Journal of Quantitative Finance and Economics. **2020**, 2, 2

ARF INDIA
Academic Open Access Publishing
www. arfjournals. com

Addressing Sustainability and Climate Adaptation in North-West Himalayan States

Falendra Kumar Sudan

Department of Economics, University of Jammu, Jammu, Jammu & Kashmir, India.
E-mail: fk_sud@rediffmail.com

Received: 19 August 2020; Revised: 24 September 2020;
Accepted: 29 September 2020; Publication: 07 October 2020

I. Introduction

Climate change has significant direct and indirect effects on societies and nations. Social factors determine the strength and vulnerability to the impacts of climate change. There are differential vulnerability and risk associated with natural disasters and catastrophic events (Enarson and Morrow, 1998; Poumadére *et al.*, 2005; Neumayer and Plümper, 2007; Enarson and Chakrabarti, 2009; Mearns and Norton, 2010; Dankleman, 2010; Huang *et al.*, 2010; David and Enarson, 2012; Seager, 2012; Sultana, 2014; Alagan and Aladukwaka, 2014; Blaikie and Brookfield, 1987; Ives and Messerli, 1989; Wisner *et al.*, 2004). These studies have focused on analyses of the loss of life, livelihood, and security due to specific extreme weather events in terms of differentiated and distinct impacts across gender, race, age, ethnicity, class, and ability.

Addressing sustainability in the energy, forestry, and agricultural sectors require mitigation-adaptation synergies (Corfee-Morlot and Agrawala 2004; IPCC 2007; UNEP 2011) for indigenous and local communities (Gadgil *et al.* 1993). However, there is the mitigation-adaptation disconnects (IPCC 2007; Dang *et al.* 2003; Thornton and Manasfi 2010), which need to be addressed for social-ecological transformational adaptation (Olsson *et al.* 2006; Kates *et al.* 2012). Human adaptive capacity (Levine *et al.* 2011) can be increased by development interventions (Huq and Reid 2009; Lemos *et al.* 2007). The Green Growth (OECD 2012) and planetary boundaries (Rockström *et al.* 2009a, b; Raworth 2012) initiatives reconnect the mitigation-adaptation disconnect in diverse social-ecological contexts.

Indigenous communities in north-west Himalaya faced rapid climate change. They face the challenge of linking adaptation, mitigation and development strategies for transformational change (Kates *et al.* 2012) within

a social-ecological system to address sustainability (Walker *et al.* 2004; Folke *et al.* 2005, 2010; Olsson *et al.* 2006) and capacity to transformability (Folke *et al.* 2010). Incremental adaptation may fail to address exposure and vulnerability to climate impacts (Kates *et al.* 2012), particularly in marginalized, indigenous and rural communities with heavy dependence on limited natural resources or ecosystem services (Kates 2000; Smith *et al.* 2003; Nakashima *et al.* 2012) wherein transformational adaptation may be inevitable (Kates *et al.* 2012; Chapin *et al.* 2009). Therefore, transformational change is relevant in using adaptation, mitigation and development strategies among indigenous communities. With the above backdrop, the present case study is focusing on Shivaliks hills in North-West Himalayan State of Jammu and Kashmir using explorative approach to ascertain the perceptions of the members of local communities and other stakeholders including community leaders and representatives on effects of climate change and its implications on local communities including the main issues and livelihood challenges faced by hill communities.

II. Objectives and Methodology

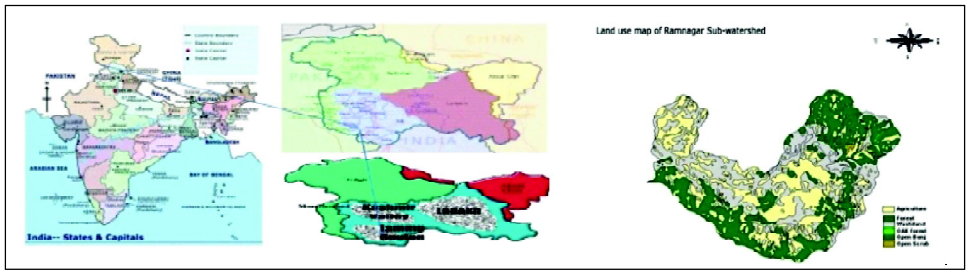
The present case study has probed the following questions: (i) What are the perceptions of the members of local communities and other stakeholders including community leaders and representatives on effects of climate change and its implications on local communities? (ii) What are the main issues and livelihood challenges faced by hill communities? (iii) What are the policy actions emanating to address the sustainability of hill communities?

