Chapter 12. Human Security

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Executive Summary

Climate change threatens human security, because it a) undermines livelihoods, b) compromises culture and identity, c) increases migration that people would rather have avoided, and d) undermines the ability of states to provide the conditions necessary for human security (high agreement, robust evidence). Human security breakdowns almost never have single causes, but instead emerge from the interaction of multiple factors. For populations that are already socially marginalized, resource dependent, and have limited capital assets, human security will be progressively undermined as the climate changes [12.1.2; 12.2]. Increases in the rate and magnitude of climate change increase the risk to human security by exacerbating negative feedbacks between cultural processes, migration and violent conflict [12.7].

Climate change affects cultures and the cultural expressions important for maintaining identity and traditional and local forms of knowledge (medium evidence, high agreement) Climate change impacts will lead to significant changes in environmental and societal conditions throughout the natural world, and in human settlements. These changes will compromise dimensions of the cultural core and assets that are highly valued by societies [12.3]. The magnitude of the perceived loss depends on the robustness of cultural identity and the mechanisms for maintaining and transferring knowledge. Culture and local and traditional forms of knowledge are highly dynamic and context dependent, reflecting and reasserting values, and shaping both adaptive and maladaptive responses.

Traditional and indigenous forms of knowledge are a major resource for adapting to climate change except when the changes exceed the knowledge repertoire (high agreement, robust evidence). Indigenous peoples have adapted to highly variable and changing social and ecological conditions [12.3]. The current rate and magnitude of change will increasingly constrain the efficacy of indigenous and traditional knowledge in adaptive responses [12.3]. Currently many indigenous peoples are politically and economically marginalized and live in regions or depend on natural resources that are highly sensitive to climatic changes. Local and traditional knowledge are often neglected in policy and research, and mutual recognition and integration of local and traditional knowledge with scientific knowledge will increase the effectiveness of adaptation responses [12.3].

Climate change will have significant impacts on forms of migration that compromise human security (medium agreement, medium evidence). Some migration flows are sensitive to changes in resource availability and ecosystem services. Major extreme weather events have in the past led to significant population displacement, and changes in the incidence of extreme events will amplify the challenges and risks of such displacement. There is evidence that many vulnerable groups do not have the resources to be able to migrate to avoid the impacts of floods, storms and droughts. There is evidence from models, scenarios and observations that coastal inundation and loss of permafrost can lead to migration and resettlement [12.3.2, 12.4.2]. Migrants themselves may be vulnerable to climate change impacts in destination areas, particularly in urban centres in developing countries [12.4.2].

Mobility is a widely used and often effective strategy to maintain livelihoods in response to social and environmental changes (high agreement, medium evidence). There is robust evidence that migration and mobility are adaptation strategies in all regions of the world that experience climate variability. People that lack the ability to move will face higher exposure to weather-related extremes in both rural and urban areas in the developing world [12.4.3]. There is some evidence to suggest that expanding opportunities for mobility reduce vulnerability and

enhance human security. Observations of implementation of planned resettlement show that legitimate and inclusive planning processes help alleviate the conflict and insecurity that individuals and communities may experience.

Some of the factors that increase the risk of violent conflict including civil wars are sensitive to climate change (medium agreement, medium evidence). The evidence on the direct effect of climate change and variability on violence is contested. Though there is little agreement about causality, there is robust evidence that shows that low per capita incomes, economic contraction, and inconsistent state institutions are associated with the incidence of civil wars. These factors are sensitive to climate change. Climate change policy responses, particularly those associated with changing property rights to land, water and resources, can increase the risk of violent conflict. A range of policies and institutions at multiple scales has been demonstrated to reduce the effects of environmental change on the risk of violent conflict. Economic growth, high per capita incomes, strong democratic institutions, social protection during economic and climate shocks, and robust institutional structures that protect property rights and manage conflict all reduce the risk that climate variability and extremes will lead to violence.

People living in places affected by violent conflict are particularly vulnerable to climate change (high agreement, modest evidence). Evidence shows that large-scale violent conflict harms infrastructure, institutions, natural capital, social capital, and livelihood opportunities. Since these assets facilitate adaptation to climate change, there are strong grounds to infer that conflict drives vulnerability to climate change impacts [12.5.2].

Climate change will lead to new challenges to states and will shape both conditions of security and national security policies (medium agreement, medium evidence). Physical aspects of climate change, such as sea level rise, extreme events, and hydrologic disruptions, pose major challenges to vital transportation, water, and energy infrastructure [12.6]. Some states are experiencing major challenges to their territorial integrity, including Arctic countries, small island states, and other states highly vulnerable to sea level rise [12.5.4]. Some impacts of climate change, such as changes in sea ice, transboundary and shared water resources, and the migration of pelagic fish stocks, have the potential to increase rivalry among states. There is evidence that the presence of robust institutions can manage many of these rivalries such that human security is not severely eroded [12.6]. These threats to national security will affect the capacity of states and communities to provide human security.

12.1. Concepts and Evidence

12.1.1. Human Security in the IPCC Assessment Reports

This chapter assesses the risks climate change poses to individuals and communities, including threats to livelihoods, culture, and political stability. These issues were raised by Working Group II (WGIIAR4) in the Fourth Assessment Report (AR4). That report identified the risk climate change poses to livelihoods (chapters 5, 7, 9 10, 16, and 17), cultures and indigenous peoples globally, but this Chapter is the first systematic assessment across the dimensions of human security.

Both WGIIAR4 and the Special Report on Extremes (SREX) noted the risks climate change poses to: water, soil, food, health and individual well-being. Chapter 7 of WGIIAR4 referred to security as a fundamental social goal, and Chapter 11 noted that the risks climate change poses to national security were poorly understood. It was also noted that migration, crises and violent conflicts increase vulnerability to climate change (Chapter 19). Chapters 7, 16 and 17 of WGIIAR4 noted that migration has the potential to enhance the adaptive capacity.

New research since AR4 has addressed the linkages between climate change and human security (Matthew et al., 2010; O'Brien et al., 2010; Oswald Spring, 2011; Scheffran et al., 2012a; Gleditsch, 2012). Specific dimensions of human security, such as food security; public health and well-being; livelihoods; and regional perspectives are examined systematically in Chapters 11, 13 and 19, and in chapters 22-29 of this report and this Chapter cross-refers to those assessments.

12.1.2. Definition and Scope of Human Security in this Assessment

There are many definitions of human security, which vary according to discipline, emphasis on risk factors, and values. This Chapter defines human security as a condition that exists when the vital core of human lives is protected, and where people have the freedom and capacity to live with dignity. In this assessment, in the context of climate change, the vital core of human lives includes the universal and culturally specific, material and non-material elements necessary for people to act on behalf of their interests. Many processes influence human security, notably: the operation of markets, the state, and civil society. Poverty, discrimination of many kinds, and extreme natural and technological disasters undermine human security.

The concept of human security has been informed by many disciplines and multiple lines of evidence and studies that use diverse methods (Paris 2001, Alkire, 2003; Owen 2004, Gasper 2005, Hoogensen and Stuvøy 2006, Mahoney and Pinedo 2007, Brauch et al., 2009, Inglehart and Norris 2012). The concept was developed in parallel by UN institutions (UNDP 1994; Commission on Human Security, 2003); and by scholars and advocates in every regional of the world (Najam 2003, Kaldor 2007, Poku and Sandkjaer 2009, Rojas 2009, Chourou, 2009, Sabur 2009, Othman 2009, Wun Gaeo 2009, Black and Swatuk 2009). In the past decade the linkages between elements of human security, global environmental change and climate change specifically has been examined through international research programmes (for example Matthew et al., 2010; Afifi and Jaeger, 2010; Foresight, 2011; Scheffran et al. 2012a). The assessment in the Chapter is based on systematic reviews. These were carried out firstly using searches of scientific databases of relevant studies published from 2000 till 2013, with searches targeted at the core dimensions of culture; indigenous peoples; traditional knowledge; migration; conflict; and transboundary rivalry. These searches were supplemented by open searches to capture book and non-journal literature.

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Box 12-1. Relationship between Human Rights and Human Security in the Context of Climate Change

Human security is inclusive of political, sociocultural and economic human rights (CHS 2003), which are both an important element of human security, and instrumental to its achievement. Climate change puts human security and human rights at risk (Slade, 2007; Humphreys, 2010; Caney, 2010). Research on climate change risks to human rights examines legal issues in policy, litigation and compensation (Posner, 2007). Several cases have tested these rights, especially of women, children, indigenous peoples, and other minorities in practice (Oswald Spring, 2008). Others argue that rights may not be useful in climate policy (Depledge and Carlane, 2007; Adelman, 2010).

The victims of human rights violations are also vulnerable to climate change impacts. In places with extreme human rights violations, their protection is an important adaption strategy dealing with specific climate impacts (Barnett, 2009).

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This Chapter assesses research on how climate change may exacerbate these and other threats to human security, and how these factors restrict the ability to adapt to climate change. Research on human security focuses on threats to the vital core of lives, including discrimination, economic crises, epidemics, extreme events, and violence (CHS, 2003; Oswald Spring, 2011, 2012). That body of knowledge has shown that underlying processes such as low health status, illiteracy, poverty, and restricted access to economic and social resources, reduce the freedom and capacity of individuals and groups to adapt to climate change, including (CHS, 2003; Betancourt et al., 2010; Goldsworthy, 2010). The systematic review in this Chapter reflects the dominant findings from the scientific literature that the impacts on livelihoods, cultural impacts, migration or conflict are overwhelmingly negative. But the literature on human security also reflects evidence that some elements of human security are not sensitive to climate change impacts, particularly those dimensions that are mainly driven by economics and other social change.

Research on the specific interaction of human security and climate change focuses on how cultural, demographic, economic, and political forces interact with impacts and risks, affecting individuals and communities (Krause and Jütersonke, 2005; Hoogensen and Stuvøy 2006; O'Brien, 2006; Betancourt et al., 2010). The analysis concerns

drivers of vulnerability across multiple scales and sectors, including, gender relations, culture, political institutions and markets. Each of these areas has its distinct disciplinary focus, methods and levels of evidence as discussed in Box 12-2.

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Box 12-2. The Nature of Evidence about Climate Change and Human Security

Understanding the effects of climate change on human security requires evidence about social and environmental processes across multiple scales and sectors. This process-based evidence is not coherent and contiguous; it comes in different forms, and is collected through a wide array of methods used in different academic disciplines. For example, this Chapter assesses anthropological research where culture influences responses to climate change or may be shaped by climate change; alongside political and economic studies which use data sets to test for correlations between climatic factors and violent conflicts; and historical observations using documentary and archaeological methods. These diverse sources strengthen the robustness of the conclusions for this assessment (Van de Noort, 2011; Nielsen and Reenberg, 2012)

Research on human security and climate change relies on theories, models and evidence on how climate variability, anthropogenic climate change and environmental risks affect human security. There is some evidence on causal links in empirical studies.

This Chapter reviews empirical studies from the social sciences using both quantitative and qualitative data, including case studies. Some studies examine the interactions between environmental changes and social outcomes. Few explicitly address climate change and human security links, but some provide evidence of climate change impacts on human security (Ford et al., 2010). Individual case studies often explain causality in given contexts, but their results may not be generalized. Where evidence from multiple comparative case studies agree, generalization is sometimes possible.

This Chapter also assesses quantitative studies about large social units with correlations among different factors. Correlations alone do not explain causality, although they may test theories of causality. The absence of a correlation does not necessarily disprove a causal theory.

