

Class and Climate Change Adaptation in Rural India

Journal:	<i>Development and Change</i>
Manuscript ID	DECH-19-247
Manuscript Type:	Original Article
Keywords:	Climate change, Rural adaptation, Class relations, Rural Maharashtra, Local climate
Abstract:	<p>This article aims to understand how climate change and its impact on livelihood are understood within village societies in India, and examines the effectiveness of the dominant individual/private and community-based adaptation models to the realities of village societies. The manuscript is based on a case study in a village in western Maharashtra. It draws on two types of primary data, both quantitative and qualitative, including a round of socio-economic survey questionnaire, and qualitative semi-structured interviews. The findings suggest that climate knowledge is highly localised: awareness of climate is primarily based on individuals' experiences and, sometimes, on familial memory of the local environment. Finally and most importantly, our study demonstrates that economic conditions (socio-economic class membership) create specificities in human-climate relations – that adaptive capacity is class-specific. As such, our findings call for a more comprehensive understanding of the class nature of climate change as central in developing effective climate adaptation strategies that addresses the specificities and complexities of village life. Examining the complexities of class relations and climate adaptation is particularly important in the Indian context because class and status privileges shape the ownership and access to natural resources, carrying implications for adaptive competences and capacities.</p>

Class and Climate Change Adaptation in Rural India

Abstract

This article aims to understand how climate change and its impact on livelihood are understood within village societies in India, and examines the effectiveness of the dominant individual/private and community-based adaptation models to the realities of village societies. The manuscript is based on a case study in a village in western Maharashtra. It draws on two types of primary data, both quantitative and qualitative, including a round of socio-economic survey questionnaire, and qualitative semi-structured interviews. The findings suggest that climate knowledge is highly localised: awareness of climate is primarily based on individuals' experiences and, sometimes, on familial memory of the local environment. Finally and most importantly, our study demonstrates that economic conditions (socio-economic class membership) create specificities in human-climate relations – that adaptive capacity is class-specific. As such, our findings call for a more comprehensive understanding of the class nature of climate change as central in developing effective climate adaptation strategies that addresses the specificities and complexities of village life. Examining the complexities of class relations and climate adaptation is particularly important in the Indian context because class and status privileges shape the ownership and access to natural resources, carrying implications for adaptive competences and capacities.

Key words: Climate change, Rural adaptation, Class relations, Rural India, Local climate

1. Introduction

Humanity and nature are facing an interlocking set of environmental crises: climatic, atmospheric, oceanic and biospheric. Of these, climate change has been recognised as the “most significant threat” to humankind at the highest levels of global governance (see esp. Obama, 2015, cited in Jeffrey, 2015). Village societies live in closer proximity to nature, typically reliant on subsistence or semi-subsistence in relation to their local environment, and as such are highly vulnerable to any environmental change. In many ways tied to the land and with low-incomes, these communities have significantly little adaptive capacities. As a predominantly agricultural society, with two-thirds of its population living in rural areas, India is particularly vulnerable to climate change. According to the latest Intergovernmental Panel on Climate Change (IPCC) report (2018), India is extremely vulnerable to climate change because of its hot tropical climate, its geography, a heavy dependence of its agriculture on stable monsoons, and its coastline that stretches over 7000 km. The report further emphasises that the most vulnerable households are those engaged in agriculture as

their primary source of livelihood. In fact seven out of the top 10 most affected hotspot districts in India are located in the state of Maharashtra, making this study a particularly important case.¹ However, despite such vulnerabilities to climate change, surprisingly little empirical research has been undertaken on the economic relation between Indian village societies and climate change adaptation, both in terms of long-term processes resulting in extreme weather events and changes in precipitation cycles but also regarding livelihood pressures from stagnating soil fertility, declining agricultural production, and increased water scarcity. Social scientific research on climate change adaptation remains focused at the levels of international governance or national policies, lacking understandings of the economic and social relations of climate change at local levels. Given the imminent threat of climate change to village livelihoods, we will address two primary questions: firstly, how is climate change and its impact on livelihood understood in rural Maharashtra?, and secondly, how effective are the dominant individual/private and community-based adaptation models to the realities of village life? The findings suggest that climate knowledge is highly localised: awareness of climate is primarily based on individuals' experiences and, sometimes, on familial memory of the local environment. Finally and most importantly, our study demonstrates that socio-economic conditions create specificities in human-climate interactions: the ways in which households design adaptive strategies are informed by their socio-economic class membership – that adaptive capacity is class-specific. Therefore, the ways in which the community responds to local climate, and/or the lack of community-based decision-making processes to coordinate adaptation – are partly attributable to the class divisions within the same village. As such, our findings call for a more comprehensive understanding of the class nature of climate change as central in developing effective climate adaptation strategies that address the class specificities and complexities of village life.

The article is structured as follows: the first section briefly points out the importance of class-based adaptation research. The second section outlines study methods and data used

¹ India has endorsed the latest report of the Intergovernmental Panel on Climate Change, stating that it will bear a disproportionate burden of climate change (Mani, et al., 2018). The World Bank report, *South Asia's Hotspots*, supports these claims finding that climate change could cost India 2.8 per-cent of its GDP. At the Conference of the Parties (COP) UNFCCC in Delhi 2002, India pushed for a joint declaration on the significance of global warming, and agreed to attempt to limit global warming to 1.5 degrees. As early as June 2008 the Indian government put forward detailed plans which involved both climate mitigation and adaptation to achieve this goal. In 2018, the government released a five-year action plan to deal with climate change, developing a mid-century strategy for low carbon growth and ambitious renewable energy targets. How the Indian government has already set strategic adaptation priorities will largely dictate its future trajectory and whilst the 2008 and 2018 plans do include some adaptation components regarding agriculture, without detailed knowledge of the adaptation needs and capacities at the village level, such plans may be largely ineffective.

in this research. The third provides a detailed introduction to the field-site, and draws its rudimentary socio-economic divisions. The fourth is dedicated to reviewing the relevant literature on climate change adaptations. This section highlights the limited empirical studies on the relations between rural societies and their socially constructed natural environment. The fifth section focuses on a critique of the assumptions underlying both individual/private adaptation, and community-based adaptation models. Using empirical examples from the field-site, the section demonstrates that both approaches lack understandings of the differences in adaptation capacities between different households within the same village. The last section concludes by remarking on some of the implications of our findings for future research into climate adaptation policy.

2. Background

As is well known, adaptive capacity is location-specific, and therefore understanding environmental, organisational, and economic factors at the village level is critical to its effectiveness (Bryan and Behrman, 2013). Of particular significance is to understand the class nature of climate adaptation in India, for which there are primarily two reasons: firstly, it has been argued that autonomous adaptation behaviour by individuals or members of an economic class is insufficient to address the challenge of climate change, and may result in resource degradation and increasing burden on other socio-economic classes (Bryan and Behrman, 2013). Secondly, community-based adaptation is seen in this field as an unchanging analytical framework within which entire rural communities seek to adjust to the impacts of climate change as a single collective. But while the concept of community denotes face-to-face relations and collective capacities, Indian villages are in fact persistently and ubiquitously riven by dynamic class and social status relations (Aslany, 2018; Harriss-White, 2003; Harriss-White and Janakarajan, 2004; Basile, 2009). How class and other forms of social status shape interactions with climate change, and how different classes perceive and experience the impact of climate change on their livelihoods, the burden of degradation of resources controlled by one class on others, and how classes with conflicting interests deploy adaptation strategies and tactics are questions that have not been addressed. Using empirical evidence from the study-site, this study identifies these gaps in the current focus of adaptation scholarship and policy – and a means to address it by empirical work embedded in understanding of village life, its socio-economic differences, and its local climate. Community-based adaptation (CBA) policies neglect detailed engagement with the specific class composition and economic needs of village societies on the ground.