In order to explore the above questions, the present case study is focusing on Ram Nagar sub-watershed in Shivaliks hills in North-West Himalayan State of Jammu and Kashmir. The perceptions of the participants have been collected through one focus group discussion (FGD) each conducted in a total of 20 villages in Ram Nagar sub-watershed in Jammu region. In each of the FGD, 12-15 participants have participated. Special attention has been paid to include poor women and indigenous and disadvantaged population groups including small farmers, scheduled castes and scheduled tribes and the community leaders and key informants with extensive knowledge of the phenomenon under study. The content analysis technique has been used to analyze the information qualitatively and supplemented by use of code and labels, field notes, sorting, shifting, constructing and reconstructing these materials, in order to prepare the case study.

III. Geographical scope - regional characteristics

The State of Jammu and Kashmir in the north-west Himalaya in India with an area of 1,38,214 km2 comprising the uppermost drainage of Indus,

Jhelum, Middle Chenab and Western Rabi exhibits great contrast in relief features, climate, soil and vegetation within comparatively narrow geographical spread. The climate of lower plains of Jammu and Kashmir that merges with plains of Punjab is sub-tropical. The climate is predominantly sub-tropical in the main *Shivaliks.* The climate in the region covering upper reaches of Pir-Panjal forming the main mountain backdrop changes from sub-tropical in the lower reaches to moist-temperate in upper reaches. The climate of Kashmir Valley (bordered between the Great Himalayas and the Pir-Panjal is dry temperate. The great Himalayan range: the innermost line of high mountains with Ladakh situated in trans-Himalayan zone is a cold desert and experiences sub-zero winter temperature.



Ramnagar is in the inner *Shivaliks.* Ramnagar sub-watershed is the catchment area of Ramnagarwali *Khad* (ephermal) in the middle catchment of river Tawi. It has an area of 32,630 Ha. and is subdivided into 39 micro-watersheds. The *Shivaliks,* locally known, as *'Kandi'* comprise of piedmont deposits made of boulder and pebbles, gravel and sand with minor clays mixed in varying proportions. One of the characteristic features of the area is the stream called *choes* or *khads,* which remain dry for most of the year. Though total rainfall is high (average 1000-1500 mm.), but its distribution is very erratic resulting in frequent droughts. This area is subject to soil erosion due to undulating topography, steep slopes, poor vegetative cover (scrub forest) and coarse to medium texture of the sedimentary material. *Shivalik* hills consist of highly erodible sand stones, conglomerates, siltstones and shales.

The uncontrolled deforestation and overgrazing in the past has resulted in the reduction of vegetative cover and accelerated erosion in the *Shivaliks*. The area experiences paucity of water for plant growth due to excessive run-off, high evaporation especially during summer, unpredictable and erratic rainfall. The eroded material from *Shivalik* hills, brought down by the seasonal rivulets *(choes)* is deposited in the sloping piedmont plain and also in the area around *choes*. The repeated deposition of coarse sediments renders these areas comparatively low in agricultural productivity.

Shivaliks in Jammu region has the majestic heights of its snow-capped mountains, green meadows, enchanting lakes and lush green forests. The region offers some of the liveliest scenic beauty across *Shivaliks*. The population of the region is most sparse in hills with high density in low-lands urban areas. Being hilly and rural characteristics, the occupational distribution of the region is biased in favour of agriculture and allied activities. The region is richly endowed with forests and mineral resources like coal, lignite, copper, lead, zinc, cobalt, limestone, bauxite, borax and precious stones. It has huge potential of horticulture and floriculture, which contribute immensely to financial strengthening of the region and provide livelihood to masses and help alleviate poverty.

The disadvantaged location, remoteness and isolation from major markets, scattered population, lack of economic infrastructure and ongoing violent conflict poses serious developmental challenges in the region. There is limited diversification in production activities due to the small size of domestic market, which offers a challenge to planners in tackling the numerous problems of economic backwardness in the region. There are numerous scenic tourism spots of attractions and comfortable weather. There is also huge tourism potential due to the existence of shrines, temples and cave temples, which have strong backward and forward linkages for income and employment generation. *Shivaliks* has always been characterized as a relatively backward economic region due to predominance of agriculture, low degree of urbanization, inadequately developed infrastructure, widespread illiteracy, high birth rates and low levels of investment. However, there is a wide scope for the development in the region which could help the region break free from its current economic stagnation.