Given the complexity of the links between climate change and human security; uncertainties in the research on the biophysical dimensions of climate change; and the nature of the social science, highly confident statements about the effects of climate change on human security are not meaningful (Scheffran et al., 2012a). Yet there is robust evidence about many of the links between climate change and human security: in this Chapter the standardized IPCC language of uncertainty is applied to those areas where appropriate.

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Human security and insecurity are universal issues. In every country there are individuals and groups who are insecure (Mahoney and Pinedo, 2007; Pietsch and McAllister, 2010). Much research suggests that while the impacts of climate change on human security will be experienced most in developing countries, human security is at risk for vulnerable populations everywhere (Naess et al., 2006; Leichenko and O'Brien, 2008; Berrang-Ford et al., 2011;).

The Chapter also evaluates research on the interaction between the state and human security, suggesting that increased human insecurity may rise with an inability to adapt to climate change, thus creating risks to national security through migration and violent conflicts. The analysis extends to assess how states protect the human security of their citizens. In other words, this chapter examines the security of the state insofar as it affects human security by affecting the ability of states to protect their citizens.

The framing of climate change as a security issue has been controversial. Some authors suggest that discourses on climate change and national security tend to downplay human security dimensions, and skew mitigation and adaptation responses towards state interests rather than the most vulnerable (Barnett 2007 and 2009; Brauch, 2009;

Dalby 2009; Floyd 2008; Trombetta 2009; Verhoeven 2009; Oels, 2013). Nevertheless, some countries associate climate change risks with conventional security risks and many countries are concerned about the risks climate change poses to relations between states (see sections 5 and 6). This Chapter therefore adopts a broad approach to human security, which is widely supported in the literature (Barnett, 2001; Brauch et al., 2008, 2009 and 2011; Matthew et al., 2010; O'Brien et al. 2010).

12.2. Economic and Livelihood Dimensions of Human Security at Risk from Climate Change

12.2.1. Climate Change Impacts on Material Aspects of Livelihood Security

Extensive evidence shows that climate change impacts on human security by altering the ensemble of assets, capabilities, entitlements, and activities required for securing a means of living (Battisti and Naylor, 2009; Hertel et al., 2010; Schlenker and Lobell, 2010; Chapter 13). Livelihoods are associated with people's access to five capital assets: social, natural, financial, human and physical. The systematic review on livelihoods and climate change is elaborated in Chapters 8, 9, 13, 18, and 22. Local and indigenous ecological knowledge (Box 18-4), diversification of activities to reduce risks, access to infrastructure and other resources interact together with changes in climate to impact livelihoods (Section 9.2).

To summarise the evidence in cognate Chapters, there are two ways by which climate change impacts upon the material aspects of livelihood security. First, it affects livelihood vulnerability through increasing exposure to shocks and stressors. Climate-related shocks brought about by storms and floods can directly destroy assets and impact on livelihoods (Deligiannis, 2012). Households that are land-less or reliant on climate sensitive capital are particularly vulnerable to such shocks (Chapter 9; Chapter 8; Chapter 22; Chapter 13, Fig. 13.2). Second, climate change can prompt mitigation and adaptation strategies that can advance or undermine human insecurity (Deligiannis, 2012) (Section 12.2.3). Because the most vulnerable and marginalized have low adaptive capacity, they will suffer the greatest impacts from climate change (e.g. Tanner and Mitchell, 2008). Those at greater risk include individuals and households below the poverty line, whose vulnerability is exacerbated by limited access to resources, entitlements, information, and decision-making processes. Much evidence shows that poorer households in both rural and urban areas have higher vulnerability to weather-related risks, with the mechanisms driving this vulnerability discussed in Table 12-1.

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Box 12-3. Gender Dimensions of Human Insecurity

A growing body of evidence indicates that human insecurity associated with climate variability and change is differentiated by gender as well as other social factors (Antwi-Agyei et al., 2012; Arora-Jonsson, 2011; Buechler, 2009; Terry, 2009; Ahmed and Fajber, 2009). In many regions of the world, women have less access to financial resources, land, education, health and other basic rights, and are excluded from decision making processes, making them less able to cope with and adapt to climate change impacts (Djoudi and Brockhaus, 2011; Demetriades and Esplen, 2008; Paavola, 2008). Evidence shows how poor women in developing countries are struggling to protect their lives, homes, assets and livelihoods from weather related hazards . Socially ascribed gender responsibilities for so-called reproductive work, such as childcare, healthcare and domestic work, including the collection of water and firewood, is directly affected by impacts of climate change on nutrition, disease burden and water availability (Denton, 2002).

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Table 12-1 summarizes studies on how climate variability and change affects the material aspect of human security. Evidence is categorized under two main dimensions: 1) deprivation of immediate basic needs; and 2) erosion of livelihood assets and human capabilities (Table 12-1). Evidence on the impacts of climate change on basic needs relates to agriculture and food security, water stress and scarcity as well as destruction of homes and properties (Carter et al., 2007; Leary et al., 2008; Peras et al., 2008; Paavola, 2008; Tang et al., 2009). Growing evidence

indicates that climate variability and change disrupts production and income, reduces spending, or alters other common practices of resource-dependent households (Chapter 13). Adverse impacts of climate change on the health and education of children can eventually lead to the erosion of human capability (Costello et al., 2009; UNDP, 2007). Similarly, evidence based on projections using various socio-economic and climate change scenarios indicates an increase in economic and health risks, including loss of lives in both less developed and developed countries (Hall et al., 2003; Tang et al, 2009; Kainuma et al., 2004).

[INSERT TABLE 12-1 HERE
Table 12-1: Observed and projected impacts of climate variability and change on basic needs and livelihoods, and their role in undermining human security.]

12.2.2. Impacts of Adaptation Actions on Livelihood Dimensions of Human Security

Established research methods and evaluations of development interventions provide robust evidence on how livelihoods can be secured in the context of external shocks and how opportunities can be enhanced through adaptation. Much of this research comes from development economics and related disciplines (Elllis, 2000; Dercon, 2004), and is increasingly applied to climate change adaptation studies. Livelihoods can provide people with opportunity (Chapter 13.2.1) and adaptation options that can be transformed into capabilities and assets (Chapter 13.2.1). Adaptation interventions and strategies that have been documented to reduce risks to human security include: 1) diversification of income-generating activities in agricultural and fishing systems (Paavola, 2008; Galvin, 2009; Tolossa, 2008; Badjeck et al., 2010; Coulthard, 2008; West and Hovelsrud, 2010); 2) migration for risk-spreading among pastoralists (Galvin, 2009) and fishers (Badjeck et al., 2009; Perry and Sumaila, 2007); 3) the development of insurance systems (Badjeck et al., 2010); and 4) education of women (Boyle et al., 2006, Rammohan and Johar, 2009).

There is emerging evidence, however, that some adaptation interventions in specific circumstances can decrease human security. For instance, agricultural intensification can initially minimize decline in yield, but may extend household production to marginal and steep lands that can in turn increase soil erosion, nutrient loss or landslides (Deligiannis, 2012).

12.3. Cultural Dimensions of Human Security

12.3.1. How Culture Interacts with Climate Impacts

Culture is analysed in this Chapter as dynamic and encompassing knowledge, worldviews, beliefs, norms, values, social relationships, perceptions of risk, power relations and responses to the world (Crate, 2008; 2011; Heyd, 2008; Roncoli *et al.*, 2009; Strauss, 2009; O'Brien and Wolf, 2010; Tingley *et al.*, 2010; Rudiak-Gould, 2012; Sudmeier-Rieux, 2012). In this definition culture shapes resilience, and drives both adaptive and maladaptive responses (Siurua and Swift, 2002; Pearce *et al.*, 2009; Nielsen and Reenberg, 2010; Petheram *et al.*, 2010; Buikstra *et al.*, 2010; Paul and Routray, 2011). This assessment focuses on the dimensions of culture that maintain identity and a sense of belonging, and that carry potential for creating unequal power relations and conflict.

Climate change is driven by, embedded in, and acts upon culture in myriad ways: consumption and energy use that drives anthropogenic emissions of greenhouse gases, are culturally embedded. And the phenomenon of climate change is perceived through scientific as well as other cultural expressions (Norgaard, 2011). Similarly, there are widely different cultural expressions of weather, risk and the need for adaptation to such hazards (Hulme, 2008; Adger et al., 2013). Since climate change has consequences for people there is high confidence that it also has significant cultural implications (Crate, 2011; Strauss 2012), with knock-on effects for human security.

For many indigenous and rural communities in particular, culture is constructed around livelihood activities such as pastoralism, herding, farming, fishing, and hunting and gathering. Research has documented how livelihoods and cultural practices have been affected by observed changes in diverse direct and indirect climate impacts: seasonal

weather patterns, extreme events, extreme drought and flood cycles, sea level rise, erosion, subsidence, coral bleaching, salinization, species abundance and composition, relocation and increasingly dangerous travel conditions (Oswald Spring et al., 2013). Many of these anthropological studies suggest that further significant changes in the natural resource base upon which many cultures depend, would directly affect the cultural core, worldviews, cosmologies and mythological symbols of indigenous cultures (Crate, 2008; Gregory and Trousdale, 2009; Jacka, 2009). Conversely many cultures have adapted to significant societal and environmental changes throughout history and colonial encounters (Nuttall, 2009; Cameron, 2012; Strauss, 2012). Much research in this area concludes that analysis of cultural understanding of environment, risk and social practices increases the explanatory power of models of risk (Ifejika Speranza *et al.*, 2008; Jacka, 2009; Adger al., 2011).

A further set of research examines cultural, local and individual perceptions and narratives of risk, resilience and adaptive capacity. It finds mixed results: that culturally embedded perceptions in some cases increase human security and in some cases are negative to human security outcomes by way of facilitating or hindering adaptation (Rudiak-Gould, 2012; Gómez-Baggethun *et al*., 2012; Burningham *et al.*, 2008; West and Hovelsrud, 2010; Zamani *et al.*, 2006; Nursey-Bray *et al*., 2012). In scientific studies of how resource-dependent communities articulate climate change, anthropological studies have shown that perception of climate change is often based on how English language terms are translated and understood in the local language (Rudiak-Gould, 2012), and the perception is interpreted through personal lifestories and culture (Kuruppu and Liverman, 2011). Anthropological studies have analysed how the concept of climate change is translated in various cultures and have observed both denial, particularly in situations where religions or cognitive frames do not perceive changing climate (Rudiak-Gould, 2012; Kuruppu and Liverman, 2011; Sánchez-Cortés and Chavero, 2011; Lipset, 2011). This denial of climate change is observed across all societies, and explained by sociological analysis as resulting from paralysis in the face of externally-imposed change (O'Brien and Wolf, 2010; Norgaard, 2011).

Scientific information on weather variability and change is framed through cultural practices: climate forecast or downscaling results are presented but not necessarily understood and assimilated well by, for example, local farmers (Roncoli, 2006). Local perceptions of what kind of knowledge is trustworthy may in fact question both scientific findings (Burns *et al.*, 2010; Ingram *et al.*, 2002) and how to deal with uncertain climate information (Roncoli *et al.*, 2011). Human security is further weakened if (climate) policy does not consider the cosmologies and epistemologies embedded in culture (Jacka, 2009; Stadel, 2008). Table 12-2 illustrates the different dimensions in which climate change is interpreted and against which human security is affected.

[INSERT TABLE 12-2 HERE
Table 12-2: Cultural dimensions of human security in the context of climate change.]

12.3.2. Community and Culture at Risk

Cultural dimensions of climate change are manifest in collective action and community. Community is a contested term in various disciplines (Gibson and Cameron, 2011). Community, as used here, refers to place-based groups that exhibit some form of unity and obligation among the members.