3. Data and evidence

This manuscript is grown out of two rounds of field research conducted between June 2016 and August 2018. It draws on two types of primary data, both quantitative and qualitative, that take into account the related processes of production and the use of natural resources (land and water in the context of this research); perceptions on climate change and its impact on livelihood; and rural households' adaptation strategies. First, a socio-economic survey questionnaire (structured interviews), collected from every available household in the village between June and August 2016 from participants, aged 18 and above. The survey covered 250 households and a total population of 1,604 in the village. The survey served as a tool in describing the socio-economic characteristics of the entire village population, and constructed a preliminary identification of socio-economical classes on the basis of land ownership.² Second, qualitative semi-structured interviews were undertaken in August 2018 among 30 sample households selected from the different classes identified through the survey. Topics included individuals' awareness and perceptions on climate change; personal accounts of their experiences with changes in the environment; perceptions of the impact of climate change on their livelihood and adaptive strategies (knowledge and practice) both at household and the village level; and changes in agricultural behaviour/s (for example crop variation, farming diversification, and moving away from agriculture). This cross-section of narratives enabled examination of the ways in which different classes experience climate change, alongside the modes of adaptation that rural households are already deploying.

4. The study site

The study-site is located 30 km south of Pune city, in the plain of series of hills, in western Maharashtra, and is mainly constituted of Maratha caste, engaged in both farm and non-farm activities.³ On the basis of the survey data, out of 250 households, 155 households (61.2 per cent of total households) in the village depend primarily on agriculture for their livelihood; 18 households (7.2 per cent of the total households) primarily depend on agricultural labour; 38 households (15.2 per cent of households) are engaged in both cultivation and other non-farm activities (for example independent economic activities such as plumbing, driving, manual factory labours, semi-skilled and skilled work in industrial units and low-ranked

² Additionally the data set was used for the purpose of household stratification/sampling – this was to ensure the finding of this research is representative of all socio-economic classes in the village.

³ The other caste groups include Scheduled Castes (10%); Dhangars (7%); and Other Backward Classes (2%).

government employment); and 33 households (13.2 per cent) have no direct connection to agriculture, mainly involved in industrial labour (unskilled manual work).⁴

In terms of agricultural production, the village is characterised by cultivation of rice, the main crop during the rainy season. However, majority of households cultivate more than one crop (for example onion, wheat and groundnuts which are mostly cultivated during the dry season). The village is commonly understood as a village of small holdings: the average landholding in the village is 2.6 acres for total land owned (the combination of agricultural land and dry land), and two acres for agricultural land, although 20 households do not own any agricultural land. The top four big land owning households, each owning more than 10 acres total land, own nine per cent of the total land surveyed in the village, while the small landholding households who own less than two acres of total land (141 households, 56.4 per cent) own together 135 acres or approximately 20 per cent of the total land surveyed in the village. The land distribution is thus highly unequal; and the ownership of agricultural/wetland is even more unequal (see Table 1). The reason for examining land distribution is that the highly unequal distribution of land suggests highly differentiated classes in the village.

Table 1 Distribution of land ownership (2015-16)

(N =250)	Wetland		Total land (Wet + Dry)		Distribution of total land	
	Freq.	Per cent	Freq.	Per cent	Area (Acre)	Per cent of total land
No land	20	8	19	7.6	0	0
Between 0.1 and 1	82	32.8	73	29.2	47.27	7.2
Between 1.1 and 2	59	23.6	51	20.4	88.125	13.5
Between 2.1 and 4	64	25.6	60	24	190.25	29.16
Between 4.1 and 6	19	7.8	29	11.6	152.25	23.3
Between 6.1 and 10	5	2	14	5.6	115.5	17.7
More than 10	1	0.4	4	1.6	59	9
Total	250	100	250	100	652.395	100

Source: fieldwork data (2016)

There is considerable water scarcity in the village and agricultural activity is primarily from rainwater and is therefore seasonal. The river that separates it from its neighbouring village has become very dry over the past 10 years, which has made the condition for the farmers (particularly small farmers) more severe. There is no water preservation infrastructure in the village and open wells are the main source of irrigation during the dry season.

⁴ See Aslany, M. (2018) *The Rural Middle Classes in India*, PhD Thesis, King's College London.

However, only 83 out of 250 households (33.2 per cent of the total households), have access to water-wells or boreholes. Climate sensitivity to agriculture is therefore very high in the village. For example, during the agricultural year 2015-16, insufficient rain had a significant negative impact on rice cultivation. According to respondents, recent changes in the climate, such as irregularity of rainfall and erraticism of agricultural seasons, have had unfavorable impact on their agricultural development, and that the climate conditions have become more critical for the livelihood strategies with time. It has resulted in various adaptation strategies such as pest control, usage of chemical fertilizers, crops diversifications, migrations, and most importantly to livelihood diversifications out of agriculture, mainly to unskilled industrial labour among the lower economic classes, and semi-skilled to skilled industrial labour and other non-farm activities among bigger landowners.

The following extract from an interview with a local farmer is illustrative of the impact of climate change on the local agriculture and the ways in which adaptation strategies are planned:

Something or the other is happening suddenly concerning the climate: there is heavy rainfall one year, and none in the following year. It looks as though the natural cycle has been disrupted. In the past we were able to plan our farming activities according to the Marathi calendar: we used to grow particular crops in particular months. Now such planning has vanished completely – it is no longer possible to plan agricultural activities. For example, prior to Bendur festival (BAIL POLA; farmers show their respect to Buffaloes by taking them off work and decorating them) and our rice sowing used to be completed, by which point the work of our bullocks used to be finished completely. Then we used to take those bulls to the forest so they can eat as much fresh grass and be free of work. But now the rice sowing goes on until much later, sometimes until the festival of Rakshabandhan (a Hindu festival when sister ties thread to her brother). Rainfalls have become irregular. Because of that farmers are very tensed. As we speak I have 200 gunny bags of onions stored. Because the weather is not good those onions are getting rotten. So some people have started growing tomatoes as a strategy to cope with the sudden weather change. But there is no good market for tomatoes and onions right now. But we have to sell our produce anyhow; otherwise they will all be wasted. The climate change has also resulted in shortage of manpower because of migrations. So you can see there is a lot of influence of extreme weather conditions on our lives. But the main impact is always on the small landowners who have no money capital to adjust to the changes – they have to struggle with water shortages if the rainfall is irregular or if the crop fails because of pests. Most of us, small farmers, are completely reliant on the rainwater. Those who own big areas of land and have better access to irrigations do not suffer the similar faith. Even if things go very badly in their farming, they have enough money capital to do some non-farm business.

