



## Ties that bind: Local networks, communities and adaptive capacity in rural Ghana



Abbrar S. Chaudhury<sup>a, b, \*</sup>, Thomas F. Thornton<sup>a</sup>, Ariella Helfgott<sup>a, b</sup>, Marc J. Ventresca<sup>c</sup>, Chase Sova<sup>a, b</sup>

<sup>a</sup> Environmental Change Institute, University of Oxford, UK

<sup>b</sup> CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Denmark

<sup>c</sup> Saïd Business School, University of Oxford, Wolfson College, UK

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### ABSTRACT

Current models of adaptation to climate change focus on common causes of vulnerability among individuals and communities in an attempt to improve their capacity to adapt. These models tend to neglect the impact on vulnerability of local relationships that include political and economic power structures. We use social network analysis to examine the connectivity and positions of vulnerable rural households and their capacity to adapt. We collected empirical data from a community of 58 smallholders in upper west Ghana on external relations with 'local actors' that are independent, operate beyond the community yet have direct relations with the community. These connections provide important resources and knowledge to build adaptive capacity that would not be generated from within the community. Our results highlight that certain external relations expose households to knowledge and other forms of capital, which in turn strengthen their ability to access and mobilise resources to respond to environmental change. However, not all external relations offer equal opportunities, which results in a stratified community and variation in the households' capacity to adapt. The network approach also identifies points where local actors can link communities and households to remote agencies crucial for planning and implementing effective adaptation. **Keywords:** Adaptation; Adaptive capacity; Rural agriculture; Climate change; Rural community, Social network analysis; Vulnerability

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### 1. Introduction

The design and delivery of effective strategies to improve the capacity of vulnerable rural populations in developing countries to adapt to climate change is complex. This complexity originates from the scale and nature of both climate change and adaptive capacity that cuts across sectors, populations and geography (Adger et al., 2005; Berkes and Folke, 1998; Cash et al., 2006; Ostrom, 2010). It is particularly important for agriculture (Sage, 2013), which is the largest source of income and jobs for poor rural households, supporting 40% of global population and providing 80% of food consumed in most of the developing world (UN, 2012). Higher temperatures in many regions reduce crop yields and changes in rainfall increase the risk of crop failures and poor

production (Nelson et al., 2009). Consequently, the many actors within agriculture must collaborate and combine their expertise and resources to tackle the threat from climate change. This requires specific strategies for the rural vulnerable as well as active cooperation among independent bodies (Chiotti and Johnston, 1995). In this paper, we focus on rural agriculture communities and their interactions with outside actors to study adaptation to a changing climate.

Managers in developing countries are increasingly emphasising human vulnerability and strategies for increasing capacity to adapt to climate uncertainties (Adger and Kelly, 1999; Heltberg et al., 2009). Community action, especially in a rural setting, has emerged as the preferred level for most initiatives as this is where the main impacts of climate change are experienced and thus where the most effective and timely responses are required (Lyle, 2015; Ostrom, 2010; Satterthwaite, 2011; Schipper et al., 2014). While community action is gaining attention, it often under-emphasises the role of variation within a community. Communities can face similar threats, but the capacity of any individual or

\* Corresponding author. Environmental Change Institute, University of Oxford, UK.

E-mail addresses: [abrarchaudhury@gmail.com](mailto:abrarchaudhury@gmail.com), [abbrar.chaudhury@ouce.ox.ac.uk](mailto:abbrar.chaudhury@ouce.ox.ac.uk) (A.S. Chaudhury).

household to cope and adapt to these threats largely depends on their personal networks, attributes, livelihoods and capital bases (Notenbaert et al., 2012; Vincent, 2007). Rural farmers, faced with drought, that have alternate sources of income may make the difference between ruin and survival. It is, therefore, important not only to examine action at the community level but to also delve into the community to target help. Strategies that fail to recognise individual differences and the contingencies and synergies between different adaptive processes and pathways (Thornton and Manasfi, 2010) may be unproductive and even exacerbate vulnerability.

The progress of adaptation in developing countries from theory and policy to implementation depends upon the important role of actor networks (Agrawal, 2010; Yaro et al., 2015). The scientific literature recognises that strong networks are essential for improving everyone's adaptive capacity (Bodin and Crona, 2009; Cassidy and Barnes, 2012; Cleary and Hogan, 2016; Füssel and Klein, 2006), but there is very little published about the methods and analysis of such human systems or complex local networks required for adaptation. This paper uses social network analysis (SNA) to examine community relations with outside actors to understand better how they influence social structure and in turn adaptive capacity, which would not otherwise be apparent from traditional community-based research. We draw attention to relationships, network structures and network positions as crucial to understanding the adaptive capacity of both households and the community. Social network analysis (SNA) is an innovative theoretical and methodological approach for analysing community structures through visualising and measuring members' relations with outside actors (Marsden, 1990; McCarty and Bernard, 2003).