There is a significant body of research that analyses community and collective action for adaptation. Its principal finding is that community-led action is effective for reducing risks and building capacity for adaptation (Davidson *et al.*, 2003; Catto and Parewick, 2008; Harries and Penning-Rowsell, 2011; Gero *et al.*, 2011; Fazey *et al.*, 2010; Furgal and Seguin, 2006; Sudmeier-Riuex *et al.*, 2012; Anik and Khan, 2011; Adler, *et al*., 2012). Specifically this literature finds that community participation in risk and vulnerability assessments produces more sustainable solutions (Ardalan *et al.*, 2010; Gero *et al.*, 2011) and that so-called co-management and learning, increases adaptive capacity (Fazey *et al.*, 2010; Armitage *et al.*, 2011; Dumaru, 2010; Ford *et al*., 2007). Caveats to such analysis highlight structural barriers to community-led action and shows that participation in collective action is limited by hierarchical power relations (Singleton, 2000; Herbert, 2005; Davidson *et al.*, 2003; King, 2008; Ensor and Berger, 2009; Nielsen and Reenberg, 2010; Onta and Resurrection, 2011).

Table 12-2 reports on evidence across issues of culturally-determined perceptions of climate risks and responses. It highlights major findings that flexibility and livelihood diversification are two key factors in successful adaptation to variability in resource abundance (de Sherbinin *et al.*, 2008; Desta and Coppock, 2004; Ford *et al.*, 2006; Kalikoski *et al.*, 2010; Hovelsrud *et al.*, 2010a,b; Rybråten and Hovelsrud, 2010; McNeeley, 2011; Marshall 2011; Eakin *et al*., 2012; Ford and Goldhar, 2012; Berkes and Armitage, 2010). Further evidence suggests that changing socio-economic and environmental conditions may constrain existing coping community mechanisms (Rattenbury *et al.*, 2009; West and Hovelsrud, 2010; Quinn *et al.*, 2011). Local community responses are also shaped by political and economic globalization, in terms of a decoupling of production- and political networks from the local level (Keskitalo, 2009), and by colonial history (Marino, 2012).

12.3.3. Indigenous Peoples

There are about up to 500 million indigenous people worldwide (see Glossary for an inclusive definition), living under a wide range of social, economic and political conditions and locations (Nakashima *et* al., 2012). Indigenous peoples represent the world's largest reserve of cultural diversity and the majority of languages, and assessments of the cultural implications of climate change for human security illustrate similarities across geographical regions and climatic conditions. For many indigenous communities, there are significant linkages between historical colonization and current climatic changes (Cameron 2012; Howitt et al 2012; Salick and Ross 2009; Marino, 2012). It is argued in some literature that research on climate change in regions with significant indigenous populations often has assumptions concerning indigenous peoples being more connected to place than others (Cameron 2012) while scientists and indigenous peoples are increasingly using hybrid knowledge across scientific and traditional domains (Huntington 2011).

To a great extent the livelihood and culture of indigenous peoples are closely connected to natural resources, and in many parts of the world they are economically and socially marginalized (Crate and Nuttall, 2009). There is a *general agreement* that historically indigenous peoples have a high adaptive capacity to highly variable environmental conditions, but less so with respect to rapidly changing socio-economic conditions and globalization (Tyler *et al.*, 2007; Crate and Nuttall 2009). Conversely, the lack of adaptation to colonization and globalization may reflect resilience and the determination of indigenous peoples to maintain cultures and identities - and so does not necessarily indicate low adaptive capacity. The challenge of maintaining cultures and livelihoods will be exacerbated by climate change (Crate and Nuttall 2009; Rybråten and Hovelsrud, 2010). Such risks are exacerbated when: traditional practices – including those related to mobility - no longer prove effective in responding to climate variability (Green *et al.*, 2010); governments relocate communities (Hitchcock, 2009; McNeeley, 2011); policy and disaster relief creates dependencies (Wenzel, 2009; Fernandez-Gimenez et al. *et al.*, 2012); there are inadequate entitlements to resources (Shah and Sajitha, 2009); income inequality within and between communities increases (Green *et al.*, 2010); there are constraints to the transmission of language and knowledge between generations (Forbes, 2007).

Climate change poses challenges for indigenous peoples, including to their knowledge systems, cultural practices, adaptive strategies, and post-colonial power relations. The extensive literature on the Arctic shows that for indigenous peoples the changing ice conditions pose risks in terms of access to food, and dangerous travel conditions (Ford *et al.*, 2008; Ford *et al.*, 2009; Hovelsrud *et al*., 2011a). Additionally there are uneven societal consequences related to sea ice use, local physiological setting and community socio-cultural dynamics (Ford *et al.*, 2008), illustrating the heterogeneity within indigenous groups found elsewhere (Barrett, 2001).

Some studies show that current indigenous adaptation strategies may not be sufficient to meet the projected changes (Wittrock *et al.*, 2011. Indigenous peoples are often portrayed as victims of climate change (Salick and Ross 2009), and as vulnerable to the consequences (ACIA 2005), with implications for their human security. Indigenous peoples have a right to maintain their livelihoods and their connections to homeland and place (Howitt *et al.*, 2011), and it is suggested that the consequences of climate change are challenging this right (Box 12-1; Crate and Nuttall 2009). Some raise the question whether the western judicial system can uphold indigenous rights in the face of climate change (Williams 2012).

Much research with indigenous peoples concludes that lack of involvement in resource management decreases resilience and thereby human security, and that it is necessary to focus on indigenous perceptions of risk and traditional knowledge of change, hazards and coping strategies and collective responses (Ellemor, 2005; Finucane, 2009; Turner and Clifton 2009; Sánchez-Cortés and Chavero, 2011; Brown, 2009). Tourism development and industrial activities are particular risks for indigenous peoples when they are not involved in decision-making (Petheram *et al.*, 2010). Lack of formal participation in international policy and management negotiations may pose risks for indigenous peoples because their perspectives may not be heard (Schroeder, 2010), and there are examples of successful indigenous lobbying and advocacy in the case managing persistent organic pollutants and heavy metals in the Arctic (Selin and Selin, 2008).

12.3.4. Local and Traditional Forms of Knowledge

There is *agreement* among researchers that involvement of local people and their local, traditional or indigenous forms of knowledge is critical for ensuring human security (Ellemor, 2005; Kesavan and Swaminathan, 2006; Burningham *et al.*, 2008; Mercer *et al.*, 2009; Pearce *et al.*, 2009; Anik and Khan, 2012). We define such forms of knowledge (also traditional ecological knowledge, farmers' knowledge, indigenous science, ethnoscience) (Nakashima and Roué, 2002) as 'a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations' (Berkes 2012: 7). In addition to reasserting culture, identity and traditional values, such forms of knowledge are experiential, dynamic, and highly context dependent, developed through interactions with other forms of knowledges, including scientific, and viewpoints (Ford *et al.*, 2006; Orlove *et al.*, 2010; Sánchez-Cortés and Chavero, 2011; Eira *et al.*, 2013).

Although some studies warn that the emphasis on the value of local/traditional knowledge may be overrated, such knowledge is increasingly seen as a critical source for understanding change, for identifying socio-economic aspects, for developing adaptation strategies and policies, as critical input to climate scientists. For example, such knowledge serve as a basis for forecasting local weather, and provide the necessary insights about the local climate elements needed for relevant meteorological forecasting (Nyong *et al.*, 2007; Tyler *et al.*, 2007; Gearheard *et al.*, 2010; Hovelsrud and Smit, 2010; Orlove *et al.*, 2000). Local and traditional knowledge are often not included in adaptation planning (King *et al.*, 2007; Ifejika Speranza *et al.*, 2008; Tàbara *et al.*, 2003), or not valued or pursued properly in scientific studies (Huntington: 2011).

Local andtraditional knowledge about historical changes and events, and adaptation strategies to changing conditions are valuable for evaluating responses to change and policy (Angassa and Oba, 2008; Desta and Coppock, 2004; Eira *et al.*, 2013; Ford *et al.*, 2008; Lefale, 2010; Osbahr *et al.*, 2010; Orlove *et* al., 2000; Fernández-Giménez, *et al.*, 2012). It is an important contribution for mitigating natural disasters (Rautela, 2005), maintaining domestic biodiversity (Emperaire and Peroni, 2007), and developing sustainable adaptation and mitigation strategies (Nyong *et al.*, 2007). Among the Borana in Africa indigenous pastoralists' technical and organizational practices have been ignored in development, which has contributed to progressive land degradation, erosion of social structures, and poverty (Homann *et al.*, 2008). Evidence from mountain regions exposed to floods illustrates that incorporation of local knowledge into policy and decision-making reduces risk (Alcántara-Ayala et al., 2004).

Local and traditional knowledge are living resources (Nakashima and Roué 2002; Berkes 2012;) and can be retained through intergenerational transmission, its integration with other forms of knowledge (King and Goff, 2010; Kalanda-Joshua *et al.*, 2011), and its utilization in monitoring and assessments (Klintenberg *et al.*, 2007; Kalabokidis *et al.*, 2008) and in disaster risk management (Becker *et al.*, 2008; Mercer *et al.*, 2009; Pareek and Trivedi, 2011; Bilbao *et al.*, 2010; Kalabokidis *et al.*, 2008). There is *strong evidence* that mutual integration and co-production of local and traditional and scientific knowledge will enhance resilience, increase adaptive capacity and reduce vulnerability (Kofinas, 2002; Oberthür *et al.*, 2004; Tyler *et al.*, 2007; Anderson *et al.*, 2007; Vogel *et al.*, 2007; West *et al.*, 2008; Armitage *et al.*, 2010; Frazier *et al.*, 2010; Marfai *et al.*, 2008; Flint *et al.*, 2011; Ravera *et al.*, 2011; Nakashima *et al.*, 2012; Eira *et al.*, 2013).

Although local stakeholders and scientists may identify competing opportunities and constraints when attempting to reconcile for example local development with resilience to natural hazards (Frazier *et al.*, 2010), the interface

between scientific and local, traditional or indigenous knowledge can be seen as a source of inventiveness rather than where validity of knowledge is contested (King and Goff, 2010). Conversely, projects integrating climate projections and local observations reveal different results or discontinuities, often attributed to different perspectives and cultures (Marin, 2010; Mark *et al.*, 2010). This creates barriers for integration (Kwiatkowski, 2011; Ravera *et al.*, 2011), illustrating the need for incorporating local and indigenous knowledge and observations into climatology, and for creating locally relevant and trustworthy climate projections (Ingram *et al.*, 2002; Ifejika Speranza *et al.*, 2008; Smit et al 2010).

There are many challenges in managing, utilizing, acknowledging and incorporating these forms of knowledge (Huntington 2011), and the participatory approach may not be sufficient because of the cultural and social dynamics of power and interpretation (Roncoli *et al.*, 2011). Some studies suggest that local/traditional knowledge may not be sufficient to provide the proper response to surprising or infrequent risks, hazards or events (Nunn, 2000; Burningham *et al.*, 2008; Kuhlicke, 2010). Additionally if local/traditional knowledge is perceived to be less reliable because of changing environmental conditions (Ingram *et al.*, 2002; Ford *et al.*, 2006), or because of extreme or new events that are beyond the current local knowledge and cultural repertoire (Valdivia *et al.*, 2010; Hovelsrud *et al.*, 2010a), then community vulnerability, and the vulnerability of local/traditional knowledge itself, may increase (Kalanda-Joshua *et al.*, 2011). In the case of coastal communities in India, the societal and environmental conditions have changed to the point at which local knowledge is no longer as applicable as it was in the past (Kesavan and Swaminathan, 2006). In the Himalayas erosion of local/traditional knowledge occurs through government regulations of traditional building materials and practices. The social cohesion embedded in such practices is weakened because of a move towards concrete construction which changes the reliance on and usefulness of traditional knowledge about wood as building material (Rautela, 2005). New conditions may require new knowledge to facilitate and maintain flexibility and improving livelihoods (see also Homann *et al.*, 2008).