As narrated by this respondent, and other small landholders, not all households are affected by climate change equally; nor do all adapt to the climate change in a similar way. In an agricultural economy such as this village where the majority of rural residents are still involved in cultivation, agricultural land is the primary identifiable means of production/subsistence. Unequal distribution of land and access to irrigations implies that the village is highly differentiated in terms of economic classes. Such unequal ownership and access to agricultural land and irrigation system carries implications for adaptive competences and capacities as we will demonstrate in this article, making a class based approach in climate change adaptation particularly important. As we will demonstrate below, adaptive strategies are class specific and vary amongst different socio-economic classes. Any effective adaptation strategy must take this into account.

5. Climate change adaptation models

Many of the dramatic shifts predicted by climate science in the coming decades are intensifying at an alarming rate across rural India: rising temperatures, changes in precipitation cycles, loss of biodiversity, extreme weather events, and declining productivity (particularly agricultural). A study by the Centre for Environment, Social and Policy Research (CESPR) and Indian Network on Ethics and Climate Change, noted the widespread loss of livelihood options across many of its regions due to climate change, especially through climate related disasters such as floods and erosion. Particular regions suffer different challenges: habitats of Indian Himalayan region and Nilgiri Tahr are quickly becoming “unsuitable”. Other regions, like Assam, are suffering significant decline in economic productivity (i.e. tea production) (Swati et al., 2012). Moreover, agriculture as currently practiced on small farms is already in the midst of an ongoing crisis (Taylor, 2015). Some studies suggest that over the last decade small holders across the agrarian regions in India have faced significant levels of indebtedness and deepening constrains upon their means of social reproduction through agriculture, resulting in the wave of farmer suicides (Taylor, 2015, p. 114). At a national level between 2003 and 2010, approximately 150,000 farmers faced with debt, committed suicides, out of which more than one fifth were concentrated in Maharashtra. These suicides are in part related to biophysical processes wherein crop failure occurs due to absent or erratic rains, which creates compounding pressures upon households (Sainath, 2013, cited in Taylor 2015, pp. 144-5).

A growing body of literature on collective action and rural development for climate change adaptation has suggested that rural communities’ adaptive organisation increases

resilience to climate risks when strengthening social networks and links with supporting institutions (Adger, 2003). In India, some research in villages has addressed perceptions of climate change, its impact on agriculture and livelihoods, together with adaptation strategies (Agarwal et al., 2018; Beermann et al., 2016; Dey et al., 2018; Lindegren and Brander, 2018; Sirohi and Michaelowa, 2007; Tripathi and Mishra, 2016; Vedwan and Rhodes, 2001). These studies outline climate risks faced by households that depend on the natural environment for their livelihoods. These risks include, “droughts, famines, floods, variability in rainfall, storms, coastal inundation, ecosystem degradation, heat waves, fires, epidemics, and even conflicts” (Agrawal and Perrin, 2008, p. 1). These studies shed light on how the impact of climate change (perceived by the village population primarily as changes in temperature and rainfall) is understood to affect agricultural productivity – both directly through physiological changes in crops and indirectly through erraticism of agricultural seasons, water availability, soil fertility, increases in destructive insects in agricultural fields, and growing illnesses. The idea of adaptation is then perceived as series of planned social adjustments to mediate such proximate climatic disturbances, which are individually or collectively intended to guard against climatic threats. These studies suggest that adaptation strategies in rural India, including, but not limited to, crop diversification, sustained investment in fertilisers, the diffusion of new technologies, and abandoning agriculture, are highly localised and village specific – that is, the social, political and economic conditions of each village create specificities in types of adaptations employed. However, adaptation is seen in these studies as an unchanging analytical frame within which entire rural communities seek to adjust to the impacts of climate change, and that in similar ways. But in fact Indian villages are persistently and ubiquitously riven by dynamic class and social status relations, which carries implications on adaptation capacity. How class and other forms of social status shape interactions with climate change has not been answered. This class basis of climate adaptation challenges the orthodox ideas that autonomous adaptation behaviour either by individuals or by communities is an appropriate grass-roots response to adaptation, or those that are community-based that may be planned or initiated at national level. The following extract from an interview with a farmer is illustrative of both specificities in types of adaptations employed in the village and the class nature of adaptations:

Ten years ago I used to yield many crops – good quality crops, and at that time my crops never had any kind of diseases, and the crop life was also longer. I did not use pesticides, or used very little, until ten years ago. But comparatively if you see nowadays the crop life is reduced. I can give you a real example: in our village we

are unable to grow the vegetable Dodka (Ridge gourd luffa, or Chinese okra, or Estropajo). Dodka in this village is vulnerable to different kinds of diseases. Hence nobody grows Dodka. Also nowadays new diseases have started with tomatoes too. The cost of purchasing pesticides is also high and as a small farmer I cannot afford it. So instead of growing tomatoes in three seasons, now I only cultivate them twice or once in a year. Because first and foremost, we are not getting proper market price for it, and secondly the expenses on tomatoes is unbearable for me. At this time [August] I yield tomatoes, and the rest of the year I really don't care much about it. Because in summer there is lots of heat, and hence tomatoes get infected with lots of diseases. Sometimes it also happens that I don't grow any tomatoes during one year because the weather condition in that particular year is not favourable. But nowadays there are latest technologies for agriculture, which I personally do not have access to. But if you see the bigger landowners have all new technologies like Mulching paper hath Roll. Now they have also started controlling the eggs of the insects, but I do not have access to any of those things. My land is small and I do not have money capital to face the unfavourable environmental changes.

Yet alongside difficulties of crop variation or equal access to technology, rural households suffer from the legacy of unequal land and water distribution within the same village – and which for poor households form significant barriers to household reproduction through agriculture. At an all-India level, by 2005–06 almost 65 per cent of agricultural households owned less than one hectare and a further 19 per cent owned between one and two hectares (Basole and Basu, 2011, cited in Taylor, 2015). The intense pressures upon households with smallholdings to provide the means for subsistence results in incorporating diverse livelihood strategies. Moving away from agriculture has become a key adaptation mechanism – it reduces dependency on the income from farming that has become unreliable due to changes in precipitation and deterioration of soil quality (Taylor, 2015). While our data indicates that lack of capacity to adapt to climate change may mean that that agriculture is no longer a sufficient means of social reproduction for a majority of households, the opportunities for off-farm employment nevertheless have expanded in an uneven fashion (Taylor, 2015). As explained by a respondent:

Because of decline in the soil quality and overall the bad condition of the land, the natural fertilizer in the land is getting reduced. Also many people of this village have migrated to work in factories and other ad hoc work in cities, hence keeping animals and taking care of animals has also reduced. Because of that the natural fertilizers like cow dung etc. has reduced and instead artificial fertilizers are being used. Also because bigger farmers have capital money, hence they are using fertilizers and pesticides full of chemicals, and do cash crops, while small landholders who have no access to water or capital depend entirely on rain, and if there is less rain, or sometimes more rain than regular, then their crop fails and they have to earn income through manual labour in nearby factories. Some small farmers have left agriculture

altogether because of that and do casual manual wage work in urban areas or in factories and workshops in nearby towns.