IV. Main Results

NWHS has been vulnerable to the loss of glaciers and more extreme events. It is among the most fragile and vulnerable ecosystems in the world. It has considerable influence on the weather patterns throughout South Asia. NWHS has high proportion of India's freshwater resources in the Indus Basin. It is recognized as one of the world's key biodiversity hotspots. NWHS consisting of the high mountains, the foothills and the Tarai area, constitutes an extremely fragile ecological zone. It has distinctive socio-cultural regions and sub-regions. In most of NWHS, the pace of economic growth is low. Livelihood opportunities are resource based and socio-economic development is minimal. The economy is predominantly rural and dependence on climate sensitive sectors is huge. Agriculture is mostly practiced on sloping lands and small parcels of terraced lands and relies

entirely on the seasonal rainfall. Owing to the very small land holdings, families rely heavily on natural resources to feed their livestock. There is continuous degradation of natural resources to meet the various needs of its growing population. Climate change has further aggravated livelihood stresses. Increasing variation in precipitation (both rainfall and snow), and temperature has altered the soil moisture availability. The situation is likely to be exacerbated due to increased temperature, altered precipitation patterns, episodes of drought, and biotic influences. Climate change has accelerated the process of marginalisation of the hill communities. How climate change has impacted the livelihoods of hill communities in NWHS is presented in Box 1.

Box 1: Effects of climate change on hill communities

Specific Changes	*Specific adverse effects*
Rising temperature i. An increase in maximum temperature up to 1degree Centigrade	a. Shifting of apple orchards towards higher altitude b. Increased agricultural and horticultural vulnerability c. Absence of alternative livelihood options d. Migration of productive labour e. Upward shift in climatic zones f. Change in cropping patterns g. Hampering planning of farm operations h. More losses in winter crop i. Changes composition of species j. Increase in pests and diseases k. Decline in crop productivity affecting food security l. Soil degradation and declining soil moisture m. Decline in fodder availability affecting animal husbandry n. Reduction in local crop diversity
Changed precipitation conditions i. Low winter precipitation (snow fall) ii. Warmer and shorter winters iii. Delayed onset of monsoon iv. Decrease in scattered light rainfall v. Increase in intense rainfall vi. Less and more erratic rainfall vii. Less or absent winter rains viii. Increased frequency of intense rainfall events	a. Decrease in water availability in summer b. Increased run-off, less infiltration and loss of surface soil c. High rates of siltation and flash floods d. Increased run-off e. Removal of forest cover f. Depleted hill aquifer regime g. Overall decreased water availability h. Drying up of streams and springs i. Less remunerative livestock due to scarcity of fodder j. Water scarcity posing challenge to agriculture and livestock k. Decline in soil moisture hampering crop cultivation l. Reduced drinking water sources adding to drudgery of women
Extreme weather events	a. Intense rainfall leading to soil erosion b. Loss of fertile soil and falling agricultural productivity c. Land degradation and soil loss
Sudden events damaging crops and property	a. Sudden weather events like hail storm b. Heavy crop losses c. Cloud bursts causing devastation d. Increased landslides compared to the past
Temperature variations	a. Increase in human-animal conflicts b. Increased pressure on forests c. Decline of biodiversity d. Proliferation of invasive species e. Increased requirement for feed supplements for livestock f. Fodder scarcity and resultant drudgery for women

Box 2: Main issues and livelihood challenges faced by hill communities

Agriculture	*Livestock*	*Water*
i. Small, marginal and fragmented land holdings	i. Limited land for fodder crops in hills	i. Less potential for large-scale development of ground water in hills
ii. Predominance of rain-fed and subsistence agriculture	ii. High proportion of land under reserve forest restricting grazing and harvesting of fodder	ii. Deforestation, grazing and trampling by livestock, erosion of top fertile soil, forest fires and development activities cause failure of the watershed
iii. Unexplored potential of land favourable temperature	iii. Limited road connectivity constrains product marketing	iii. Unchecked flow of water during the monsoon to cause a sudden swelling of streams and rivers
iv. Heavy soil erosion in hills	iv. High proportion of low yielding livestock leading to low productivity per animal	iv. Flash-floods in the foothills and even in the plains
v. Higher cost of production	v. Poor veterinary infrastructure facilities	v. Droughts in the villages located on the slope of the mountains
vi. Low (and often unavailability of timely) inputs	vi. Limited mobility due to difficult terrain	
vii. Poor access to extension services in agriculture	vii. Animal husbandry practiced as an ancillary activity only	
viii. Long distances to markets and limited added value		

V. Policy Implications

The hill communities have realized that climate change has accelerated the process of degradation of the natural resource base. The effects of climate change are more severe on women and poor marginalized groups including small and marginal farmers. Hill communities do not know how to cope up with this sudden change. There is limited access to finance and other Climate Smart Technology resources. Addressing sustainability and climate change vulnerabilities will need resource use optimization and adoption of Climate Smart Technologies for creating and sustaining livelihood opportunities. In this context, building the local capacities through necessary skills and knowledge for climate resilience of poor hill communities and their livelihood resources is not over emphasised.