12.4. Migration and Mobility Dimensions of Human Security

12.4.1. Impacts of Climate Change on Displacement, Migration, and Mobility

12.4.1.1. Nature of Evidence on Climate Change and Migration

Migration is prevalent in every part of the world, driven by economic and other imperatives. Existing migration systems may be significantly disrupted by impacts of climate change in a number of important dimensions. Migration, defined in terms of temporal and spatial characteristics, is generally classed as a permanent or semi-permanent move by a person of at least one year that involves crossing an administrative but not necessarily a national border. As a result, migrants alter their baseline population of reference and their local networks (Brown and Bean, 2005).

The most significant contemporary trend in migration by volume of movement continues to be major movements of people from rural to urban settlements. The proportion of the global population that is urban has risen from 10 percent in 1900 to over 50 percent in 2009 and is projected to reach 59 percent by 2030 (UNDP 2009; Grimm et al., 2008). Around 80 percent of all migration is presently within countries. Existing global migration trends mapped onto ecological zones by de Sherbinin et al. (2012) show that the past four decades have seen out-migration from mountain regions and from drylands. Net migration to coastal zones was over 70 million people in the 1990-2000 census period, even though cities and coastal zones themselves are at risk from the impacts of climate change.

As with other elements of human security, the dynamics of interaction with climate change are multi-faceted and direct causation is difficult to establish. There is a growing literature on the demographic, economic and social processes of climate migration interactions (Afifi and Jäger 2010; Piguet et al., 2011; Serrano Oswald et al., 2013). The major emphases are on disentangling causation and multiple drivers of migration; displacement of populations from extreme events; governance challenges and the rights of international migrants and displaced peoples; and on the challenges of migration for urban sustainability and climate impacts (Foresight 2011; Black et al., 2011a,c; White, 2011a; Parnell and Walawege, 2011; Seto, 2011 Geddes et al., 2012;).

The most common methods used to examine the actual processes of migration and climate change risks include statistical inference to explain observed migration patterns with climate or related impacts as independent variables; sample surveys of actual migrants to explain their individual drivers of the decision to migrate; and other modeling techniques and indepth qualitative studies designed to explain the social processes and context by which migration decisions are made, often using historical analogies (McLeman and Hunter, 2010; Piguet, 2010). Some modeling studies project impacts of climate change on the viability of continued habitation and examine the impact of rainfall decline or land inundation as a risk factor for the displacement of people. These studies have, for risks such as sea level rise, quantified potential displacement (Nicholls et al., 2011). As with all the major elements of human security in this Chapter, the issue of causality between environment or risk and the human security outcomes of migration are not established.

12.4.1.2. Do Climate Change Impacts Increase Displacement or Restrict Mobility?

It is widely established that extreme weather events displace populations because of their loss of place of residence or economic disruption. This Section reviews evidence on how displacement is highly differentiated socially and has significant economic and social costs (Hallegatte, 2012). Much of the literature, such as reviewed in IPCC SREX report, concludes that with an increasing incidence and changing intensity of extreme weather events due to climate change, there may be increased levels of displacement.

Much evidence shows a distinct temporal dimension to displacement ranging from localised and short-term movement of people, through intra-regional migration to international displacement as a result of large-scale events. The Pakistan floods of 2010 caused primarily localised displacement for large numbers of people across a wide area (Gaurav et al., 2011). The evidence on displacement as a result of climate-related extremes suggests that most displaced people attempt to return to their original residence and rebuild as soon as practical.

In general, structural causes of vulnerability, such as income inequality, race, class, and discrimination, deeply affect the livelihood drivers of displacement and the consequences of return. The migration associated with Hurricane Katrina, for example, shows that in New Orleans economically disadvantaged populations were displaced in the immediate aftermath and have not returned (Myers et al., 2008). Fussell et al. (2010) found that 14 months later black residents returned more slowly, because they had suffered greater housing damage. Adams et al. (2009) identified factors that have led to a ‘chronic disaster syndrome’ where some populations are unlikely to return, and Hori and Shaefer (2010) suggest that displacement affected human security through housing, economic and health outcomes. There is also evidence of gender differentials in displacement from extreme events, especially when they lose their social networks or their social capital, and are often affected by adverse mental health outcomes in situations of displacement (Tunstall et al., 2006; Oswald Spring, 2008; Hunter and David, 2011).

Structural vulnerabilities affect the ability to cope with climate change and extreme events without migrating. Hurricane Mitch in 1990 affected different Central American countries and displaced up to two million people either temporarily or permanently. The impact was highly differentiated by country, with much lower displacement rates in Belize compared to Nicaragua, Honduras and El Salvador, with large scale displacement and an increase in international migration of 300 percent from Honduras (Glantz and Jamieson, 2000; McLeman and Hunter, 2010). But the impacts of such events are highly uneven. While the poorest households in Honduras were hardest hit by the hurricane (McSweeney and Coomes, 2011), they were less vulnerable to storms a decade later due to changes in land tenure and better early warning systems (Villagrán, 2009).

Not all populations are displaced by extreme weather events. A further strand of evidence on migration shows social differentiation in access to the resources necessary to migrate (Renaud et al., 2011; Black et al., 2012). A review by Black et al. (2012) proposed that populations that are trapped through lack of mobility. Figure 12-1 illustrates these dynamics, showing how vulnerability is inversely correlated with mobility, leading to those being most exposed and vulnerable to the impacts of climate change having the least capability to migrate. Therefore, climate change risks may be most significant when they reduce and constrain opportunities.

[INSERT FIGURE 12-1 HERE
Figure 12-1: Relationship between vulnerability to environmental change and mobility. Lack of mobility and high vulnerability are positively correlated. Adapted from Black et al. (2013).]

One consistent theme of the hazards literature is that while migration responses are common, movement is costly and disruptive and hence may only be used as an 'adaptation of last resort' (McLeman, 2009). Paul (2005) found that there was little displacement in Bangladesh as a result of flooding in affected villages and that residents perceived an influx of migrants due to the reconstruction. Hurlimann and Dolnicar (2011) showed for eight Australian settlements that relocation and migration was perceived to be the least desirable adaptation. Haug (2002) showed that pastoralists displaced due to drought in Sudan in the 1990s attempted to return to their previous settlements after the drought, notwithstanding conflict and other factors. McLeman and Hunter (2010) reviewed historical cases of displacement migration and concluded that non-migration or rapid return migration significantly outweighs permanent migration following hurricane impacts in the Caribbean, Dust Bowl migration in the 1930s USA, or dry season migration in the West African Sahel.

Table 12-3 summarises studies on weather extremes and long-term environmental change with migration outcomes showing that some events and trends lead to increased displacement of populations (column 1); while others lead to reduce mobility and significant trapped populations (column 2). Table 12-3 also demonstrates that in many circumstances (column 3) sections of populations are differentially affected, on the basis of ethnicity, wealth or gender (Elliot and Pais, 2006; Gray and Muller, 2012; Upton, 2012). Table 12-3 therefore demonstrates that the key impacts of climate change include increased displacement; reduced mobility and trapped populations; and migrant populations moving towards destinations likely to be more hazardous due to the impacts of climate change (Black et al., 2011a).

[INSERT TABLE 12-3 HERE
Table 12-3: Empirical evidence on observed or projected mobility outcomes (migration, immobility, or displacement) associated with weather-related extremes or impacts of longer-term climate change.]

Studies highlight that long distance migration is reduced by drought in pastoral systems and hence is experienced as reduced mobility (Findley, 1994; van der Geest, 2011; Sánchez et al., 2012). All pioneer migration to urban centres requires significant human and financial capital and hence is restricted to wealthier populations. Henry et al. (2004) confirmed in a multi-year study of Burkina Faso that the movement to other rural areas increased in dry years, but long distance or international migration was limited to years of high agricultural productivity. Kniveton et al. (2011) model migration movements from the 1980s in Burkina Faso and project that future scenarios of decreased rainfall would significantly increase rates of out-migration from rural areas.

Displacement migration as an adaptation to environmental change has a potential interaction with conflict: increased demands on local resources and services can create competition with resident populations, or where there is ethnic tension and distrust between migrants and residents (Reuveny, 2007; Warner et al., 2010; Hendrix and Salehyan, 2012). Evidence in this area is mixed. There is no established consensus on relationships between resource scarcity (whether the initial state or resulting from immigration) and conflict (Section 12.5; Hendrix and Salehyan, 2012). An analysis of multiple cases of large scale population displacement in Africa (from causes such as civil war and conflict) report that significant conflict emerged in receiving areas in around 50 percent of cases, and is less likely when migrants and residents are of the same ethnicity and religion (Reuveny, 2007). Conversely, conflict, particularly large-scale violent conflict, can lead to displacement. This is most common where much of the population is dependent on the environment for livelihoods, as conflict impacts the ability of communities to access resources and respond to environmental variation, increasing the propensity for migration out of the area (Raleigh, 2011). That such displacement may initiate new conflict in receiving areas indicates the complex nature of conflict, and that migration will simply be one contributing factor.

There is some evidence that new migrants are more at risk in cities for two reasons. First, low income migrants are vulnerable to labour market discrimination, access to services such as health care and to crime and violence (McMichael et al., 2012; Fox and Beall, 2012). Second, low-income migrants cluster in high-density areas with exposure to flooding and landslides, with these risks increasing with climate change (Chatterjee, 2010; McMichael

et al., 2012). Migrants in Buenos Aires, Lagos, Mumbai and Dakar (Chatterjee, 2010; World Bank, 2010; Mehrotra et al., 2011) are more likely to be exposed to weather-related hazards than long-term residents. In Dakar (1998-2008), 40 percent of new migrants resided in areas with high flood risk. Wang et al. (2012) found that migrants had less knowledge about typhoon risks in Shanghai. Tompkins et al. (2009) showed that new migrants in the Cayman Islands are most vulnerable to tropical cyclones as they are least likely to prepare for cyclones, live in locations with high exposure to cyclone impacts, and interact mostly with expatriates without previous cyclone experience. There is no established evidence that rapid urbanization itself is a source of conflict: Buhaug and Urdal (2013) test hypotheses on social disorder and population growth in 55 cities in Africa and find that rapid growth of city populations does not drive urban unrest.

12.4.1.3. Migration Trends and Long-Term Climate Change

Long-term environmental change, sea-level rise, coastal erosion, and loss of agricultural productivity (Table 12-3) will have a significant impact on displacement. Barbieri et al. (2010) estimated emigration rates in Brazil from affected rural areas and found that de-population occurs with relatively modest rates of warming. In their scenarios the biggest increase in migration comes from productive agricultural areas that support a large labour force. Medelsohn et al. (2007) concluded that in dryland Brazil urban migration is highly likely due to agricultural income loss.

Longer term environmental change caused by climate change also amplifies existing trends such as rural to urban migration, though results diverge on the importance of climate change and resource scarcity. Modelling studies with future projections on Mexico-US migration rates (Feng et al., 2009), and on Brazilian internal migration (Barbieri et al., 2011) show that projections of drying increase emigration in established migration routes and de-population of rural areas (Kniveton et al., 2011). Barrios et al. (2006) used statistical modelling of changes in rainfall to explain migration rates to African cities. They observed rainfall decreases during the past fifty years and showed statistically they only partially explained differences in urbanization rates, with shortages in rainfall increasing urbanization in sub-Saharan Africa, but often propelled by simultaneous liberalization and policy change.