Yet livelihood ‘diversification’ has proven extremely uneven within rural India. A detailed study of livelihood diversification in the village (Aslany, 2018) shows that while some diversification strategies did succeed in increasing real incomes for some, for most small farmers it has offered little opportunity to cope and to mitigate low productivity in agriculture, which in turn have implication on class division in rural India.

6. The limits of individual/private and community-based adaptation models

Given the stark realities of climate change within a village such as our study site, what existing policy frameworks for adaptation could be effective in this context? The mainstream approaches to climate change adaptations can be broadly categorised into either individual private adaptation and community-based adaption (CBA). In this section we provide an overview of each approach, offering an immanent critique of the claims of each model through examples of lived experiences of the village. In so doing, we highlight the necessity of further research into the class-basis of adaptation strategies.

Understanding the political economy of climate change at the local level is vital for any effective approach to adaptation. Economic needs of industry and production are not only leading contributors of global GHG emissions, but economic considerations such as livelihood and income are also typically placed at the forefront of all adaptation strategies. For example, it is common to have adaptation policy overlapping with development objectives (McGray et al., 2007). However, at the macro-level, most climate adaptation research remains focused either at systems of international governance or national policy, lacking the necessary examination of the cross-sectoral nature of climate change at the local level. Even though rural communities form the bulk of the food and agriculture sector and are especially vulnerable to the worst impacts of climate change, existing approaches do not yet adequately engage with the role of local dynamics of power and interests in shaping governance approaches to climate adaptation – this is especially so at the village level. Cammack has shown the disconnection between some of the proposed solutions addressing climate change at the local level, highlighting the need for more concerted research into this area (Cammack, 2007). Similarly, Tanner and Allouche have argued that effective climate change initiatives must explicitly recognise the political economy of inputs, processes, and outcomes at the local level (Tanner and Allouche, 2011). Moreover, as Sovacool and Linnér

have shown, adaptation projects can produce unintended, undesirable results that can become highly pernicious within communities, having uneven affects that exacerbate existing inequalities and social discord (Sovacool and Linnér, 2016). Yet, as our data demonstrates, households within the same village are not equally affected by climate change in relations to their livelihood, nor exist under similar climate threats, due to different livelihood options and resources for adaptation.⁵ In the absence of policy initiatives that balance competing and highly disaggregated economic, social, and political interests – and especially those that fail to factor in environmental-economic trade-offs at the local level – may have harmful, unintended consequences. The purpose of our research design is to expose the discrepancies and contradictions between individuals within the same village that emerge between the positive feedback loop of class position, climate change effects, and climate change adaptation.

In our study site, there are only individual based adaptation actions – undertaken ad hoc and utterly dependent on the resources available to the individual or household. Typically, individual/private adaptations alter behaviour according to perceived shifts in climate change, seek to minimize private economic losses, and are usually small-scale, and reactive strategies applied only *after* observing climate change impacts (Eakin and Patt, 2011). As Ostrom has shown, at multiple scales – from the individual to the village – have different perceptions, needs, and preferences and as such each make adaptation decisions based on their access to and control over resources (such as assets, time, and habitus) and decision-making power (Ostrom, 2005). When looking at village communities, individual/private adaptation is fraught with problems of opposed private and climate interests, limits of scale, lack of cooperation, and competing or contradictory ends/wants – many of which have been highlighted in the Fifth Assessment Report of the IPCC the international framework for individual adaptation. Despite recognising these limitations however, the Fifth Assessment Report is largely irrelevant to rural Indian villages. The Report's emphasis on lifestyle changes are divorced from the socio-cultural context of rural India where most village communities are already car-free, do not fly, and eat largely plant-based diets. Birth-rate is the only strategy applicable and yet is made devoid of key cultural and economic concerns related to Indian village communities and family systems. Even if we regard lifestyle and consumption as a factor at the village-level, its relative contribution pales in

⁵ For a similar finding in Bangladesh see G.M.M. et al, "Strategies and Barriers to Adaptation of Hazard-Prone Rural Households in Bangladesh," in *Limits to Climate Change Adaptation* Editors: Leal Filho, Walter, Nalau, Johanna (Eds.), Springer, 12ff.

comparison to the climate footprint of international corporations where 100 companies have been reported as responsible for 71% of global emissions since 1988 (The Carbon Majors Database Report, 2017). Studies have shown that, globally, the private sector is currently not held accountable for adaptation finance or adaptation expenditure; there is no evidence that mobilised private adaptation finance leads to the desired adaptation outcomes in developing countries; and there is little evidence that mobilised private adaptation finance leads to desired adaptation outcomes (Pauw, 2017).

Given the individualised nature of village income to each household, adaptation actions such as infrastructure and access to climate technologies are simply too expensive to implement privately – even though they may be technically effective. In order to increase the number of possible desirable adaptation actions, a village society – and each household within it – needs more disposable resources that can be dedicated to adaptation. This requires both fair collective decision-making processes but also economic and technical resources to undertake the strategy. Yet such solutions suffer from two problems as our findings suggest: Indian villages are not necessarily collective but tend to be structured loosely around individual household decision-making processes; and secondly, there is little economic resources or education/technology transference to underpin these individual/private adaptation strategies.

Our data show that access to, or control over, assets or social status is a fundamental constraint to the effectiveness of individual/private adaptation strategies (all interview extracts are illustrative of this). Primary barriers to individual/private adaptation revolve around the lack of availability or access to financial resources or assets to adopt adaptation practices (Bryan et al. 2013; Brouwer et al., 2007; Gbetibouo, 2009; Deressa, et al. 2009). As we have found, the bargaining power over access to water or soil is one of the major issues facing small and marginal farmers like Sagar who told us:

Mud and wet soil are being dug and taken away from the hills in the village [which is the common land] by the upper class big farmers [large landowners] or upper caste households in the village. That is a good quality soil. They also engage in lots of tree cutting – I have seen it myself many times. These big farmers in a way contribute to the adverse environmental changes in the village. Some of them take the mud [wet soil] from the hills and sell the mud to the smaller farmers who have no access to irrigation. Sometimes they also divert the water towards their own land. We cannot say anything to them, as they are the upper class. Some of them also sell water to small farmers who have no access to irrigation. Water access in our village is limited and is always in the disposal of upper class farmers. We small farmers mainly rely on the rainwater for our farming and therefore plan our crop accordingly. Nowadays the rain is also unpredictable and irregular so planning becomes very hard.

In response to a question about community planning to reduce the impact of climate change, another farmer told us:

In our village each and every person handles the situation individually because each and every household has a different size of land or different access to water-well, and therefore different money capital available. It happens that sometimes some people face some financial problems so they sell mud etc. So there is no community planning. But sometimes we come together and decide that we should all together sell the mud of the hills, because it is the common land of the village and should therefore benefit all of us. But it is not possible because the big farmers oppose it. These big farmers are not present in the village themselves – they are mainly living in cities. But they appoint a middleman to take care of that land and sell the mud on their behalf. That is how things are done here. So we can say they are mud thieves (Maati chor). Selling mud is wrong.