We apply SNA to the external relations of a rural community of 58 smallholders in Upper West Ghana with 'local actors'. We define local actors as those that are independent, operate beyond the community yet have direct relations with households. These local actors provide important resources and knowledge that would not be generated from within the community.

Our research has two key objectives. First, we seek to understand the potential effect of external relations upon community structure and the network positions of households with the community through local actor networks. Second, we seek to map the association between the network positions of households and their capacity to adapt by using selected household adaptive capacity indicators and network measures.

## 2. Theoretical development

In this study we apply a multi-disciplinary approach, using ideas from climate vulnerability, adaptive capacity and networks to study adaptation in rural communities. The concepts that underpin our research are often subject to wide interpretation both in practice and in theory. Our focus is on the broad climatic challenges faced by agriculture in rural communities and the role of local networks in shaping capacity to adapt to these challenges.

### 2.1. Vulnerability and adaptive capacity

Human adaptive capacity and vulnerability are interrelated and have been widely discussed in the literature (Adger, 2006; Ribot, 2010; Smit and Wandel, 2006). The often-cited United Nation's Intergovernmental Panel for Climate Change definition of vulnerability is the "degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes" (McCarthy et al., 2001). Simply, vulnerability is exposure and sensitivity of a system to hazardous conditions. Adaptation is a manifestation of the capacity to reduce the vulnerability of a system, region or community to survive the

consequences of climate change or exploit beneficial opportunities (IPCC, 2014). Availability of adaptive measures does not necessarily reduce vulnerability because it requires people's capacity to implement those measures (Füssel and Klein, 2006), which is often a question of political and economic power rather than simply adaptive capacity (Ribot, 2011). System level action is important because it emphasises the interplay between social and ecological schemes but it neglects inequalities within societies. Societies are often severely stratified, in terms of opportunities, power, influence and access to resources (Lanski, 1966). For our study, we focus on vulnerability and adaptive capacity at both the community and household levels.

Adaptation programmes focused on agriculture and food security are designed to help vulnerable populations as well as the broader ecosystem cope with climate change. Populations are assessed to identify how best to assist them based on their socio-economic and environmental characteristics, such as age, poverty, climatic risks and the ability to choose strategies that are important to them (Chaudhury et al., 2016a; Füssel and Klein, 2006; Ribot, 2010). The current models for adaptation, however, face several challenges. The first is that adaptation does not have a widely accepted definition (Füssel, 2007; Smit et al., 2000). Adaptation measures are usually constrained by complex links between social and ecological systems (Berkes and Folke, 1998) as well as human and biological activity (Thornton and Manasfi, 2010). Second, adaptation is seldom an exclusive response to climate change but also to wider development deficits (Berrang-Ford et al., 2011). Efforts to separate adaptive from development measures are often futile (McGray et al., 2007). The development field is widely studied and has its fair share of critics who draw attention to problems of power, agency, political and cultural bias, and neoliberal capitalist-incentive approaches (Ferguson, 1990; Mosse, 2004). These critiques have generated various solutions for reducing vulnerability and improving capacity to adapt, with differing emphasis on governments, markets, and communities to lead the process (Chambers, 1994; Mikkelsen, 2005). Evidence, however, suggests that no single model works in all circumstances (Adger et al., 2005; Ostrom, 2010) but they all share a common focus that addresses local vulnerability, while drawing on different methods.

Despite the ambiguity in defining vulnerability and adaptive capacity, considerable progress has been made to develop indicators for measuring local adaptive capacity (Thornton and Manasfi, 2010; Vincent, 2007). Based on published research, we have identified several household adaptive capacity indicators for analysis (refer to Table 2 in Section 4 – Research Design and Methodology). These indicators enable households to respond effectively to unexpected challenges, adopt remedies and take advantage of new opportunities to improve their capacity to adapt (Jones et al., 2010). Although it is challenging to measure adaptive capacity, we will relate these indicators to the connectivity of the rural households to understand the link between the two.

### 2.2. Adaptive capacity and local actor networks

Managers focus exclusively on causes common to all units when faced with models for adaptation that are based on factors of vulnerability occurring within and not between social units (such as individuals, households or communities). Efforts are then directed to alter these attributes in order to improve capacity to adapt to threats. However, most vulnerability driven models tend to overlook that individuals do not exist in isolation but function within an interactive society, characterised by unequal power relations (Cameron, 2012). These interactions often include many other external actors who may provide knowledge and resources that help those coping with climatic challenges. The literature

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