Nicholls et al. (2011) estimate displacements based on potential sea-level changes till 2100. A 0.5m sea-level change implies a likely land loss of 0.877 million km^2 by 2100, displacing 72 million people, with no adaptation investment and with 2.0 metres, 1.789 million km^2 would be lost, displacing 187 million people, or 2.4 percent of global population, mostly in Asia. If all coasts were protected with dikes and beach nourishment, these estimates fall to 0.041-0.305 million people displaced by 0.5-2.0 m of sea level rise. Hallegatte et al. (2011) assume that such protection measures are very likely as the cost of not investing in protecting urban land and infrastructure is so great. Existing migration trends are also likely to exacerbate impacts of climate change and vulnerability themselves. There is a well-documented drift of population into coastal and regional settlements. Curtis and Schneider (2011) project 12 million people to be affected by sea-level rise by 2030 in four major coastal areas in the US.

Even in areas under threat from long-term climate change, individual migration decisions and aggregate flows are embedded in economic and cultural imperatives. Mortreux and Barnett (2009) found that migration from Tuvalu was not driven by perceptions of climate change and that despite forecasts that the island could become uninhabitable, residents have remained for reasons of culture and identity. Shen and Gemenne (2011) concur that both Tuvalu residents and migrants from Tuvalu in New Zealand did not cite climate change as a reason for movement. Both studies also argue that environmental risks directly affect perceptions of potential well-being and economic opportunities: hence the impacts of climate change may be a more significant driver of future international migration. Observational studies of international migration show that past migration flows are the greatest predictors of future flows because of identity and cultural linkages in both source and destination regions (Serrano Oswald, 2013).

12.4.2. Migration as an Adaptation to Climate Change Impacts

From a human security perspective, migration is a widely used adaptation strategy that reduces risks in highly vulnerable places. Studies have outlined the social processes by which migration reduces vulnerability, and often conclude that a greater emphasis on mobility within adaptation policies would be effective (Barnett and Webber, 2010; Bardsley and Hugo, 2010; Warner, 2010; Gemenne, 2011). This emerging literature focuses on four areas of government intervention: a) social protection mechanisms such as cash transfers to reduce the likelihood of temporary displacement from weather-related extremes (Johnson and Krishnamurthy, 2010); b) adaptation in destination regions, by reducing the vulnerability of migrants in growing urban areas; c) protection and assistance of migrants as they move with rights to citizenship and ability to make economic linkages back to source regions and countries (Fox and Beall, 2012; Martin, 2012); and d) dealing with the prospect of relocation of settlements.

With observed climate changes, such as melting permafrost, and projected changes in resource productivity and risks, various governments are engaged in planning to move settlements as part of adaptation strategies (de Sherbinin et al., 2011). Scientific literature on these policies most often portrays resettlement as a failure of adaptation and a policy of last resort (Barnett and Webber, 2010; Fernando et al., 2010; Hugo, 2011; de Sherbinin et al., 2011). Most of the evidence to date, learning from other resettlement programmes, demonstrates negative social outcomes for those resettled, often analysed as breaches in individual human rights (Johnson, 2012; Bronen, 2011). There is some documented examples of settlements that are already planning for their own relocation, such as five indigenous communities in Alaska that are threatened with increased erosion, loss of ice cover and flooding over the past decades (Bronen, 2010). These settlements have undertaken planning for relocation and have received government funding for these processes. In line with all major analyses in this area, Bronen (2010) concludes that while the relocations are feasible, cultural and psychological elements at individual and community level are difficult to assess. There is significant resistance to relocation, even where such options are well planned and have robust justifications, as demonstrated by (Marino, 2012) for relocation in Alaska.

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Box 12-4. Evidence on the Existence of Environmental Migrants and International Policy to Protect Them

Legal and political research has shown that the term climate refugee is not meaningful. First, the quantified global estimates of 'environmental refugees' proposed by Myers (2002) and others, for example, and repeated in policy documents, have been widely criticised (Black et al., 2011a; Taccoli, 2009; Piguet, 2010; Gemenne, 2011; Jakobeit and Methmann 2012; Bettini, 2013). Most present research focuses on the multiple drivers and on migration processes and shows that models of displacement fail to include other adaptation strategies and that quantifying displacement as the prime migration issue fails to account for the reality of migration systems and existing flows.

Second, there is widespread agreement in the scientific and legal literature that the use of refugee in this context is 'erroneous as a matter of law, and conceptually inaccurate' (McAdam, 2011, p. 102). The arguments put forward for a specific legal instrument to deal with migrants who have been displaced as a direct result of climate change impacts include issues of rights given that such migration is imposed and involuntary (Bell, 2004); the scale of the potential issue with the potential for large populous areas to be inundated in the future due to sea level rise in particular (Bates, 2002); and the particular status of small island nations where displacement could affect sovereignty (Biermann and Boas, 2009; Williams, 2008; Owens, 2008).

For international displacement and migration, there is a growing literature on the nature of displacement; whether there are governance mechanisms facilitating migration at present; and the optimal design of such mechanisms in future (e.g. Biermann and Boas 2009, Williams, 2008; Bryavan and Rajan, 2006; Docherty and Giannini, 2009; Martin, 2009; McAdam, 2011). This literature focuses on strategies for adaptation, mitigation and resilience building, and concludes that significant adaptation may be required to protect and to empower internal or international migrants triggered by climate change. Several legal proposals have been analysed by socio-legal studies suggesting new multilateral conventions, or compensation mechanisms to countries where the population is forced to migrate (Bierman and Boas, 2012).

New international governance mechanisms for international displacement address the difficulties to develop such an instrument in international law. Most migration and climate studies point to the environment as triggers and not causes for migration decisions. Some studies focus on the geo-political implications of changing the Geneva Convention on refugees to include environmental migrants as well as the lack of global instruments to handle internal displaced peoples or international migrants (Martin, 2009; Cournil, 2011). Others discuss the implications of climate migrant status in international migration, where full citizenship and economic status in destination countries are often not realised (McAdam, 2011; Hartmann, 2010). Many small island countries are reluctant themselves to have their international migrants designated as being victims of climate change (McNamara and Gibson, 2009; Farbotko, 2010; Fabrtoko and Lazrus, 2012; Barnett and O'Neill, 2011).

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12.5. Dimensions of Conflict and Vulnerability to Climate Change

12.5.1. Climate Change as a Cause of Violent Conflict

In the past decade there has been a significant increase in research investigating the interactions between climate change and violent conflict, reflecting policy discourses that climate change impacts and resource scarcity could escalate conflict risks. Changes in climate will bring groups of people into conflict over property rights, markets, and public goods. Offsetting those risks, there is evidence that in specific circumstances resource scarcity drives adaptation and innovation (Butzer 2012, Gausset and Whyte 2005, Mehta 2010). And resource scarcity rarely escalate to violence, and violent conflict itself has generally become less common and less intense since 1991 (Goldstein 2011, Themnér and Wallensteen 2012). Risks between climate change and conflict are defined as emerging in Chapter 19 (19.4) as this is a new area of research. This Chapter concludes that there are multiple interactions between conflict and climate change impacts, and that some well established contributing factors to conflict are sensitive to climate variability and change.

There is a modest amount of research that explores the relationship between large-scale disruptions in climate and the collapse of past empires (using statistical analysis and data derived from archaeological and other historical records). For example, the timing of the collapse of the Khmer empire in the Mekong basin in the early 15th century corresponds to an unusually severe prolonged drought (Buckley et al 2010). DeMenocal (2001) summarizes evidence that suggests that major changes in weather patterns coincided with the collapse of several previously powerful civilizations, including the Anasazi, the Akkadian, Classic Maya, Mochica, and Tiwanaku empires. The precise causal pathways that linked these changes in climate to changes in civilizations are not well understood due to data limitations. This evidence from historical antecedents cannot be taken to mean future changes in climate will lead to large-scale political collapse due to diverse changes and globalization in the contemporary world (Butzer 2012).

A modest body of research shows that the Little Ice Age was associated with more cases of political upheaval and warfare than in any other period (Parker 2008, Zhang et al 2011), including in Europe (Tol and Wagner 2010), China (Brook 2010), and the Ottoman empire (White 2011b). These studies all show that climate change can exacerbate major political changes given certain social conditions, including a predominance of subsistence producers, conflict over territory, and autocratic systems of government with limited power in peripheral regions.

There is very little research that explores the risks that climate change poses to violent conflict between states in the past half century. Most recent studies agree that systemic trends towards peace between countries are unlikely to be affected by the impacts of climate change, even with respect to expected changes in transboundary rivers (Bernauer and Siegfried 2012, Brochmann and Hensel 2009, Dinar et al 2011, Feitelson et al 2012, Gartzke 2012, Goulden et al., 2010, Tir and Stinnett 2012, Wolf 2007). All studies show that there are robust institutions that mediate information and create commitments to shared solutions to manage the transboundary impacts of climate variability. The growth and improved capacity of these institutions is major reason why war between states is increasingly rare (Goldstein 2011).

There is a modest amount of research that finds an association between increases in temperature and violent crime (Anderson 1987, Anderson 2001, Breetzke and Cohn 2012, Butke and Sheridan 2010, Field 1992, Gamble and Hess 2012, Rotton and Cohn 2001). Theories that explain that pathways between higher temperatures and violent crime are contested (Breetzke and Cohn 2012, Gamble and Hess), and there is also debate about the effect of very high temperatures on violent crime, with some evidence showing that violent crime falls in conditions of extreme heat (Gamble and Hess 2012, Rotton and Cohn 2001). These debates highlight uncertainties that limit conclusions about the effects of climate change on violent crime. Evidence for this relationship between temperature and violent crime is mostly from cities within the United States, and from crime data in recent decades, whereas historically, and globally, rates of violent crime generally fall as per capita wealth increases (Cole and Gramajo 2009, Neumayer 2003). Studies that seek to discover the major causes of violent crime do not identify temperature and other climate variables are significant, with factors relating to culture, income, and policy explaining most of the variation between countries and over time (Cole and Gramajo 2009, Fajnzylber et al 2002, Karstedt 2001, Kawachi et al 1999, Neumayer 2003).

Most of the research on the connections between climate change and violent conflict focuses on the connections between climate change and civil war. For the most part this research examines rainfall or temperature variability as proxies for the kinds of longer-term chances that might occur due to climate change (see also Chapter 19). One study examines the relationship between temperature and violent conflict (Burke et al. 2009), although this has been challenged (Buhaug 2010). The vast majority of studies seek evidence from Africa, and using satellite-enhanced rainfall data collected since 1980. A global study by Hsiang et al (2011), finds that since 1950 and in countries that are teleconnected to ENSO the risk of war within countries rises during an ENSO period. This study is supported by some studies that find associations between deviations in rainfall and civil war (Miguel et al. 2004, Hendrix and Glaser 2007), but contradicted by others that find no significant association between droughts and floods and civil war (Buhaug 2010, Buhaug and Theisen 2012, Theisen et al., 2012, Slettebak 2012). Examination of individual conflict shows that there is no prospect of identifying specific civil wars as being primarily driven by climate. Box 12-5 demonstrates multiple resource and political dimensions of the Darfur conflict with no studies concluding that the conflict was climate-driven.

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Box 12-5. Climate and the Multiple Causes of Conflict in Darfur

Climate variability is popularly reported to be a significant cause of the mass killing in the Darfur region that began in 2003 (see Mazo 2009): long term drought and vulnerability of the population to drought has been identified as the trigger and cause. Five detailed studies of the conflict conclude that climate variability and related environmental changes are proximate but not primary causes of the violence.