Other studies confirm our observations. For example, studies sensitive to the context of Indian villages has shown that water trading can give individual irrigators who understand the system and have the financial capacity to purchase water far greater flexibility in adaptation, thereby exacerbating existing inequalities within the community (Bryan and Berhman, 2013; Taylor, 2015). Similarly, farmers acting individually may choose to expand agricultural production or begin to use invasive methods (chemical and pesticides) as a response to climate change, leading to resource degradation and increasing the burden on other members of the community. These actions then become maladaptive, increasing the vulnerability of individuals, institutions, sectors, or regions (Barnett and Campbell, 2010).

Studies demonstrate that the influence of social capital on the effectiveness of individual adaptation, alongside individual preferences, knowledge, and interests (Bryan and Berhman, 2013). The UNFCCC has stated with high confidence that individual and societal knowledge influences the capacity to develop and use technologies to achieve adaptation objectives (UNFCCC, 2006; Adger et al., 2007). Yet it is important to refract such rational-choice assumptions with how class relations intersect across any other number of other individual characteristics. One particularly important class intersection is gender. Bryan and Behrman have shown how gender has a profound impact on individuals' ability to cope and adapt with climate change. In rural India, women are largely excluded from lands right and from participating in group decision making to change such social status, thus constraining them from many forms of adaptation. When collecting data, there was a fundamental difference in male and female responses. Women were often unable to provide accurate answers to questions, and were often hesitant and uncertain in their responses, and therefore

were unable to give opinions on the topics. Many women stated that they were not familiar with the topic of climate change, or its impact on livelihood, or adaptation strategies, which made them less confident of engaging in the interview. Evidence suggested women were largely excluded in the household decision-making without which many adaptations cannot be utilised.

Furthermore, data gathered showed that members of upper class or big landowning class in the village are differentiated from other classes by its successful accumulation of capital (land and irrigation), which enabled members to systematically hire-in wage labourers and appropriate the surplus value from the labour power of others, investing this surplus in the expanded field of non-agricultural productive units. Such accumulation strategies through diversified modes of accumulation among the member of the upper class are due to their abundant water access. This allowed big landowning to be relatively unconcerned with securing water supplies or to invest in irrigation facilities, which reduced their need to re-invest in agricultural development and for this surplus capital to be available for reinvestment away from agriculture. In contrast, for small landholders with little access to capital and who often have little access to irrigation, greater care and financial investment is required to develop agricultural facilities and maintain subsistence levels. The example of the biggest landowner in the village, illustrates such diversification. He owns a total of 25 acres, of which 15 acre is under rice cultivation. Having farmed all his land until a decade ago, he now leases out 10 acres to a factory on a 50-year contract. He stated that doing business is 'more trendy' than doing farming, and is more profitable. Other sources of family income include investment in real state and a dairy business, generated from their own livestock. When I asked how he invested his extra income he stated: 'I invest my capital in purchasing lands, and then selling those lands in one or two years. I earn good money in that. I also invest a lot in private education for my children.'

Outside these contradictory interests of private accumulation and environmental protection, individual/private adaptation is also limited by the fact that both individual and social characteristics (such as those particular to each village locale) may act as deep-seated barriers to adaptation (Adger et al., 2009, in Klein et al., 2014) – also shown in the interview extracts above. Within Indian villages, understanding how the characteristics of ethics, knowledge, attitudes to risk, cultural values, and decision-making processes both constrain and enable adaptation must be taken into account (Adger et al., 2008). One of the most important is community norms or values that may conflict with adaptation strategies. Rohan has shown how both individuals and groups have associated value systems (defined as

meaning-producing cognitive structures) that integrate members into predictable relations amongst value priorities (Rohan, 2000, p. 270). These value systems play an important role in responding to climate change adaptation as they frame what is to be prioritised at the village level. For example, it has been shown that communities prefer to implement activities that they are familiar with (Spires, Shackleton, and Cundill, 2014). Yet, it is important that values are not presented in such a way as to render village-systems as operating under uniform value-systems as these may be hegemonic but are always contested. Individuals and households may challenge and dissent from such values, pursuing different adaptation strategies. As stated simply by Piggott-McKellar et al., ‘while a barrier may be perceived as such by one actor, it may not be the case for another, depending on how something is valued’ (Piggott-McKellar et al., 2019, p. 3). Climate change that poses limits to the sustainability of an individual farmer may not be perceived or felt by another farmer due to either highly localised environmental variations, differences in the type of produce/crops, and regarding access to resources. Even where values hold across a village community, individuals have their own perspectives about what are acceptable, tolerable, or intolerable risks. When uniform values are absent, there is usually also discordance or lack of cooperation capable between individuals acting privately within the same village that may lead to competing and even contradictory ends. For example, some local governments in Australia have reported the difficulties in pursuing adaptation efforts owing to perceived conflicts between potential adaptation options and the values and preferences of individuals and stakeholder groups within the community (Measham et al., 2011, p. 917). Other studies have found this cooperative lack may lead to a duplication of efforts and a waste of scarce resources, or in the worst cases, conflicting outcomes (Lipper and Pelling, 2006).

Many have argued that to avoid the negative outcomes of individual/private adaptations that communities must work collectively, rather than individually, to address the many challenges they face (Bryan and Behrman, 2013) – and CBA has become one of the most popular alternative models. CBA is defined as “a community-led process, to empower communities by being based on their priorities, needs, knowledge and capacities (Reid et al., 2009, p. 13, cited in Piggott-McKellar et al., 2019). Inter alia, CBA requires: collective action and social capital; long-term impact into planning processes; integration of local knowledge and perceptions of climate change and risk; to be led by local decision-making processes; to be in accordance with community priorities and needs (Hickey and Mohan, 2004). In these ways CBA aims to address the root causes of vulnerability within communities (Ayers and Forsyth 2009) through the co-production of adaptation strategies made between local needs

and inputs with external scientific or policy experts that promises to be more effective than individuals acting alone. Given that climate change impacts and adaptive capacity are location-specific, CBA at the village level appears crucial to any successful adaptation strategies in rural India. Indicative of this view is a small but growing body of literature on CBA and rural development (Adger, 2003; Ayers and Forsyth, 2009; Dodman and Mitlin, 2011) that highlights that such approaches may strengthen social networks and thereby increase community resilience to climate change (Adger, 2003).

Given these promises, it is disconcerting that the ways in which CBA models are produced and enacted has, in most cases, been shown to be far from its principles (Carolan 2006). A key limitation is that many CBA projects are not participatory (Leventon et al. 2014; Simane and Zaitchik, 2014). Piggott-McKellar et al. have undertaken a review of the barriers to community-based adaptation that is comprehensive (Piggott-McKellar et al., 2019), showing that CBA initiatives are usually implemented hierarchically in top-down processes, lacking genuine and meaningful community participation under the guise of ‘consultation’, with external priorities and outside decision-making structures retaining real power (Piggott-McKellar et al., 2019; Reid and Schipper 2014). Such top-down approaches may not be in the best interest of the community, concentrating on economic and sectorial risks rather than the livelihood vulnerability in local communities (Ayers, 2011), or neglecting the community’s participation in policy-making and implementation (Agrawal and Perrin, 2008). CBA has been looked at through disaster risk management (Liu et al. 2016; Stone et al. 2014), natural resource management (Measham and Lumbasi, 2013; Mountjoy et al., 2013; Mountjoy et al., 2016), and tourism (Ruiz-Ballesteros, 2011; Sebele, 2010) but not through class relations at the village level – so that CBA is inherently abstracted from local context of rural India. Piggott-McKellar et al. show the disparity between critical academic literature on CBA and what is actually being implemented on the ground – calling it a “dearth” of analysis (Piggott-McKellar et al., 2019, p. 4). Without understanding the class differences between individuals and households within the village society, CBA’s commitment to the principle that adaptation be driven by the community will remain partial, a hierarchical imposition rather than co-production of adaptation.

