash national park. It also shares boundaries with the Kereyu Oromo in the east and southeast, the Issa Somali in the southwestern escarpments bordering the Amhara region.

According to the Afar National Regional State (ANRS) plan on adaptation to climate change, there is an increasing trend of rainfall in central Ethiopia while an overall declining trend was recorded in the water stressed northern and southern lowland regions. In Afar, the rainfall patterns are perceived to have changed over the past decades, particularly in terms of timing and duration (NAPA, 2007). The frequency of drought is viewed as increasing particularly over the past two decades. ANRS Programme of Plan on adaptation argued that the changes have become more noticeable since the major famine in 1984. Except in drier years, changes in the seasonality, distribution and regularity of rainfall were more of a concern than the overall amount of rainfall.

3.1.2 Somali Regional State

Somali Region borders Afar Region to the north-west. It has nine administrative zones: Shinile, Jijiga, Fik, Degahbur, Korahe, Warder, Gode, Afdar and Liban. The Shinile administrative zone is located in the north-west of the Somali regional state. The Shinile zone borders the Afar region to the north-west, the Oromia region to the south, the Jijiga zone (Somali region) to the south-east, and Djibouti to the north-east. The Shinile zone is made up of six districts:

Shinile, Dambal, Aysha'a, Erer, Afdem and Meisso. The altitude in the Shinile zone ranges from 950 to 1350 m above sea level. Its terrain consists of undulating hills, stony outcrops interspersed with plains of loose soil covered by bush and woody grasses. Three seasonal rivers, namely Erer, Hurso and Chow, and several dry river beds are found in the area (SCUK and DPPA, 2008).

3.2 Data Collection Procedure

The study adopted a purposive sampling technique for the collection of data. The rationale for using purposive sampling is to select key informants deemed to have information on what the study is trying to address (Creswell, 2003). The study used both primary and secondary data. Primary data collected using Participatory Rural Appraisal techniques especially, Focus Group Discussion (FDG), individual interviews and Key Informant Interview. These instruments contained both open ended and semi structured questions. To understand climate change adaptation process among pastoralists in Ethiopia, a series of brainstorming sessions was carried out in Government and Non Government offices (Awash Fental Care Ethiopia, Awash Fental Pastoral, Agriculture Rural Development office, Afar National Region Office, Save the Children UK (Somali), Shinile Pastoral Agriculture Rural Development office, Ministry of Agriculture Rural Development & Pastoral Forum Ethiopia).

Focus group discussions were conducted in the two selected kebeles (sub district) of study areas- Dudub and Boloyita of Afar region and eight at Degahjabis, Barak, Mete, Millo, Goad and Berdher of Shinile zone in Somali region. Participants included herders, elders and clan leaders focused on the livestock species owned, community perceptions of major climate change hazards, probable cause and impacts; adaptive measures of climate change, pattern of the rainy season and the amount of rainfall during last decades; traditional signs and knowledge held for season forecasting; different practices that lessen the impact of climate change, issues of pasture and water access and conflicts. For cross triangulation, in depth interviews with ninety two respondents were held with prominent individuals on Climate change perception, impact and adaptation.

3.3 Data Analysis

The Statistical Package for Social Sciences (SPSS 15) and the excel spreadsheet were used for data capturing, validation and analyses. Presentations were done using descriptive statistical inferences like frequency tables, cross-tabulations and statistical graphs.

4. Results and Discussion

4.1 Perception of Climate Change and its impact

The individual interviews and the focus group discussion (FGD) revealed that the pastoralists were of the view that there is an observed decrease in length of rainfall pattern from a favourable period of four to two months. The rainy season is progressively becoming shorter starting late and finishing earlier with high rate of unpredictability. The dry season is also becoming longer leading to shortage of pasture contributing to the gradual extinction of indigenous grasses. This observation is backed by the findings of the ANRS who observed that indigenous grass are gradually being replaced by an unknown exotic plant. The interview and FGD indicated an increasing trend of temperature as observed by the communities in the study areas. This condition according to the respondents have contributed to extreme heat stress in the past five years (from 2006-2010).

During extended dry periods, livestock's access to pasture and water is limited. The lack of pasture and water weakens the livestock making them susceptible to variety of diseases. Livestock diseases contribute to rapid loss of livestock assets, reduction in milk supply and reproduction during disaster incidence. Livestock are the primary victims of the impacts of climate change. The interviews revealed reported cases of increase occurrence of parasites and infectious disease during the dry season, characterized by recurrent drought and temperature increase. Camels and goats, which are said to be most resistant to droughts, have been affected by these emerging diseases. Individual interviews revealed that majority of the respondents (91%) acknowledge the existence of the threat of diseases to their livestock over the past 7 years. Similarly, the key informant's interview from Afar Pastoral, Agricultural and Rural development office of Awash Fental Wereda reported that there is a new camel disease at least 30% of the camel population in the wereda. The wereda office, in collaboration with National Veterinary Institute (NVI) are not yet identified the type of disease.