(i) Participatory development

Climate change will have differentiated impacts on sections of the population. Women and poor and marginalized groups, especially small and marginal farmers will be more severely impacted. Climate smart actions are required at the family level through participatory approach. Other social groups should be covered and benefited indirectly through capacity building, awareness generation and sensitization efforts. They should also

be benefited by area based/ landscape based development actions. The main focus should be on vulnerable small and marginal farming families whose livelihoods are solely dependent on primary sectors such as agriculture and livestock. The climate smart technologies at the household level should be initially implemented on pilot basis and after initial success these should be replicated in other groups. Before project implementation, orientation meetings should be conducted involving all stakeholders to understand the objectives and approach and facilitate developing rapport with the community members. At the community level, project planning, implementation and monitoring should be done with the participation of all village level groups with proper representation of different age groups, caste, class, religion and ethnicity. All this should provide a platform to participate in planning project interventions, implementing and monitoring, space for women and marginalized communities to participate in decision making and create ownership of all project activities implemented in the community. The project participants should be selected by including households with greater dependence on agriculture for income and livelihoods, households in remote hill areas with limited alternative livelihood options, poor farmers with basic minimum resources to meet their livelihood requirements, women headed households taking care of farming and bearing direct burden of degradation of natural resources, and poor households including scheduled caste and scheduled tribe households.

(ii) Greater participation of women

Women have been identified as more vulnerable to effects of climate change due to their active involvement in agriculture and allied sectors**.** Due to lack of productive activities in hills, majority of productive men migrate for improved income opportunities. Women and elderly bear the major burden of agricultural tasks and meeting household needs. Women are engaged in all productive agricultural tasks. Women also take care of all livestock related activities. Thus, there is feminization of agricultural and livestock work. With climate change, they experienced increased work pressure causing greater physical and mental stress. Therefore, interventions for climate smart agriculture should be gender sensitive. Women should be the primary stakeholder in addressing sustainability.

(iii) Participation of Schedule Castes/Schedule Tribes

Schedule castes are highly dependent on agricultural labour and livestock to derive a livelihood due to less resources and options to adapt to climate change. Due to discrimination and exclusion, they are deprived of their social, economic and political rights and opportunities. The socio-economic

vulnerabilities along with remoteness placed a greater strain on their adaptive capacity to address shocks, stresses and change. The Schedule castes and Scheduled tribes constitute nearly one-fifth of the population. These household will need individual household-based activities based on size of their landholding, for which capacity building, awareness generation and sensitization efforts should be given due priority. The focus should be on area- based and landscape-based development actions too so that whole hill community in the sub-watershed should benefit directly or indirectly. The activities should be targeted to reduce climate vulnerability and improve existing coping strategies as adopted by the hill communities. The introduction of mix of climate smart technologies at the household as well

Table 4: Problem Identification and Suggested Technology Solutions

Problems	*Solutions*
i. Growing water scarcity for drinking and irrigation ii. Unseasonal, irregular, less consistent and unpredictable rains iii. Drying natural springs	i. Recharging Natural Springs using site specific mechanical and vegetative measures ii. Rainwater harvesting using ponds iii. Innovative water use efficiency demonstrations iv. In situ natural water reserves in hills
i. Growing fodder scarcity to support livestock ii. Increased neglect of common pastoral lands	i. Fodder promotion on private and community lands ii. Measures for perennial green fodder availability
i. Absence of horticulture development in line with favourable conditions ii. Extreme weather events iii. Limited options for crop and income diversification	i. Promotion of horticulture ii. Promotion of protective cultivation of vegetables iii. Crop intensification, collection and cooperative marketing
i. Low cattle productivity ii. Low livestock yield iii. Lack of organized milk collection and marketing efforts	i. Improved breeding services ii. Scientific and climate sensitive livestock management iii. Cooperative milk collection and marketing iv. Promotion of cooperative dairy
Declining agro-biodiversity	i. Participatory conservation ii. Development of community seed banks iii. Seed production multiplication iv. Improved market services
Lack of scientific weather data service	Partnership with local research and scientific institutes
i. Lack of crop diversification ii. Absence of techno-managerial inputs for horticulture development	i. Introduction of high value, temperate horticulture fruit types and grafts ii. Improved market services
Degradation of natural resources	Climate smart and resource based development

as community level will help address the climate change and variability and improve the livelihoods of these communities.