We agree with Adger et al. that the ability of individuals, households, and villages to respond to climate change depends on the *context* in which it occurs (Adger et al., 2009). Yet this context must include *all* factors that determine adaptive capacity and therefore specifically include class relations. That is, as rural households suffer under livelihood pressures that further complicate adaptation, CBA must be integrated with the complexity of

class relations alongside its usual focus on development, disaster risk, and livelihood resilience (Davies et al., 2009; Heltberg, Siegel, and Jorgensen, 2009). For example, in rural Bangladesh, Amin, Rai, and Topa (2003) have shown that while CBA activities are successful in reaching the poor they are less successful in reaching the vulnerable, and unsuccessful in reaching the vulnerable poor. If village societies are not seen in direct reference to their actual existing class relations, adaption can result in exacerbation of existing inequalities and levels of marginalisation (Buggy and McNamara, 2016). At the same time, CBA must also recognise that individuals and households within the same village do not have a monolithic set of interests, priorities, or abilities to participate and thus, as Byran and Behrman have argued, social differentiation by economic status and class, age, ethnicity, gender, and social status are of crucial significance in any CBA actions. However, little research has yet been directed to the intersection of class with gender, race and caste in relation to climate adaptation. Our interviews consistently showed the lack of community-based adaptation planning. For example a farmer who owns 2-acre of agricultural land told us:

In earlier times frankly speaking all used to help each other. For example, during summer, when we did not have much work, we used to take up various collective activities, like cleaning the village, making roads, or taking care of the agricultural waste. But unfortunately now in today's time nobody is ready to listen to anybody or participate in collective actions.

Another farmer gave us a similar narrative:

A solution to a problem only comes when each and everyone gives his cooperation. Government finds out what calamity has taken place and how much losses have occurred, and as per that people are given benefits, and accordingly that final report is prepared by Government authorities. But if you talk about the village, village people do not cooperate. Because in the village each and everyone's thoughts are very different. Every individual just thinks about himself. Every person has a big mountain of thoughts about himself only. Everyone is facing his or her individual problems. Hence we do not come together to face environmental challenges. How is it in big cities [he asked us]? I don't know about the thought processes in cities.

For CBA to be genuine initiatives must be framed around the capacities – material and institutional - that already exist within communities (Dean, Green, and Nunn, 2017). As such CBA must tread a fine-line: comportment with local cultural and institutional conditions and, at the same time, to ensure that all members of the community have the ability to

meaningfully participate in these structures, without which CBA would merely become a tool of power and privilege. The broader impact of CBA depends on who within the community is able to participate in CBA strategies, and how. A number of variables, including age, wealth, ethnicity, social status or gender, have been shown to shape the ability of community members to participate in CBA strategies (Thomas and Twyman, 2005; Eriksen and Lind, 2009; Schwartz et al., 2011). Yet certain village members may disproportionately hold decision-making power or control over community assets, land, political channels, knowledge, cultural norms and values. Here, deeply entrenched social institutions may determine which group members will be able to have a voice and ultimately exercise power. As with individual-adaptation barriers, many poorer village members may not have access to key complimentary assets (land or money) necessary for participation in CBA. Our research highlighted the absence of either vertical or horizontal institutions or governance structures related to climate change.

The ways in which CBA can be ‘community-based’ are myriad, from deliberative, grass-roots, to broad engagement of stakeholders or even consultations. What distinguishes CBA is that it must be aligned with the community needs and perceptions (Piggott-McKellar et al., 2019, p. 13) and it is here that scholarly critique must be focused. Of particular concern is how top-down approaches continue to be used in CBA projects under the guise of being “community based” (Reid and Schipper, 2014). Many national-plans often fail to adequately include local communities and institutions in the policy-making process and in implementation of adaptation efforts (Agrawal and Perrin, 2008). As argued by Piggott-McKellar et al. (2019: 6), the assumption behind CBA that “community” can represent a cohesive, unified, and homogenous group, however: “this assumption can be misleading given that communities contain both individuals and groups of people that have different socio-political characteristics including varying levels of access to and control over services (such as education and health care), resources, decision making, and political influence, among others. This results in some people, or groups of people, within communities being more marginalised and vulnerable than others.” Our class relational approach, offers an immanent critique of the claims of CBA exposes the gap between its promise and reality, by examining CBA efforts in concrete terms. Such knowledge must be embedded in real class relation of the recipient communities to be effective, to provide a more holistic and deeper understanding of how CBA barriers can be addressed according to communities themselves and thus provide better outcomes at the local level. Without this move enmeshed within real economic concerns of people, CBA activities whether directed to livelihood resilience (such

as income diversification and agricultural technologies); disaster risk reduction; capacity strengthening of government institutions and local civil society; and advocacy and social mobilisation (Giroto, Ehrhart, and Oglethorpe, 2012) may have pernicious outcomes in already class-riven village societies.

7. Conclusion

Literature on climate change adaptation highlights how adaptation is an inherently “political” process; it produces “winners” and “losers” in terms of distribution of benefits and costs (Adger et al., 2006; Eriksen and Lind, 2009). What we have observed in our study village is that the class basis of the village differentiates the adaptive capacity of its people, compounding existing economic and climate inequalities. This suggests the presence of different social-economical classes within the same village community, depending on how each individual or household relies on environmental factors for subsistence or labour, a finding that highlights the urgent need for a deeper engagement with the class basis of adaptation at the local level, something only future research can determine. Both individual/private and CBA adaptation models are confounded by the class-basis of village life, and yet little research is being undertaken into this complexity without which adaptation policy cannot ameliorate climate change effectively. In this way, our findings agree with Piggott-McKellar et al. (2019) that CBA initiatives must overcome the assumption that communities are a cohesive, united group and instead view them in their concrete differences, heterogeneity, and unequal characteristics. Furthermore, we agree that it is important that CBA is not idealised as a panacea for the implementation of adaptation initiatives without understanding the local socio-political context, inclusive of class. A class-relational approach promises to offer an added dimension to understanding the complexity of a village society by showing how, and in what ways, individuals and households within the same village community have divergent adaptation capacities.