According to the key informants in both study areas, the problem of rangeland degradation in the Afar and Somali regions are related with the prevalence of prolonged drought. A notorious invasive species called *Prosopis juliflora* is repeatedly reported to have invaded the Afar and Somali rangelands. Due to severe environmental degradation in the area, the ecosystem has lost its natural immunity to react against the invasive species. Majority of the respondent (92%) were of the view that, the reduction in rangeland has in part contributed to the reduction of milk and meat products in the regions.

4.2 Traditional Strategies for Climate Change Adaptation

The focus group discussions revealed that pastoralists have traditional natural resource management strategies that are aimed at providing the capacity to adapt to harsh environmental conditions including climate change and climate variability, and also to manage rangeland and livestock during the dry and wet seasons. In the Afar region, traditional institution Medaa Aba, a legal system that makes decisions governs the proper management and fair utilization of rangeland. It has a hierarchical structure starting with clan leaders at the top level to the head of a household. The Medaa Aba is the highest decision making body of all the clans. Medaa Aba encompasses every aspect of legal issues and decisions on range of legal matter from simple to a serious one.

Through this traditional institution, responsibilities are assigned to young people in the community to undertake the assessment responsibilities of available water sources and

pasture for livestock during the wet and dry season. They report back to the community about the situation with due consideration of the availability of feed both in quality and quantity, and estimate for how long the feeds and water sustain the livestock. After the assessment, the decision making body decides the number of livestock and the duration of stay at a particular place. Failure to respect the Medaa Aba's instruction results in a penalty of slaughtering female animals, regarded as highly valuable assets.

Pastoralists interviewed are aware of the existence and the impact of climate change on pasture and water resources. In Shinile, there is no local rangeland management system. The FGD at Shinile zone revealed that the pasture lands in the area is regarded as common resource for pastoralist other than their clans; even the Issa (neighboring tribes), as far as from Djibouti have the right to use pasture and water found in their localities.

The study in Northern Kenya (Luseno et al, 2002) also revealed that pastoralists watch the behavior of livestock & wildlife towards particular features on the upcoming season's climate. Based on the authors' findings, it seems to be considerable tacit knowledge and much room for exploration of the scientific foundations of ethno-metrology among East African pastorals.

4.3 Local knowledge and Innovations for Climate Change Adaptations

Pastoralists have long applied indigenous forecasting approaches to predict seasonal climatic events. The focus group discussion revealed one of the classical local approach known as "Dagu". It is an indigenous form of organized information exchange and network mechanism in the Afar region. This system helps pastoralist to assess the availability of pasture and information exchange, which serves as a traditional early warning system in their locality. In this traditional exercise which is embedded in the culture of locals in the Afar region, when one person meets another person from a different locality (whether they are strangers or they know each other), they spend the sometime to exchange information and about their livestock, pasture and new events observed during their journey. Through Dagu, the clan leader passes the information for the community to take measures in readiness for adverse weather conditions such as drought or extreme temperature. Such measure include the slaughtering of newly born calves to maintain standing stock during adverse conditions when water and pasture resources are scarce.

In both study areas, certain characteristics of animals have been decoded by pastoralist in the study areas and used for predicting the beginning of new season:

Animal behaviors

The change in behavior of livestock in a certain manner may be used as indicators of emerging rains or drought. For example, goats may shake their legs as if they are stuck in mud, erection of body hair and shivering. These sign are taken by pastoralists to indicate the emergence of rain in the area. In the events of water shortage or beginning of a drought period, cattle may lose appetite for grazing and become sleepy and breathe as if they are tired. Such symptoms are taken by pastoralists to indicate that they may travel longer distance in search of water and pasture. Based on this information, some measures to be prepared to cope with shortage or absences of rain.

Astrologic phenomena

Through the observations of stars around the moon, star readers are able to forecast weather events that will unfold in the course of time. For instance, if that star is covered by the moon this indicates that there is no rain in the season. This information is passed on to their clan to inform decision that is made to cope with the eminent shortage foe rainfall. For example, calves are slaughtered as a coping mechanism to maintain the standing population for available resources.

The Afar communities have adopted the heat and make water cool enough to drink, through building a bed like structure in the traditional houses with two gates. One gate serves to allow air intake and the other functions as exhaust. Water is stored in traditional bags made of goat hide. The bags will be suspended a few inches above the ground. After a while the water will get cool and becomes ready to drink. This is how they construct a traditional air cooling system to get cool drinking water.

In Shinile zone of Somali region, water bag is put on the floor with a water-soaked sack as a cooling mechanism. The science behind this traditional innovation is that water molecules during the process of evaporation are converted from the liquid to vapor and escape from the surface. During the process, water molecules take heat energy with it which is from the surface of the bags creating a cooling effect on the behind.