(iv) Identification of vulnerability and required adaptation measures

In order to make an assessment of the climate vulnerability and existing coping strategies adopted by the hill communities, participatory approaches should be used. In the focus group discussions with the communities, it was noticed that climate change and variability have directly affected the livelihoods of these communities. The climate smart technologies focusing on main livelihood resources such as water, livestock, and crops at the household and village level should be based on type of vulnerabilities faced, for which building partnerships with relevant scientific and technical institutes for backup services is not over-emphasised. Table 4 presents the identified problems and viable technological options to address sustainability.

VI. Conclusion

There are various dimensions of sustainability such as human, social, economic, psychological and environmental, which are interconnected and when taken together, can form a solid basis for policy decisions and actions. The application of all spheres of sustainability to real socio-economic situations results in preservation of natural resources, protection of environment, robust economy and improved quality of life for our people. Climate change poses numerous risks to health and livelihoods of communities. Who is at risk? How social groups respond to climate change? The answers to these questions will depend on their needs, values, cultures, capacities, institutional forms, and the environmental characteristics of the places they live. Robust decisions about climate adaptation involve clear understanding the diverse goals of individuals, communities, and institutions, and the degree to which these are in conflict, and can be aligned. Decisions must be made under conditions of complex uncertainty. Successful implementation of climate adaptation strategies requires understanding how actors and institutions at each level and in each sector will enable or constrain responses. Thus, regardless of the risks, places, and groups involved, adaptation is at its core a social issue.

The climate change in NWHS can, to a large extent, be attributed to anthropogenic activities. Human interferences continue to intensify sharply in hills of NWHS and increase pressures on the environment to assimilate/absorb wastes. Climate change is the most prominent, but only one of the various changes that these NWHS presently face and which threaten social

welfare. The magnitude and nature of the impacts of climate change processes depend upon human responses. In this sense, to avoid dangerous anthropogenic interference in north-west Himalayan climate system, far-reaching behavioural changes will be required. In recent decades, there has been an ever increasing realization that human-society-economy-environment interactions in north-west Himalayan States give rise to complex and dynamic socio-economic-ecological systems in which both anthropogenic and biophysical drivers play central roles. The current challenge is to understand the dynamics of these coupled socio-economic-ecological or human-biophysical systems well enough to anticipate large-scale changes and to take steps either to reduce their likelihood or to minimize their impact once they do occur.

Therefore, in order to better understand various dimensions of sustainability and climate adaptation and to respond effectively to climate change impacts in NWHS, inputs from the communities are required to provide crucial insights into the human-social-economic-environment dynamics of climate change. It is only when the human-social-economic elements are linked with the environmental element that ecosystem change and successful implementation of coping strategies and resource management can be achieved. A community perspective is required, where various dimensions of sustainability and climate adaptation and the anthropogenic impacts are integrated into analyses of climate change in NWHS. A community lens allows for a broader understanding of climate vulnerability and directs attention to the human and social resources, institutions, policies and power relations for development and poverty reduction. For climate adaptation to be pro-poor and resilience, addressing the socioeconomic determinants of vulnerability must be part of adaptation strategies.

References

Alagan, R. and Aladuwaka, S.: Gender mapping in post-disaster recovery: lessons from Sri Lanka's tsunami, in: Global Perspectives on Gender and Space, edited by: Oberhauser, A. and Johnston-Anumonwo, I., Routledge, New York, 181–199, 2014.

Blaikie, P. and Brookfield, H.: Land Degradation and Society, New York, Routledge, 1987.

Chapin FS, Kofinas GP, *et al.*: Principles of ecosystem stewardship: resilience-based natural resource management in a changing world. Cambridge University Press, 2009.

Corfee-Morlot J, Agrawala S: The benefits of climate policy. Glob Environ Chang 14(3):197–199, 2004.

Dang HH, Michaelowa A *et al.*: Synergy of adaptation and mitigation strategies in the context of sustainable development: the case of Vietnam. Clim Pol 3(Supplement 1):81–96, 2003.