References

- Adger, W. N. (2003) 'Social capital, collective action, and adaptation to climate change', *Economic Geography*, Vol. 79, pp. 387–404
- Adger, W. N., S. Dessai, M. Goulden, M. Hulme, I. Lorenzoni, D. R. Nelson, and A. Wreford (2009) 'Are There Social Limits to Adaptation to Climate Change?', *Climatic Change*, 93 (3–4): 335–354.
- Adger, W.N., Dessai, S., Goulden, M., et al. (2008). Are there social limits to adaptation to climate change? *Climatic Change*. 93: 335-354.
- Agarwal, P. K. et al. (2018) 'The climate-smart village approach: framework of an integrative strategy for scaling up adaptation options in agriculture', *Ecology and Society*, 23(1): 14.
- Agrawal, A. and Perrin, N. (2008) 'Climate adaptation, local institutions and rural livelihood', *IFRI Working Paper*, No. W081-6, Michigan: International Forestry Resources and Institutions Program, University of Michigan.
- Amin, S., A. Rai, and G. Topa (2003) 'Does microcredit reach the poor and vulnerable? Evidence from Northern Bangladesh', *Journal of Development Economics*, 70: 59–82.
- Annah E. Piggott-McKellar, Karen E. McNamara, Patrick D. Nunn & James E. M. Watson (2019): What are the barriers to successful community-based climate change adaptation? A review of grey literature, *Local Environment*, DOI: 10.1080/13549839.2019.1580688
- Assam State Action Plan on Climate Change (2015 - 2020). Report. Assam: Department of Environment and Forest, Government of Assam, India, September 2015. pp. 1-127.
- Aslany, M. (2018) *The Rural Middle Classes in India*, PhD Thesis, King's College London.
- Awasthi, A. (2018) "Why India needs to worry about climate change," *BBC News*, (25 October 2018), Available at: <https://www.bbc.com/news/world-asia-india-45949323>
- Ayers, J., and T. Forsyth (2009) 'Community-based adaptation to climate change: Strengthening resilience through development', *Environment*, 51 (4): 22–31.
- Barnett, J., and Campbell, J. (2010) *Climate Change and Small Island States: Power, Knowledge, and the South Pacific*. London; Sterling, VA: Earthscan.
- Basile, E. (2009) 'The Institutional Embeddedness of Indian Rural Capitalism', in Basile, E. and Mukhopadhyay, I. (Eds.) *The Changing Identity of Rural India: A Socio-historic Analysis*, New York: Anthem Press, pp. 31-62.
- Basole, A., and Basu, D. (2011) 'Relations of production and modes of surplus extraction in India: part I – agriculture', *Economic & Political Weekly*, XLVI(14), pp. 41–59.
- Beermann, J., Damodaran, A., Jörgensen, K. & Schreurs, M. A. (2016) 'Climate action in Indian cities: an emerging new research area', *Journal of Integrative Environmental Sciences*, Vol. 13, No. 1, pp. 55-66

Brouwer, R., S. Akter, L. Brander, and E. Haque. 2007. Socioeconomic vulnerability and adaptation to environmental risk: A case study of climate change and flooding in Bangladesh. *Risk Analysis* 27(2): 313–326.

Bryan, E. & Behrman, J. (2013) ‘Community–based adaptation to climate change: A theoretical framework, overview of key issues and discussion of gender differentiated priorities and participation’, CAPRI Working Paper No. 109. Washington: International Food Policy Research Institute.

Bryan, E., C. Ringler, B. Okoba, C. Roncoli, S. Silvestri, and M. Herrero (2013) ‘Adapting agriculture to climate change in Kenya: Household strategies and determinants’, *Journal of Environmental Management* 114: 26–35.

Buggy, L., and K. E. McNamara (2016) ‘The Need to Reinterpret “Community” for Climate Change Adaptation: A Case Study of Pele Island, Vanuatu’, *Climate and Development*, 8 (3): 270–280.

Cammack, D. (2007) ‘Understanding the Political economy of climate change is vital to tackling it’, Prepared by the *Overseas Development Institute for UN Climate Change Conference* in Bali, December 2007.

Carolan, M. S. (2006) ‘Sustainable agriculture, science and the co–production of ‘expert’ knowledge: The value of interactional expertise’, *Local Environment: The International Journal of Justice and Sustainability*, 11(4): 421–431.

Davies, M., B. Guenther, J. Leavy, T. Mitchell, and T. Tanner (2009) ‘Climate change adaptation, disaster risk reduction, and social protection: Complementary roles in agriculture and rural growth?’ *IDS Working Paper*, 320, University of Sussex Brighton: Institute of Development Studies.

Dean, A., D. Green, and P. D. Nunn (2017) ‘Too Much Sail for a Small Craft? Donor Requirements, Scale, and Capacity Discourses in Kiribati’, In *Island Geographies: Essays and Conversations*, edited by E. Stratford, 67–88. New York: Routledge.

Deressa, T. T., R. M. Hassan, C. Ringler, T. Alemu, and M. Yesuf (2009) ‘Determinants of farmers’ choice of adaptation methods to climate change in the Nile Basin of Ethiopia’, *Global Environmental Change*, 19: 248–255.

Dey, T., Pala, N. A., Shukla, G., Pal, P. K., Das, G. and Chakarvarty, S. (2018) ‘Climate change perception and response strategies of forest fringe communities in Indian Eastern Himalaya’, *Environment, Development and Sustainability*, Vol. 19, No. 2, pp.1-14.

Dodman, D. and D. Mitlin (2011) Challenges for community–based adaptation: Discovering the potential for transformation, *Journal of International Development*, published online 25 Feb 2011.

EBRD (2011) ‘Political economy of climate change policy in the transition region’, in *Special report on Climate Change: the Low Carbon Transition*, European Bank for Reconstruction and Development, Chapter 4.

Eriksen, S., and J. Lind (2009) 'Adaptation as a political process: Adjusting to drought and conflict in Kenya's drylands', *Environmental Management*, 43: 817–835.

Gbetibouo, G. A. (2009) 'Understanding farmers' perceptions and adaptations to climate change and variability: The case of the Limpopo Basin, South Africa', *IFPRI Discussion Paper*, 849. Washington, D.C.: IFPRI.

Giroto, P., C. Ehrhart, and J. Oglethorpe (2012) *Integrating Community and Ecosystem-Based Approaches in Climate Change Adaptation Responses*, http://careclimatechange.org/files/adaptation/ELAN_IntegratedApproach_150412.pdf.

G.M.M. et al, "Strategies and Barriers to Adaptation of Hazard-Prone Rural Households in Bangladesh," in *Limits to Climate Change Adaptation* Editors: Leal Filho, Walter, Nalau, Johanna (Eds.), Springer, 12ff.

Hallie C. Eakin and Anthony Patt, "Are adaptation studies effective, and what can enhance their practical impact?", in *Wiley Interdisciplinary Reviews: Climate Change*, 2 (2) (2011), pp. 141-153.

Harriss-White, B. (2003) *India Working: Essays on Society and Economy*, Cambridge: Cambridge University Press

Harriss-White, B. and Janakarajan, S. (eds. 2004), *Rural India Facing the 21st Century: Essays on Long Term Village Change and Recent Development Policy*, London: Anthem Press.

Heltberg, R., P. B. Siegel, and S. L. Jorgensen (2009) 'Addressing human vulnerability to climate change: Toward a 'no-regrets' approach', *Global Environmental Change*, 19 (1): 88–99.

