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Research paper

Climate change adaptation in the western-Himalayas: Household level perspectives on impacts and barriers

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ABSTRACT

A vast amount of knowledge and experience on coping with climatic variability and extreme weather events exists within local communities, and indigenous coping strategies are important elements of successful adaptation plans. Traditional knowledge can help to provide efficient, appropriate and time-tested ways of responding to climate change especially in far-flung communities. However, little is known about how traditional coping strategies translate into adaptation to long-term changes, and to what degree they prevent pro-active, transformational responses to climate change. This paper assesses the use of climate related information for communities in the Himalayan foothills of rural India, and reports on the barriers to adaptation planning and actions. Surveys have been carried out to analyze the current practices and the role of information in planning for climate change adaptation in the rural areas of the Nainital region of India located in Western Himalaya. Respondents perceive the local climate change, the intensity of change, and the negative impacts on the community and landscape. Decreases in water quantity and changes in precipitation patterns are among the major concerns for respondents, however, communities have begun to use traditional knowledge and historical climate information for developing strategies suitable to cope with impacts of climate change. Going forward, additional information is needed to match the high priority community needs with viable adaptation strategies. Lack of money, lack of access to information, and lack of awareness or understanding are considered the three largest hurdles besides low priority for adaptation, recognized by community members as barriers to adaptation planning and actions. Adaptation plans must be integrated into both top-down and bottom-up approaches to plan for enabling sustainable development and the efficient use of information for adaptation. Finally, traditional knowledge seems to be useful not only in contrasting climate change impacts, but also in recovering several ecosystem services that work all together for enanching the quality of life of villagers at local scale.

1. Introduction

Mountain areas of the world cover 24% of the global land surface (UNEP-WCMC, 2002) and host roughly 12% of the global human population (Huddleston and Ataman, 2003). Mountain areas are repositories of biological and cultural diversity and provide vital ecosystem services, such as the provisioning of food and wood, natural hazard protection, habitat diversity and cultural services (Körner and Ohsawa, 2005) to both local communities and those in the surrounding lowlands (Grêt-Regamey et al., 2012). However, mountain environments are fragile, and people living in mountainous areas are exposed to environmental stressors as well as human stressors (Nogues-Bravo et al., 2007; Macchi, 2010). These stressors are interconnected and, together with the geographical isolation, increase the existing pressure on water, land, and other natural resources and services, which can have serious consequences for mountain resident livelihoods. Although the impacts of climate change act equally on developed and on developing countries, on the rich populations as well as on those indigent, however, underdeveloped and poor nations are more vulnerable (Adger et al., 2003). Climate change impacts intensify the stress on the system with wide ranging effects on the environment, biodiversity, and socioeconomic conditions (Beniston, 2003). Consequently, these new conditions together with the increased human pressure on natural systems may limit mountain resident's inherent capacity to cope and

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adapt to changes (Macchi, 2010). However, little knowledge exists about the impacts of climate change on the livelihoods of mountain communities, and their capacity to adapt to climatic variability and change (Macchi, 2011), except at very coarse spatial and temporal scale (Fagre et al., 2003).

In a socio-ecological system the adaptive capacity can be the adaptation process through which societies make themselves better able to cope with actual or expected climate stimuli or their effects (McCarthy et al., 2001; IPCC, 2001b). The accurate analysis of the adaptation process requires to focus on the local scale, where the evaluation of local responses at the individual or household level can provide evidences for expected future conditions, and allows for appropriate adaptation policy responses (Adger and Vincent, 2005; Smit and Wandel, 2006).

However, lack of information has repeatedly been identified as a barrier to climate change adaptation planning and implementation (Crabbe and Robin, 2006; Mukheibir and Ziervogel, 2007; Tribbia and Moser, 2008; Lowe et al., 2009; Carter and Culp, 2010; Foster et al., 2011; Archie et al., 2012). Therefore, the possibility to have access to relevant information is an extremely valuable resource, and communities that have access to this kind of information can successfully carry out an adaptation process (Cruce, 2007). Although not always available or accessible, good quality information from multiple sectors (climate, hydrology, agriculture, forest and socioeconomics) are needed both to assess the impacts of and the vulnerability to climate change and to work out on adaptation strategies (Fischer et al., 2002; Schroter et al., 2005). Successful adaptation will entail adjustments and changes at every level, through local-scale actions that will provide the most effective protection for communities and individuals, especially in areas with marginalized or natural resource dependent populations.