Dankelman, I. (Ed.): Gender and Climate Change: An Introduction, Earthscan, Washington, DC, 2010.

David, E. and Enarson, E. (Eds.): TheWomen of Katrina: How Gender, Race and Class Matter in an American disaster, Vanderbilt University Press, Nashville, Tennessee, 2012.

Enarson, E. and Chakrabati, B. G. (Eds.): Women, Gender and Disaster: Global Issues and Initiatives, Sage Publications, New Delhi, India, 2009.

Enarson, E. and Morrow, B.: The Gendered Terrain of Disaster: Through Women's Eyes, Praeger, Miami, 1998.

Folke C,Hahn T*et al.*: Adaptive governance of social-ecological systems.Annu Rev Environ Resour 30:441–473, 2005.

Folke C, Carpenter SR *et al.*: Resilience thinking: integrating resilience, adaptability and transformability. Ecol Soc 15(4):20, 2010.

Gadgil M, Berkes F, *et al.*: "Indigenous knowledge for biodiversity conservation." Ambio 151–156, 1993)

Huang, W., Kan, H., and Kovats, S.: The impact of the 2003 heat wave on mortality in Shanghai, China, Sci. Total Environ., 408, 2418–2420, 2010.

Huq S, Reid H.: Mainstreaming adaptation in development. IDS Bull 35(3):15–21, 2009.

IPCC AR4 WG2: Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (ed) Climate change 2007: impacts, adaptation and vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2007.

Ives, J. D. and Messerli, B.: The Himalayan Dilemma: Reconciling Development and Conservation, Routledge, London, 1989.

Kates RW.: Cautionary tales: adaptation and the global poor. Clim Chang 45(1):5–17, 2000.

Kates RW, Travis WR *et al.*: Transformational adaptation when incremental adaptations to climate change are insufficient. Proc Natl Acad Sci 109(19):7156–7161, 2012.

Lemos MC, Boyd E *et al.*: Developing adaptation and adapting development. Ecol Soc 12(2):26, 2007.

Levine S, Ludi E *et al.*: "Rethinking support for adaptive capacity to climate change." A report for the Africa Climate Change Resilience Alliance. Overseas Development Institute, London, 2011.

Mearns, R. and Norton, A. (Eds.): Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World, World Bank, Washington, D.C., 2010.

Nakashima DJ, Galloway McLean K, *et al.*: Weathering uncertainty: traditional knowledge for climate change assessment and adaptation. Paris, UNESCO, and Darwin, UNU, 2012.

Neumayer, E. and Plümper, T.: The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981–2002, Ann. Assoc. Am. Geogr., 97, 551–566, 2007.

Olsson P, Gunderson LH *et al.*: Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. Ecol Soc 11(1):18, 2006.

Poumadère, M., Mays, C., Le Mer, S., and Blong, R.: The 2003 Heat wave in France: Dangerous Climate Change Here and Now, Risk Anal., 25, 1483–1494, 2005.

Raworth K.: A safe and just space for humanity. Oxfam Discussion Paper, February. Oxford: Oxfam, 2012.

Rockström J *et al.*: Planetary boundaries: exploring the safe operating space for humanity. Ecol Soc 14(2):32, 2009a.

Rockström J, *et al.*: 'A safe operating space for humanity'. Nature 461, 23 September 2009.

Seager, J.: Noticing Gender (or Not) in Disasters, in: The Women of Katrina: How Gender, Race, and Class Matter in an American Disaster, edited by: Enarson, E. and David, E., Vanderbilt University Press, Nashville, Tennessee, 2012.

Smith J, Klein R *et al.*: Climate change, adaptive capacity and development. Imperial College Press, London, 2003.

Sultana, F.: Gendering Climate Change: Geographical Insights, Prof. Geogr., 6, 372–381, 2014.

Thornton T, Manasfi N.: Adaptation–genuine and spurious: demystifying adaptation processes in relation to climate change. Environ Soc 1(1):132–155, 2010.

UNEP: Towards a green economy. Pathways to sustainable development and poverty eradication. United Nations Environment Programme, Nairobi, 2011.

Walker B, Holling CS *et al.* Resilience, adaptability and transformability in social–ecological systems. Ecol Soc 9(2):5, 2004.

Wisner, B., Blaikie, P. M., Cannon, T. and Davis, I.: At Risk: Natural Hazards, People's Vulnerability and Disasters, 2nd Edn., New York, Routledge, 2004.