Hickey, S., and G. Mohan (2004) 'Towards participation as transformation: Critical themes and challenges', In *Participation: From tyranny to transformation*, S. Hickey and G. Mohan, eds. London and New York: Zed Books.

Klein, R.J.T., G.F. Midgley, B.L. Preston, M. Alam, F.G.H. Berkhout, K. Dow, and M.R. Shaw, (2014) Adaptation opportunities, constraints, and limits. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Leventon, Julia, Felix K. Kalaba, Jen C. Dyer, Lindsay C. Stringer, Andrew J. Dougill (2014) 'Delivering Community Benefits Through REDD+: Lessons From Joint Forest Management in Zambia', *Forest Policy and Economics*, 44: 10–17.

Lipper, L. and M. Pelling (2006) 'Disaster risk, climate change and international development: Scope for, and challenges to, integration', *Disasters*, 30 (1): 19-38.

Liu, Y., K. Yin, L. Chen, W. Wang, and Y. Liu (2016) 'A Community-Based Disaster Risk Reduction System in Wanzhou, China', *International Journal of Disaster Risk Reduction*, 19: 379–389.

Mani, M., Bandyopadhyay, S., Chonabayashi, S., Markandya, A. Mosier, T. (2018) *South Asia's Hotspots : Impacts of Temperature and Precipitation Changes on Living Standards. South Asia Development Matters*; Washington, DC: World Bank. Accessed on <https://openknowledge.worldbank.org/handle/10986/28723>

Martin Lindegren & Keith Brander (2018) Adapting Fisheries and Their Management To Climate Change: A Review of Concepts, Tools, Frameworks, and Current Progress Toward Implementation, *Reviews in Fisheries Science & Aquaculture*, Vol. 26, No. 3, pp. 400-415

McGray, H., A. Hammill, R. Bradley, E. L. Schipper, and Parry, J. E. (2007) *Weathering the storm: Options for framing adaptation and development*, Washington, D. C.: World Resources Institute.

Measham, T., and J. Lumbasi (2013) ‘Success Factors for Community-Based Natural Resource Management (CBNRM): Lessons From Kenya and Australia’, *Environmental Management*, 52 (3): 649–659.

Mountjoy, N. J., E. Seekamp, M. Davenport, and M. Whiles (2013) ‘The Best Laid Plans: Community-Based Natural Resource Management (CBNRM) Group Capacity and Planning Success’, *Environmental Management*, 52 (6): 1547–1561.

Mountjoy, N. J., M. R. Whiles, G. Spyreas, J. R. Lovvorn, and E. Seekamp (2016) ‘Assessing the Efficacy of Community-Based Natural Resource Management Planning with a Multi-Watershed Approach’, *Biological Conservation*, 201: 120–128.

Ostrom, E. (2005) *Understanding institutional diversity*, Princeton: Princeton University Press.

Pauw, W. P. (2017) *From Public to Private Climate Change Adaptation Finance: Adaptation finance for financing adaptation?* Utrecht: Univ. Utrecht, Diss.

Reid, H., and L. Schipper. (2014) ‘Upscaling Community-Based Adaptation: An Introduction to the Edited Volume’, In *Community-based Adaptation to Climate Change: Scaling it up*, edited by L. F. Schipper, J. Ayers, H. Reid, S. Huq, and A. Rahman, 3–21. Abingdon, Oxon: Routledge.

Reid, H., M. Alam, R. Berger, T. Cannon, S. Huq, and A. Milligan (2009) ‘Community-based Adaptation to Climate Change: An Overview Participatory Learning and Action’, *Community-Based Adaptation to Climate Change*, (pp. 11–33), Nottingham: Russell Press.

Ruiz-Ballesteros, E. (2011) ‘Social-ecological Resilience and Community-Based Tourism: An Approach From Agua Blanca, Ecuador’, *Tourism Management*, 32 (3): 655–666.

Sainath, P. (2013), “Tankers and the Economy of Thirst”, *The Hindu* (March 27), Available at: <http://www.thehindu.com/opinion/columns/sainath/tankers-and-the-economy-ofthirst/article4551597.ece>

Schwarz, A. M., C. Béné, G. Bennett, D. Boso, Z. Hilly, C. Paul, R. Posala, S. Sibiti, and N. Andrew (2011) 'Vulnerability and resilience of remote rural communities to shocks and global changes: Empirical analysis from Solomon Islands', *Global Environmental Change*, 21(3): 1128–1140.

Sebele, L. S. (2010) 'Community-based Tourism Ventures, Benefits and Challenges: Khama Rhino Sanctuary Trust, Central District, Botswana', *Tourism Management*, 31 (1): 136–146.

Simane, B., and B. F. Zaitchik (2014) 'The Sustainability of Community-Based Adaptation Projects in the Blue Nile Highlands of Ethiopia', *Sustainability*, Switzerland 6 (7): 4308–4325.

Sirohi, S. and Michaelowa, A. (2007) 'Sufferer and cause: Indian livestock and climate change', *Climatic Change*, 85:285–298.

Smit, B. & Pilifosova, O. (2001) 'Adaptation to climate change in the context of sustainable development and equity', in McCarthy, J. et al (eds.) *Climate change 2001: Impacts, Adaptation, and Vulnerability*, Cambridge: Cambridge University Press; UNFCCC (2007) *Climate change: Impacts, vulnerabilities, and adaptation in developing countries*. Bonn: UNFCCC.

Sovacool, B., and Linnér, B. (2016) *The Political Economy of Climate Change Adaptation*, Palgrave/Macmillan

Spires, M., S. Shackleton, and G. Cundill (2014) 'Barriers to Implementing Planned Community-Based Adaptation in Developing Countries: A Systematic Literature Review', *Climate and Development*, 6 (3): 277–287.

Stone, J., J. Barclay, P. Simmons, P. Cole, S. Loughlin, P. Ramón, and P. Mothes (2014) 'Risk Reduction Through Community- Based Monitoring: the Vigías of Tungurahua, Ecuador', *Society and Volcanoes*, 3 (1): 1–14.

Swati, C., Sengupta, A., Sharma, N. and Ravindranath, N. H (2012) 'Climate Variability and Farmers Vulnerability in a Flood-prone District of Assam', *International Journal of Climate Change Strategies and Management*, Vol. 4, No. 2, pp. 179-200.

Tanner, T. and Alleouche, J. (2011) 'Towards a New Political Economy of Climate Change and Development', *IDS Bulletin Special Issue: Political Economy of Climate Change*, Vol. 42, No. 3, pp. 1-14.

Taylor, M. (2015) *The Political Ecology of Climate Change Adaptation: Livelihoods, agrarian change and the conflicts of development*, London: Routledge.

Thomas, D. S. G., and C. Twyman (2005) 'Equity and justice in climate change adaptation amongst natural–resource–dependent societies', *Global Environmental Change* 15(2): 115–124.

Tripathi, A. & Mishra, A. K. (2016) 'Knowledge and passive adaptation to climate change: An example from Indian farmers', *Climate Risk Management*, Vol. 16, pp. 195–207.

Vadwan, N. and Rhodes, R. (2001) 'Climate change in the Western Himalayas of India: a study of local perception and response', *Climate Research*, Vol. 19, pp. 109-117.