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Understanding resilience of pastoralists to climate change and variability in the Southern Afar Region, Ethiopia

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ABSTRACT

Change in climate and climate extremes are acknowledged as a vital challenge to pastoral production systems. Alternative systems that are accessible to a household in order to make a living could determine the household's resilience at a given point in time. This study was conducted in the Southern Afar region in Ethiopia to understand the resilience of pastoralists to climate change and variability. A household questionnaire survey and focus group discussions were employed to collect primary data at household level. A total of 250 pastoral households were sampled using stratified random sampling. The data obtained were analysed using descriptive statistics and principal component analysis. The resilience of households to climate shocks and stresses was determined using a two-step modelling approach by clustering households into livelihood groups, gender and districts. The results indicated that agro-pastoral households were more resilient than pastoralists to climate-induced shock. Furthermore, households in the Gewane district were more resilient than those in the Amibara district. Female-headed households were less resilient than male-headed households. Enhancing livestock assets and productivity, social safety nets, access to market, credit, extension services and education, improving irrigation crop farming, and providing farm inputs significantly enhanced the resilience of pastoralists to climate change and variability.

1. Introduction

In pastoral communities of Ethiopia, climate-induced shocks and stressors such as drought, rising temperature and irregular rainfall reduce pasture and water availability leads to animal loss through hunger and disease (Conway, 2000). The weather-related natural disasters frequently occur in pastoral areas of Ethiopia, which has been exacerbated by the depletion of the natural resources and destruction of ecosystems due to anthropogenic activities (Tadege, 2007). Ethiopia is particularly susceptible to drought, making drought the most significant disaster influencing the country over time (Seleshi & Zanke, 2004). Rainfall anomalies and the delayed onset of the rainy season along with rising temperatures, lead to impoverished grassland, lack of feed and water, and heat stress to livestock. This has, in turn, increased the mortality rate of herds, susceptibility of livestock to disease and emaciation as a result of the long distances they travel in search of pasture and water (Muluneh & Demeke, 2011). Although the drought may occur all over the globe, in general its harm is not as intense as in Africa, particularly in Ethiopia (Funk et al., 2008; Seleshi & Zanke, 2004; Williams & Funk, 2011). Droughts, heat waves and floods have increased in Ethiopia over the past decades. Excessive floods due to the high intensity of rainfall in the Ethiopian highlands caused loss of life and damaged properties of the people who inhabited arid and semi-

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arid areas (Tadege, 2008).

It has been observed that although change in climate happens all over the world, its influence and extent differ across multiple levels and scales. Its impacts are not the same at district, regional, national and global level. Although changes in climate and climate extremes will be the greatest challenge for people in Ethiopia, few studies have been undertaken on the resilience to climate change. Most literature investigated seasonality, poverty and food insecurity (Dercon & Krishnan, 2000). Studies conducted expressly in the context of farmers' resilience to climate change and climate variability is limited. Deressa et al. (2008) assessed the vulnerability of households to climate-induced shocks and stresses at national level in Ethiopia. However, insights into resilience to climate perturbation vary with the scale of analysis. Resilience to climate-induced shocks assessed at national level can conceal variations in local resilience of households (Parkins & MacKendrick, 2007). Accordingly, the national-level (macro-scale) assessment by Deressa et al. (2008) could have overlooked variations in vulnerability at the local level since the vulnerability level may vary even among households at district level. Households at district level can vary in terms of level of food insecurity, coping and adaptation capacity, access to credits, public services, safety nets and natural resources. In such conditions, variability at local level is usually ignored in nationwide resilience studies. Therefore, it is difficult to precisely understand the spatial aspects of households' resilience from nationwide resilience assessments. This shows the significance of scale in resilience studies and ensures the necessity of resilience studies at micro-level.

A study at district, regional, national and global level is essential to integrate worthwhile adaptation strategies in development policies. The reason for this is that adaptation/coping capacities to climate change and variability can vary at all these levels, taking into account households' level of income, local exposure, and education level, to mention but a few. It is on the basis of these premises that the present study was conducted to understand the resilience of pastoralists to climate change and climate variability in the Southern Afar region of Ethiopia.

2. The resilience concept

Resilience is the capability of a social–ecological system to continue after a shock and to reorganise while sustaining a fundamentally similar function (Folke, 2006; Holling and Meffe, 1996; Walker et al. 2004). The idea of resilience was initially used by Holling and Meffe (1996) to define ecosystem resilience, but is currently applied to other contexts. The concept is progressively used in social sciences to explain people or household resilience (Levin et al., 1998), thus a broader concept of resilience is adopted. The wide variety of resilience concepts makes it complicated to detect common characteristics. However, nearly all descriptions stress the ability to adapt effectively against shocks. Norris et al. (2008) suggests an overall agreement on two significant characteristics of the resilience definitions, namely (i) it is better conceived as a capability or a process than as a result, and (ii) it is well-conceptualised as adaptability rather than steadiness. A first step in the direction of understanding the resilience concept in a learning environment is to discourse the important characteristics and regulations of the system. In order to enhance a common understanding of resilience in the situation of diverse systems, Norris et al. (2008) identified the most important principles, namely (i) a changing environment is given, (ii) systems are too complex to know or map all interdependencies, and (iii) there is not only one stable state in reality – alteration is the common state. Resilience therefore, is a learning process and no stable state exists in reality.

There are two contrasting resilience concepts. The first concept is described by Gunderson et al. (1995) as resilience in engineering and by Cutter et al. (2008) as the ability to persist and survive a disaster with minimal influence and destruction. It includes the ability to lessen or evade damages, encompass the impacts of hazards, and bounce back with slight disturbances (Cutter et al., 2008). Rose (2009) also describes engineering resilience as the time taken by a system to recover to its earlier state after a disturbance. Furthermore, not only the time required for bouncing back, but also the pattern of bouncing back should be considered. According to the engineering resilience framework, opportunities to adapt or learn from a previous disturbance and shift to an alternative state are often not taken into account. The second resilience concept, called ecological resilience, is the amount of perturbation that a system can accommodate without redefining its structure and function (Holling and Meffe, 1996; Walker et al., 2004). A concept regularly quoted when referring to resilience of an ecosystem is the *adaptive renewal cycle*, primarily developed by Holling (2001). The adaptive renewal cycle is an informative model made from long-time measurements of ecosystem changes over time, such as the succession of species in four phases of change forced by periodic disturbances and processes (Folke, 2006). Resilience refers to persistent or robustness of a system to disturbance and about the possibility that disruption may lead to the occurrence of new trajectories. Therefore, resilience offers the ability of the system to adapt to disturbances, which allows for sustainable development. It does not mean that resilience has always been a positive characteristic of the system (Folke, 2006).

3. Methodology

3.1. Description of study areas

The Afar region is situated in the north-eastern part of Ethiopia and comprises an area of about 72,053 km^2 (CSA, 2008) between 39° 34′ and 42° 28′ East Longitude, and 8° 49′ and 14° 30′ North Latitude. The Afar Region has a population of approximately 1.4 million people, of which approximately 87% are living in rural areas (CSA, 2008). The study was conducted in the Southern Afar region, in Amibara and Gewane districts (Fig. 1). Agro-ecologically, the Amibara is semi-arid with a temperature ranging from 25 °C to 35 °C and an average annual rainfall of 530 mm. The altitude of Amibara ranges from 720 m asl to 1100 m asl. Gewane is arid and semi-arid with a temperature ranging from 28 °C to 42 °C and an average annual rainfall of 450 mm. The altitude of Gewane ranges from 550 m asl to 650 m asl (CSA, 2008).

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