Lack of information is not the only barrier to action (Archie et al., 2012), because other constraints such as lack of funding, competing priorities, and lack of public support and understanding are all hurdles that often have to be overcome (Shackleton et al., 2015). Therefore, there is the need to make climate information more accurate, accessible and useful considering the importance of these information to support adaptation and to manage climate risk especially in rural areas (Roncoli et al., 2002; Ziervogel et al., 2005; Hansen et al., 2009). A significant barrier to adaptation is not only the presence of gaps in knowledge (Klein et al., 2014) (or knowledge deficits) related to the impacts of climate change, adaptation options, and uncertainty, but also the significant obstacles to have access, integrate and mobilize knowledge (Adger et al., 2007; Klein et al., 2014). Science, information, knowledge and learning are necessary factors for adaptation planning and implementation (Klein et al., 2014; Ford and King, 2015).

This paper intends to fill a research gap related to the role of information to adapt to climate change. This is carried out by providing both the theoretical context to understand the relationship between traditional coping strategies and adaptation, as well as some practical needs of vulnerable households in the Himalaya that can be in common with other mountainous regions. In order to address this issue, the current study focuses on the perspectives of residents of rural mountain communities in the Indian Himalaya. In particular, the aim of this paper is to address the role of traditional knowledge and adaptation strategies in countering the ill-effects of the climate change, and to analyze whether sufficient information exist to enable residents to adapt.

1.1. The overview on Himalaya

The Himalaya, one of the largest mountain systems in the world, lies in one of the poorest regions in the world (Hunzai et al., 2011), and it is a physically and biologically complex and diversified mountain system. The mountains are characterized by high biodiversity, undulating physical settings, varied climatic regimes, and diversified social and cultural peculiarities. Unique historical, linguistic, political, cultural (religions, house styles, livelihoods farming methods), structural, ecological, and psychological dimensions define distinctly the region and its people (Dahal, 2008). The Himalayan region, a fragile area susceptible to multiple hazards such as earthquakes, landslides, droughts, wildfires, cloudbursts, is facing a multitude of undesirable changes across both biophysical and social realms many resulting from climate change (Jing and Leduc, 2010). It is expected that the net increase in temperature in the region will be between 1.7 °C and 2.2 °C by 2030 over 1970s levels (INCCA, 2010), however, increase in incidence and intensity of extreme events has been observed during the last few years (UAPCC, 2012). These changes pose serious threats to water resources, biodiversity, agriculture, human health, and food security (Chaudhary and Bawa, 2011), integral components of a good quality of life (MEA, 2005). People of the region lack access to basic facilities, services and institutions, and have higher dependency ratios on natural resources (Hunzai et al., 2011). Thus, the geography and socio-economic settings of the Himalaya make the region highly vulnerable to risk factors such as climate change, population growth, and globalization (Gerlitz et al., 2014). A risk-based approach could help to clarify the underlying relationships between the actual adaptation behavior, the awareness of climate change-related phenomena, and local people beliefs in future climate change (Li et al., 2017).

In the context of climate change, vulnerability is the degree to which a system is susceptible to, and unable to cope with adverse effects of climate change, including climate variability and extreme events (IPCC, 2001a). Climate change will pose additional impacts on the social and natural resources under the current social and physical settings of Himalaya, making the region more vulnerable (IPCC, 2007). Therefore, the impacts of climate change and the ongoing adaptation strategies can exacerbate a precarious situation for the Himalayan communities, already vulnerable to a multitude of environmental risks. Specific knowledge and data on human wellbeing in the Himalaya is limited, however, the continued effects of climate change need immediate understanding of local scale vulnerability. Therefore, it is important to understand how households and communities currently deal with change and to analyze whether or not these strategies will be beneficial in the future.

The knowledge of preferences and of the social prospects of the local community encourages the development of environmental decision-making process more informed (and therefore most reliable) and qualitatively more valid (Davies et al., 2015). The management policies must be inspired to the social perspectives in order to be considered adaptive. So that, in the future these policies should combine human welfare with the enhancement of ecosystem services. In this way, it is essential to manage ecosystems and to create future economies that foster both sustainable ecosystem services supply use and the promotion of human well-being (Reyers et al., 2009). In particular, the investigation of perception is fundamental for understanding adaptation and transformation vulnerability state. This because in the decision-making processes it is fundamental the way how people perceive the risks of climate change that it is the basis of their resulting adaptive capacity (Coelho, 2004). Their perceptions of the risks linked to climate change bear heavily the decisions about their everyday actions and how to adapt their behavior (Menapace et al., 2015).

Human perception of the environment shapes and is shaped by human knowledge of the environment, and involves interpretation of events or information; therefore, any landscape consists of two basic elements, the biophysical components of an area affected by human activities and analyzed through “objective” analysis, and the perception and the value assigned to the environment by people, evaluated through “subjective” analysis (Petrosillo et al., 2007, 2013). However, researchers have been carried out to evaluate the perception of household or community about different aspects of the climate change, but in a very disaggregate manner. In this research context, Tse-ring et al. (2010) and Chaudhary and Bawa (2011) have examined perception of changes in climate and consequences of such changes for biodiversity and agriculture, through household interviews in Himalaya.