The detailed studies find that the violence in Darfur has multiple causes, notably:

- The legacy of past violence, which established groups that had a history of violent action, and a supply of weapons
- Manipulation of ethnic divisions by elites in Khartoum
- Weakening of traditional conflict resolution mechanisms through government policies, and as a consequence of famines
- Systematic exclusion of local groups from political processes, including of the Fur, Masalit, and Zaghawa ethnic groups
- Limited economic development and inadequate provision of public services and social protection, stemming from governance and policy failures, political instability, and misuse of official development assistance
- Desertification, declining productivity of arable land, and increased aridity.

(Brown 2010; Hagen and Kaiser 2011, Kevane and Gray 2008, Sunga 2011, Verhoeven 2011)

All analyses agree that it is not possible to isolate any of these specific causes as being most influential (Hagen and Kaiser 2011, Kevane and Gray 2008, Sunga 2011, Verhoeven 2011). Most authors identify government practices as being far more influential drivers than climate variability, noting also that similar changes in climate did not

stimulate conflicts of the same magnitude in neighboring regions, and that in the past people in Darfur were able to cope with climate variability in ways that avoided large scale violence.

These studies therefore dispute the identification of the Darfur conflict as being caused by climate change, arguing that attributing this conflict to climate change masks the culpability of actors and the major drivers of insecurity.

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There remains significant disagreement about the nature of the evidence and the strength of the conclusions that can be drawn from it. There is agreement that climate is only one factor in the risk of civil war, and that where other risk factors are extremely low (such as where per capita incomes are high, and states are strong democracies), the impact of changes in climate on civil war is negligible (Bernauer et al 2012, Koubi et al 2012, Scheffran et al. 2012a).

A growing body of research examines the connections between climate variability and smaller scale violent conflicts (communal violence). There is some agreement that both increased rainfall and decreased rainfall in resource-dependent societies enhances the risk of localized violent conflict, particularly in pastoral societies in Africa (Adano et al 2012, Butler and Gates 2012, Hendrix and Salehyan 2012, Raleigh and Kniveton, 2012, Theisen 2012). In all such cases, the presence of institutional structures that protect property rights and manage conflict are highlighted as the critical factors in mediating such risks (Adano et al. 2012, Benjaminsen et al., 2012, Butler and Gates 2012, Hidalgo et al. 2010, O'Loughlin et al 2012, Gausset 2005, Theisen 2012).

In response to the challenges of finding direct associations between changes in climate and violence, some research has examined the effects of changes in climate on factors that are known to increase the risk of civil war (Berholt and Lujala 2012, Koubi et al. 2012). Civil war has been studied extensively using quantitative and qualitative techniques, and there is strong agreement about factors that increase the risk of civil war, namely: a recent history of civil violence, low levels of per capita income, low rates of economic growth, economic shocks, inconsistent political institutions, and the existence of conflict in neighboring countries (Blattman and Miguel 2010, Brückner and Ciccone 2010, Dixon 2009, Hegre and Sambanis 2006, Miguel et al. 2004, Weede 2004). Nevertheless, almost all studies note that there are few convincing theories that explain the ways these factors cause violence.

Many of the factors that increase the risk of civil war are sensitive to climate change. For example, there is robust evidence that climate change will slow rates of economic growth and impede efforts to grow per capita incomes, particularly in Africa where the risk of conflict is highest (chapter 10) (Eboli et al 2010, Mendelsohn et al. 2000, Mendelsohn et al. 2006, Stern 2007). Extreme events, which may become more intense due to climate change, can also produce economic shocks (Bergholt and Lujala, 2012; Hallegatte 2012; Adam, 2013), although the direct association between disasters and violent conflict is contested (Bergholt and Lujala 2012, Pelling and Dill 2010, Slettebak 2012). There is some evidence that under certain circumstances disasters can provide critical opportunities to build peace in conflict settings, and to improve governance institutions (Bruckner and Ciccone 2011, Kingsbury 2007, Olson and Gawronski 2010). There are theoretical reasons, but limited evidence, to suggest that climate change can lead to more inconsistent political institutions (Barnett and Adger 2007, Scheffran et al. 2012b).

In summary, there is justifiable common concern that climate change may increase the risk of violent conflict in certain circumstances (Bernauer et al. 2012; Gleditsch, 2012; Sceffran et al., 2012), even if the strength of the effect is uncertain. This concern is justified given robust knowledge of the factors that increase the risk of civil wars, and evidence that some of these factors are sensitive to climate change, There is also general agreement in the literature that there is a need for theories and data that explain the processes that lead from changes in climate to violence, including on the institutions that help avoid violent outcomes (Barnett and Adger, 2007; Sheffran and Battaglini, 2011; Buhaug and Theisen 2012, Gleditsch, 2012; Murtinho and Hayes, 2012;). However, confident statements about the effects of future changes in climate on violence of any kind are not possible given the absence of generally supported theories and evidence about causality (see Box 12-5).

12.5.2. Conflict and Insecurity Associated with Climate Policy Responses

Research is beginning to show that climate change mitigation and adaptation actions can increase the risk of violent conflict, as well as compound vulnerabilities in certain populations (Bumpus and Liverman 2008; Adger and Barnett 2009; Dabelko, 2009; Webersik 2010; Fairhead et al. 2012, Marino and Ribot, 2012,). There is evidence that violent political struggles occur over the distribution of benefits from natural resources (Peluso & Watts, 2001). On this basis, in circumstances where property rights and conflict management institutions are ineffective, efforts to mitigate or adapt to climate change that change the distribution of access to resources have the potential to create and aggravate violent conflict.

Actions taken in response to climate change can aggravate significant inequalities or grievances (Marino and Ribot, 2012), limit access to land and other resources required to maintain livelihoods, or otherwise undermine critical aspects of human security (Bumpus and Liverman 2008, Fairhead et al. 2012). Instances of maladaptation or greenhouse gas mitigation efforts at odds with local priorities and property rights increase the risk to populations and may increase the risk of conflict, particularly where institutions governing access to property are weak, or favour one group over another (Barnett and O'Neill, 2010; Butler and Gates 2012, McEvoy and Wilder, 2012).

Research on the rapid increase in biofuels finds evidence connecting "land grabbing," land dispossession, and social conflict (Molony and Smith 2010; Borras Jr. et al. 2010; Dauverge and Neville 2010; Vermeulen and Cotula 2010). Some research has identified links between increased biofuels production, food price spikes, and social instability such as riots (Johnstone and Mazo 2011).

The provision of financial resources in payment for ecosystem services projects such as are associated with Reduced Emissions from Deforestation and Forest Degradation (REDD) have the potential to stimulate violent conflicts (Melick 2010). For example, efforts to ensure 'REDD readiness' in Tanzania (Beymer-Farris and Bassett, 2012) and the Congo basin (Brown et al., 2011) have placed communities opposed to marginalization and displacement in conflict with conservationists and governments. Eriksen and Lind (2009) likewise find that climate change adaptation in Kenya has the capacity to aggravate surrounding conflicts.

Climate change mitigation will increase demand for deployment of less carbon-intensive forms of energy, including hydropower, some of which have historically resulted in social conflict and human insecurity (for example forced resettlement), and this is a basis for concerns about increased violence and insecurity in the future (Conca 2005; McDonald-Wilmsen et al., 2010; Sherbinin et al. 2011). Other research points to an increased use of nuclear power increasing the threat of nuclear proliferation or incidents of nuclear terrorism (Socolow and Glaser 2009).

12.5.3. Violent Conflict and Vulnerability to Climate Change

Many of the capacities required to adapt to climate change are threatened by the presence of ongoing or recent conflict (Barnett 2006, Brklacich et al., 2010). There is a strong body of evidence from development studies and political science that violent conflict undermines human security and the capacity of individuals, communities, and states to cope with changes (Stewart and Fitzgerald 2001; Blattman and Miguel 2010,). This evidence base suggests, with *high confidence*, that where violent conflict emerges and persists, capacity to adapt to climate change is likely to be low (as illustrated in Figure 12-2) (Barnett, 2006; Lind and Eriksen, 2006; Eriksen and Lind, 2009; Adger, 2010).

[INSERT FIGURE 12-2 HERE
Figure 12-2: Conflict and post-conflict societies exhibit low levels of governance and human development. Source: Adger (2010).]

There is some evidence that violent conflict degrades the quantity and quality of natural resources, and often leads to these resources being exploited inefficiently. Chronic political instability in Zimbabwe, is, for example implicated in high levels of illegal bush meat hunting (Lindsey et al., 2011). Conflict, and the displacement of large populations,

can also alter the abundance and distribution of biodiversity and can result in significant deforestation (Chase and Griffin, 2011; Lindsell et al., 2011; Stevens et al, 2011).

Violent conflict interrupts the ability of resource dependent individuals and communities to access natural resources (Pike, 2004; Detraz, 2009; Kolmannskog 2010; Raleigh, 2011), and in so doing limits their capacity to adapt to climate change. The denial of strategic space as a tactic in violent conflicts (through for example, deliberate destruction of crops and spreading of landmines in conflict affected regions) can reduce the capacity of individuals and communities to access natural capital (Berhe, 2007; Unruh, 2011).

Conflict disrupts markets and destroys infrastructure, limits education and the development of human capital, causes death and injury among a state's workforce, and decreases the ability of individuals, communities and the state to secure credit (Blattman and Miguel 2010, Goodhand, 2003; Stewart et al., 2001). Conflict thus creates poverty and constrains livelihoods which in turn increases vulnerability to the impacts of climate change (Nigel, 2009; Deng 2010a, Hilson and van Bockstael, 2011). Thus violent conflict is a major cause of hunger and famines (de Waal 1993, Messer and Cohen 2011, Rowhani et al., 2011).

The capacity for collective action is a critical determinant of the capacity to adapt to climate impacts, and this too can be undermined by violent conflict, depending on the nature of violence and the strategies households adapt in response (Deng, 2008 and 2010b). When conflict exacerbates existing horizontal inequalities between ethnic or religious groups, foments distrust in local or government institutions, or isolates individuals and households, capacities that are critical to coping with climate impacts are also degraded (Bogale & Korf, 2007). In situations where there is violent conflict, efforts to address climate change that provide financial or resource flows, or political levers that can be captured by local elites or illegitimate institutions, may compound divisions where such efforts (Brown et al., 2011; Verhoeven, 2011).

Conflict related displacement also creates and exacerbates social isolation and accompanying sources of vulnerability. Isolation from social networks can make it difficult to achieve pillars that underlie traditional livelihoods, such as marriage, access to land, or access to communal social safety nets in times of vulnerability (Raleigh, 2011; Kolmannskog 2010).

Violent conflict can decrease the capacity of local and state level institutions to function effectively (Feitelson et al., 2012; Tignino, 2011). For example, chronic political conflict has reduced the ability of governance institutions at many scales to manage water resources in the Gaza Strip effectively (Shomar, 2011), parts of the Balkans (Skoulikidis, 2009), and the Middle East (Zeitoun et al., 2012). Instability has affected planning process around urban land use in Palestine (Raddad et al., 2010) and traditional institutions for governing fishery rights in the Lake Chad Basin have been challenged by the presence of armed groups and illegal taxation systems sustained by non-legitimated government agents (Bene et al., 2003). Political instability has also been shown to contribute to poor urban governance in some regions of Iraq (Hassan, 2010).

Violent conflict may also undermine the ability of states to prevent and respond to natural disasters and humanitarian crisis (Keen, 2008). A lack of trust in government commitment or capacity to respond, the presence of police or military forces that lack legitimacy, or recent conflict between government and local forces, hampers the ability of these institutions to provide effective relief (Wisner, 2001).