In regions with arid climates such as Afar and Somali regions, excessive heat is a major problem that causes thermal discomfort to human. The field visit reveals that pastoralist construct their houses with soil roofs which is deemed as an adaptation methods to regulate the excessive heat in the Shinile zone of Somali region. This soil roof evaporation and transpiration provide is believed to provide a natural cooling system to pastoral local buildings.

Another adaptation measure taken in the study areas is maximization of the number of female animals while keeping males at a minimum. Female-dominated-herd-structure is an imperative adaptive strategy that ensures a fast revival of herds in case of a minimum number of animal survival following exceptional harsh droughts incidence. FGD explained pastoral communities have a culture not selling pregnant female animals. According to the key-informant, the sale of pregnant female animals in the market is an indication of crisis occurring and this information is processed as an early warning system by nearby Pastoral Agricultural Offices.

4.4 Policy recommendations for enhancing climate change resilience

Policy and development programming aimed at pastoralists and the lands in which they live have often been based on misconceptions about the nature of both pastoralism and the non-equilibrium environments in which pastoralists live (Ellis and Swift 1988; Scoones 1995). Furthermore, a number of researchers have argued that mobile pastoralism represents a response to the variability of rainfall and pasture resources in dry lands which is both ecologically and economically rational (Scoones 1995; Niamir-Fuller 1998). While a deeper understanding of the nature of pastoralist livelihoods and production systems is gradually seeping into policy and programming (Davies 2008), there are still many unanswered questions about appropriate policy directions.

Building on the recognition of the need for a bottom up approach, recent projects have started to employ a more local level strategy to climate change adaptation. Policymakers and other stakeholders can play a role in local adaptation, and trigger a process of recognition and reflection. At local level, pastoralist might be able to benefit from knowing what other pastoralists are practicing to cope up with climate change, then introduce and implement these to their own situations .The documentation of innovations is not an end in itself. It remains, nevertheless, important as a symbol of the local capacity to create and react to local problems.

Local people are innovative in climate change adaptation on their own initiative. Research and development to mitigate climate change in a sustainable way will be more effective if it recognizes their innovativeness to build upon it, deliberately seeking to integrate with these local initiatives. This will also strengthen local capacities to adapt more quickly to climate change conditions. Specific lessons for policy that can be drawn from analyzing the above results are:

- Scientists and development practitioners need to be more aware of local people's innovation in managing their resources through local institutions. They need to look beyond traditional knowledge about climate change adaptation and recognize the local emerging technologies for climate change adaptation.
- Not only men but also women pastoralists are engaged in innovation for climate change adaptation. It is therefore important to ensure that climate change adaptation related policies are gender sensitive and recognize and support women's role in climate change adaptation.
- Capacity building is needed to prepare numerous researchers, development agents and local administrators to recognize local innovation and to facilitate pastoral led experimentation and learning. Climate change development projects should give adequate attention to rangeland and animal diseases that are locally important to meet cultural needs and to suit specific agro ecological conditions.
- Systematically identify local innovations in climate change adaptation and seek to understand how they are deliberately managing their resources in the face of climate change. Together with these and other local stakeholders, assess the merits and demerits of these innovations, and agree on activities needed to support the ones regarded as successful in improving local livelihoods.
- Offer locally appropriate forms of rewards and encouragement in terms of recognition and socio economic benefits to encourage pastoralists to innovate for sustainable management of natural resources.
- Support local pastoralist institutions in organizing climate change innovation event as a way to share their knowledge and achievements.
- Partnerships of different stakeholders can enhance local innovation processes to generate sustainable uses of natural resources. Multi stakeholder partnerships to deepen knowledge about the local emerging technologies are essential to make full use of their innovation and reveal opportunities to add value to the local climate change innovation.

5. Conclusions and Recommendations

Afar and Somali Pastoralists are adapting to these climate changes in local innovative ways. Pastoralists are aware of climate variability including decreasing trends of rainfall in amount and distribution. It is important for stakeholders to recognize the role of local and indigenous knowledge. Management of mobility and resources has long been guided by traditional institutions, and therefore these institutions have been a vital part of pastoralists' adaptive strategy, helping pastoralists take advantage of opportunities and cope with the consequences of climate variation. Therefore, building the capacity of this local institution is crucial in implementation of adaptation strategies and measures.

Planned adaptation interventions under rangeland management could build on existing coping capacity and fill gaps where this capacity is being undermined. The management of invasive alien species also has the potential of securing the asset base of pastoral communities. The Government of Ethiopia has identified rangeland management as a priority adaptation project in its NAPA. Intervention activities include the introduction of fodder species and the management of invasive alien species and bush encroachment. It is important to note that not all current local innovation used to cope with hazards is appropriate for long term adaptation. Some strategies, based on short-term considerations can worsen environmental degradation. i.e. traditional coping strategies such as charcoal and firewood selling. However, charcoal and firewood selling leads to massive deforestation, leading to intensification of climate change impacts. Government and NGOs should focus on enhancing alternative technologies & income generating activities

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