12.5.4. Peace-Building Activities in Promoting Adaptation

It is widely established that resource management has significant potential to contribute to conflict management by channeling competing interests over resources into non-violent resolutions (Conca and Dabelko, 2002; Conca and Wallace 2009; Hammill and Matthew 2012). This research on environmental peacebuilding and peacemaking considers that natural resource management, and by extension climate change adaptation, can build peace to avoid conflicts, and broker peace in conflict situations.

Research on bilateral and multilateral interactions between two or more states from 1948 to 2008 shows evidence of significant formal cooperation among river basin riparian states, and no cases of water causing two states to engage in war (Wolf et al, 2003; De Stefano et al. 2010). Transboundary water cooperation, particularly joint management, flood control, and technical cooperation, can form a basis for longer-term cooperation on a range of contentious issues. Efforts at basin wide institutional development to lower conflict potential focuses on moving from the common assertion of rights to water to addressing the multiple values of water, and to sharing benefits across national boundaries (Sadoff and Grey 2002).

Beyond water, there is less evidence about the effectiveness of efforts to enhance cooperation and lower conflict around natural resources. Some transboundary conservation areas, referred to as 'peace parks', are designed to reduce conflict and enhance cooperation across borders. The evidence of the effectiveness of peace parks is limited and ambiguous, with some studies showing some evidence of political, economic and conservation cooperation (Ali and Marton-LaFevre, 2007), but also conflict generation between local communities, elites and states (Duffy 2002).

12.6. National Security Dimensions of Climate Change

Climate change will affect state security through mechanisms such as impacts on critical infrastructure, threats to territorial integrity, changing access to resources, or responses to climate change. State militaries are active in assessing and responding to these challenges (Dabelko, 2009). These infrastructure and geopolitical impacts directly affect state capacities to provide a range of ecological, economic, social, and political services that fundamentally contribute to human security (Barnett, 2003; Barnett et al., 2010; Webersik, 2010).

12.6.1. Critical Infrastructure and State Capacity

Climate change is expected to damage a range of critical infrastructure, with water and sanitation, energy, and transportation infrastructure posing especially severe vulnerabilities (Chapter 8; Rozenzweig et al., 2011; UN Habitat, 2011). Climate change is expected to exacerbate water supply problems in sensitive urban areas, to limit the ability to cool power plants, to increase energy demand beyond capacity in areas of high temperature increase, to disrupt power supply and telecommunications in areas of increased snow and ice storms, and to damage vital transportation infrastructure in areas subject to flooding and storm surge (see Chapter 8). Areas that are vulnerable to flooding and landslides will have greater risk of such infrastructure damage (Adelekan, 2010; Awuor et al., 2008; Revi 2005).

Climate change impacts on critical infrastructure will reduce the ability of some states to provide social and public services (see Chapter 8). For example, power outages stemming from water shortages or storms can in turn lead to reductions in service delivery on the part of hospitals, police forces and emergency response forces. Damage to roads, rails, airports, bridges and related transport infrastructure can similarly reduce the ability of governments to provide for citizen needs. Hughes et al. (2010) estimate a modest 1-2 percent additional investment costs to adapt water supply infrastructure to climate change, but with wide variation between countries. Thawing permafrost, for example, will affect water infrastructure but affect the whole viability of settlements and infrastructure in high latitude areas (Chapter 28; Larsen et al., 2008; Marino, 2012). In poorer countries or where economies depend heavily on climate-sensitive activities such as agriculture, climate impacts are expected to lead to significant declines in income and in turn government revenues. Mideksa (2010) estimates losses of nearly ten percent in Ethiopia GDP.

12.6.2. Geopolitical Issues

Analysis of the actions of states and security institutions show that many states view current and anticipated climate changes as contributing to geopolitical concerns (Dabelko 2009; Smith 2011). The ability of states to share resources and provide human security is challenged by climate change impacts. Climate change can create contested terrestrial

and marine territorial claims and in extreme cases can threaten the territorial integrity or viability of states (Barnett and Campbell, 2010; Houghton et al., 2010; Yamamoto and Esteban, 2010).

For small island states and countries with significant areas of soft low-lying coasts (Hanson et al., 2011) such as Bangladesh, Tanzania (Kebede and Nicholls, 2012), and Singapore (Ng and Mendelsohn, 2005) sea-level rise and extreme events threaten to erode and subsume significant land areas and associated infrastructure and settlements without significant adaptation investment (Chapter 5; Nicholls et al., 2011). For countries comprised entirely of low-lying atolls, sea-level rise, ocean acidification, and increases in episodes of extreme sea-surface temperatures, compromise human security for existing or larger numbers of people (Barnett and Campbell 2010, Fisher 2011). With projected high levels of sea-level rise beyond the end of this century, the physical integrity of low lying islands is under threat (Chapter 29, Houghton et al., 2010). The opening of resources, such as the social, economic and political dimensions of loss of sea ice in the Arctic (Chapter 28), represents an example of climate change impacts being geopolitically significant to states, even in the absence of direct conflict (Box 12-6).

Productive ocean fisheries are already directly affected by climate change, with loss of yields in the tropics, changing range of important commercial species in temperate regions, and greater variability in productivity and species composition in virtually all oceans (MacNeil et al., 2010). Fishing, as an economic activity often involves changing practices and locations, but the increased globalization of fisheries operations (Berkes et al., 2006) has been suggested to increase transboundary rivalry and threaten the sustainability of some fisheries (MacNeil et al., 2010).

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Box 12-6. Evidence on Security and Geopolitical Dimensions of Climate Change Impacts in the Arctic

Impacts of climate change on the Arctic region exemplify the multiple interactions of human security with geopolitical risks. System wide changes in the Arctic region affect multiple countries and a global commons resource given Arctic roles in regulating the global climate and ocean systems (Carmack et al., 2012; Duarte et al., 2012). Anticipated changes will contribute to greater geopolitical considerations and human insecurity in the Arctic region. They include: food insecurity affecting specific cultures and knowledge systems (outlined in Section 3); energy security implications through opening of sub-sea oil and gas reserves; increased shipping; and increased presence of militaries in the region.

Summer Arctic ice has had five of the lowest recorded minima in the period 2007-11 (Duarte et al., 2012), and projections of future loss suggest an ice-free Arctic ocean in summer by mid-century or before, with implications for land based infrastructure, shipping, coastal communities and transport (Holland et al., 2006; Stephenson et al., 2011; Larsen et al., 2008; See Chapter 28). There is only limited evidence on changes either creating or reviving terrestrial and maritime boundary disputes among Arctic countries (Borgerson, 2008; Lusthaus, 2010). Further, there is little evidence that the changing Arctic will become a site for violent conflict (Berkman, 2010; Brosnan et al., 2011; Young 2009; Young, 2012), given political institutions such as the Arctic Council are providing a forum for resolving resource sharing, new transportation practices, and boundary disputes. Research on livelihoods and cultural change dimensions of human security, however, also concludes that climate and ecological shifts will contribute significant challenges for adaptation (Nuttall, 2012; Hovelsrud et al., 2011b).

_____ END BOX 12-6 HERE _____

The impacts of climate-induced water variability on transboundary water basins constitute a cluster of geopolitical concerns. The high levels of international interdependence on transboundary rivers such as the Nile, Limpopo, Amu Darya, Syr Darya, Mekong, Ganges, Brahmaputra, and Indus connect the conditions of the rivers with national development trajectories. Climate change is anticipated to affect the timing and rate of flow of these rivers, contributing to concern over negative outcomes from additional stresses stemming from increased consumption and increased populations.

Research on transboundary conflict and cooperation prioritizes rate of change rather than absolute scarcity in connection with the risk of conflict over water, particularly between states (De Stefano et al. 2012). This focus stems from higher perceived risk of conflict when institutions at local, state, and regional levels have less time to adapt to scarcity or variability by dealing with disputes through diplomatic and other non-violent mechanisms (Wolf et al. 2003; De Stefano et al. 2010; De Stefano et al. 2012). Sudden changes in flow that heighten risk and challenge institutional responses include declines in seasonal snow or glacial melt. Transboundary basin institutions and international legal mechanisms have demonstrated the ability to lessen the likelihood of violent conflict (McCaffrey, 2000; Sadoff and Grey, 2002; Dellapenna and Gupta 2009; Tir and Stinnett, 2012;). Other research emphasize these transboundary water institutions receive limited financial and political investment, do not always include all riparians, and are present in only a limited number of transboundary basins (Conca et al., 2002).

Research on bilateral and multilateral interactions between two or more states from 1948 to 2008 shows significant formal cooperation among river basin riparian states while most interactions are low levels of cooperation and low levels of conflict (Wolf et al., 2003; De Stefano et al., 2010). Some find that the presence of a shared river basin is correlated with increased risk of state-to-state or dyadic conflict (Gleditsch et al., 2006), but the evidence suggests only a limited number of overtly violent conflicts between states and no cases of water causing two states to engage in formal war. Zeitoun and Warner (2006) and Zeitoun and Mirumachi (2008) distinguish between equitable and inequitable cooperation among transboundary riparians cooperating through joint water management institutions. Relative power differentials between countries, territories, or groups stemming from upstream or downstream position, economic power, or military power can undercut the wider conflict reduction impacts of formal institutional cooperation.

Geoengineering - intentional large-scale interventions in the earth system - either to reduce the sun's radiation that reaches the surface of the earth or to increase the uptake of carbon dioxide from the atmosphere (See Chapter 20), is increasingly considered a strategy to address climate change. The uncertainty and high likelihood of differential impacts of geoengineering (such as reduced precipitation in Asia (Ricke et al. 2011) with negative food production implications), are anticipated sources of tension or conflict between states (Robock 2008; Preston, 2013). The ability of states to unilaterally deploy geoengineering under limited international legal mechanisms creates the potential for conflict. A history of security institutions deploying geoengineering and weather modification presents the prospect of military involvement in climate change responses or reactions to them (Fleming, 2010). The degree of securitization of climate change is debated (Brzoska, 2012, add cites), but in the case of geoengineering, concern stems from possible dual use that potentially would violate the 1977 UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (Keith, 2000; Robock, 2008Corner and Pidgeon, 2010).

12.7. Synthesis

The evidence reviewed in this Chapter shows that climate change poses risks to various dimensions of human security, which arise through diverse causal processes, and which will be manifest at different scales. There is high agreement in the literature for this conclusion that comes from multiple lines of evidence. There are, however, multiple and competing perspectives on the nature and causes of insecurity arising from climate change (Barnett 2010). For example, farmers in the Sahel are concerned about the risks climate change poses to their livelihoods (Mertz et al. 2009), whereas people in Tuvalu report that the cultural impacts of migration are a primary concern (Mortreux and Barnett 2009). Organisations whose mandates include various aspects of human security also tend to focus on some risks of climate change over others. For example the International Council on Human Rights Policy is concerned with the risks climate change poses to human rights, the International Organization for Migration is concerned with the implications of climate change for migration, and the United States National Intelligence Council is focused on the risk climate change will increase political instability. In this respect the framing of climate change as an issue of human security facilitates conversations across the boundaries of diverse policy communities (Gasper 2010).

The risks that climate change poses to human security arise through multiple and interacting processes: those processes also operate across diverse spatial and temporal scales. High levels of complexity means that no

conceptual model or theory captures the full extent of the interactions between all of climate change, livelihoods, culture, migration and violent conflict. However, as this Chapter has shown, there are feedbacks between the key elements of livelihoods, culture, migration, and violent conflict. Figure 12-3 depicts interactions between the primary elements discussed in this Chapter. Deterioration in livelihoods, for example, is a human security issue in its own right, and also gives rise to migration, which may be adaptive, or unavoidable and undesirable: such movements in turn imply changes in important cultural expressions and practices, and, in the absence of institutions to peacefully manage the settlement of migrants in destination areas, can increase the risk of violent conflict. This conflict can in turn undermine livelihoods, impel migration, and weaken valued cultural expressions and practices. The evidence in the Sections above shows that some interventions and policies enhance human security, while others inadvertently can exacerbate insecurity (depicted in red and blue arrows in Figure 12-3).

[INSERT FIGURE 12-3 HERE
Figure 12-3: Synthesis of evidence on the impacts of climate change on elements of human security and the interactions between elements. Examples of positive and negative changes in security associated with interventions indicated by arrows.]

A key finding of this Chapter is that institutions are integral to the risks climate change poses to all dimensions of human security. Again there is high agreement on this finding, with multiple lines of evidence from food security, to migration, to conflict resolution. The risks climate change poses to human security sometimes arise directly through interaction of material effects of changes in climate, through physical, biological and ultimately impacts in society. But evidence in this Chapter suggest that often the risks to human security also arise through ways in which institutions anticipate and react to these perceived or actual changes (Barnett et al. 2010; Ribot 2011; Artur and Hilhorst 2012). These institutional responses can significantly dampen or amplify the way changes in climate give rise to human insecurity (see Figure 12-3). For example, although declining productivity in crops and fisheries impacts on the food available to semi-subsistence farming and fishing households, anticipated or actual increasing scarcity on food markets also causes higher food prices, which can further undermine food security in those households (Chapter 7, and Badjeck et al., 2010; Downing 2002; Oluoko-Odingo 2011).

Adaptation and mitigation strategies can also dampen or increase human insecurity. With respect to both adaptation and mitigation strategies, there is an emerging consensus that those that are imposed on communities are more likely to impact negatively on human security than those that facilitate communities to respond in ways that are consistent with their capabilities and values (medium agreement, limited evidence) (Ensor and Berger, 2009; Barnett and O'Neill 2011, Marino 2012, Mercer et al. 2012). Adaptation strategies that seek to reduce exposure to climate change, through the development of large infrastructure or the resettlement of communities against their will, carry risks of disrupted livelihoods, displaced populations, deterioration of valued cultural expressions and practices, and in some cases violent conflict. Conversely, strategies such as the provision of microfinance, assistance to overcome barriers to mobility, and improving access to education and health care, enhance the ability of vulnerable populations to make and implement decisions that are consistent with their own capabilities and values. Hence such interventions are increasingly being shown to offset the adverse effects of climate change on livelihoods, unwanted migration, culture, and violent conflict. Similarly, mitigation policies that entail changes in property regimes that are not consistent with resource ownership and use can impact negatively on human security (Bumpus and Liverman 2008; Beymer-Farris and Bassett, 2012). There is as yet more limited evidence to demonstrate that mitigation activities that align with local interests and institutions can have co-benefits for human security, mitigation, and adaptation (Klein et al., 2005; Ayers and Huq, 2009; Laukkonen et al., 2009; Moser 2012).

Thus, climate change is not yet the primary risk to human security: it is one of many drivers of human security that vary in priority depending on location and circumstance. For regions where human insecurity is prevalent, these additional factors include poverty, discrimination, and inadequate provision of public services and public health, and opportunities for education. Investments in institutional responses to facilitate adaptation can dampen many of the potential adverse effects of climate change on human security (see Figure 12-3). Conversely, inappropriate climate policy responses may accelerate and amplify human insecurity.

There remains much uncertainty about the future impacts of climate change on human security. On the basis of current evidence about the observed impacts of climate change on environmental conditions, climate change will be

an increasingly important driver of human insecurity in the future (see Figure 12-3). At very high rates of projected warming, all of the aspects of human security discussed in this chapter will be adversely affected (for example in high latitude regions Box 12-6). At high rates of warming the rate of changes in environmental conditions in most places will be without any precedent in human history (New et al. 2011). Hence the evidence about the effects of past and present changes in climate on human security that informs much of the current literature on human security and climate change will be increasingly of diminishing value in analysing the human security implications of rapid or severe climate change.

Frequently Asked Questions

FAQ 12.1: How does lay knowledge of risks help adaptation to climate change?

Lay and traditional knowledge about the environment and climate are deeply rooted in history, and encompass important aspects of human life. Such knowledge is instrumental in shaping responses to climate change in all parts of the world. For many indigenous and local communities, for example, culture is constructed around livelihood activities, such as herding, hunting, fishing or farming. These cultural expressions include critical knowledge on dealing with highly variable environmental and societal conditions. Cultural perceptions of resilience to climate change, however, can either facilitate or hinder adaptation. Traditional knowledge is instrumental in developing community adaptation strategies and is increasingly seen a critical source for both scientific understanding of the consequences of climate change and for developing successful adaptation policies [12.3].

FAQ 12.2: How does migration contribute to adaptation to climate change impacts in vulnerable regions?

Patterns of migration are well established and primarily driven by economic factors: the dominant movement in the world is still from rural to urban areas within countries. Some migration flows are sensitive to changes in resource availability and ecosystem services and hence some rural to urban migration flows may be amplified by climate change impacts in developing and urbanizing countries. Migrants themselves may be vulnerable to climate change impacts, particularly in hazardous urban destinations. Given multiple motivations for all migration decisions, it is difficult to categorise any individual as a climate migrant [12.4].

FAQ 12.3: Will climate change cause war between countries?

Climate change has the potential to increase rivalry between countries over shared resources. For example, there is concern about rivalry over changing access to the resources in the Arctic and the future of transboundary rivers. Climate changes represent a challenge to the effectiveness of the diverse institutions that manage relations over these resources. However, there is high scientific agreement that this increased rivalry is unlikely to lead directly to warfare between states based on the evidence to date. That evidence shows that the nature of resources such as transboundary water and a range of conflict resolution institutions have able to divert rivalries in ways that avoid violent conflict [12.5 and 12.6].

References

Adam, C., 2013: Coping with adversity: The macroeconomic management of natural disasters. *Environmental Science and Policy*, doi: 10.1016/j.envsci.2102.04.007.

Adams, V., T.V. Hattum, and D. English, 2009: Chronic disaster syndrome: Displacement, disaster capitalism, and the eviction of the poor from New Orleans. *American Ethnologist*, **36(4)**, 615-636.

Adano, W.R., T. Dietz, K. Witsenburg, and F. Zaal, 2012: Climate change, violent conflict and local institutions in Kenya's drylands. *Journal of Peace Research*, **49(1)**, 65-80.

Adelekan, I.O., 2010: Vulnerability of poor urban coastal communities to flooding in Lagos, Nigeria. *Environment and Urbanization*, **22(2)**, 433-450.

Adelman, S., 2010: Rethinking human rights: The impact of climate change on the dominant discourse. In: *Human rights and climate change.* [Humphreys, S. (ed.)]. Cambridge University Press, Cambridge, pp. 159-179.

Adger, W.N., 2010: Climate change, human well-being and insecurity. *New Political Economy*, **15(2)**, 275-292.

Adger, W.N. and J. Barnett, 2009: Four reasons for concern about adaptation to climate change. *Environment and Planning A*, **41(12)**, 2800-2805.

Adger, W.N., J. Barnett, F.S. Chapin III, and H. Ellemor, 2011: This must be the place: Under representation of identity and meaning in climate change decision-making. *Global Environmental Politics*, **11(2)**, 1-25.

Adger, W.N., J. Barnett, K. Brown, N. Marshall, and K. O'Brien, 2013: Cultural dimensions of climate change impacts and adaptation. *Nature Climate Change*, **3(2)**, 112-117.

Adler, C.E., D. McEvoy, P. Chhetri, and E. Kruk, 2012: The role of tourism in a changing climate for conservation and development. A problem-oriented study in the Kailash Sacred Landscape, Nepal. *Policy Sciences*, , 1-18.

Adrianto, L. and Y. Matsuda, 2002: Developing economic vulnerability indices of environmental disasters in small island regions. *Environmental Impact Assessment Review*, **22(4)**, 393-414.

Afifi, T. and J. Jäger, (eds) 2010: *Environment, forced migration and social vulnerability.* Springer, Berlin, .

Aguilar MY, Pacheco TR, Tobar JM, and Quinonez J. C, 2009: Vulnerability and adaptation to climate change of rural inhabitants in the central coastal plain of El Salvador. *Climate Research*, **40(2-3)**, 187-198.

Ahmed, S. and E. Fajber, 2009: Engendering adaptation to climate variability in Gujarat, India. *Gender and Development*, **17(1)**, 33-50.

Ahmed, S. A., Diffenbaugh, N. S. and Hertel, T. W. 2009: Climate volatility deepens poverty vulnerability in developing countries. *Environmental Research Letters*, **4(3)**, 034004.

Alcantara-Ayala, I., 2004: Hazard assessment of rainfall-induced landsliding in Mexico. *Geomorphology*, **61(1–2)**, 19-40.

Alcántara-Ayala, I., M. López-Mendoza, G. Melgarejo-Palafox, R.C. Borja-Baeza, and R. Acevo-Zarate, 2004: Natural Hazards and Risk Communication Strategies Among Indigenous Communities. *Mountain Research and Development*, **24(4)**, 298-302.

Ali, S., and J. Marton-LaFevre (eds.), 2007: *Peace Parks: Conservation and Conflict Resolution* The MIT Press, Cambridge, MA.

Alkire, S., 2003: Concepts of human security. In: *Human Insecurity in a Global World.* [Lincoln C. Chen, S. Fukuda-Parr, and E. Seidensticker(eds.)]. Harvard University Press, Cambridge, pp. 15-40.

Anderson, C.A., 1987: Temperature and aggression: effects on quarterly, yearly, and city rates of violent and nonviolent crime. *Journal of Personality and Social Psychology*, **52(6)**, 1161-1173.

Anderson, C.A., 2001: Heat and violence. *Current Directions in Psychological Science*, **10(1)**, 33-38.

Anderson, M., L. Holcombe, and D. Williams, 2007: Reducing landslide risk in areas of unplanned housing in the Caribbean—a Government-Community partnership model. *Journal of International Development*, **19(2)**, 205-221.

Angassa, A. and G. Oba, 2008: Herder Perceptions on Impacts of Range Enclosures, Crop Farming, Fire Ban and Bush Encroachment on the Rangelands of Borana, Southern Ethiopia. *Human Ecology*, **36(2)**, 201-215.

Anik, S.I. and M.A.S.A. Khan, 2012: Climate change adaptation through local knowledge in the north eastern region of Bangladesh. *Mitigation and Adaptation Strategies for Global Change*, **17**, 879-896.

Antwi-Agyei, P., A.J. Dougill, E.D.G. Fraser, and L.C. Stringer, 2012: Characterising the nature of household vulnerability to climate variability: empirical evidence from two regions of Ghana. *Environment Development and Sustainability*, 10.1007/s10668-012-9418-9.

Ardalan, A., K.H. Naieni, M. Mahmoodi, A.M. Zanganeh, A.A. Keshtkar, M.R. Honarvar, and M.J. Kabir, 2010: Flash flood preparedness in Golestan province of Iran: a community intervention trial. *Am J Disaster Med*, **5(4)**, 197-214.

Arctic Climate Impact Assessment ACIA, 2005: *Impacts of a warming arctic: Arctic climate impact assessment.* Cambridge UK, Cambridge University Press, pp. 1042.

Arenstam Gibbons, S.J. and R.J. Nicholls, 2006: Island abandonment and sea-level rise: An historical analog from the Chesapeake Bay, USA. *Global Environmental Change*, **16(1)**, 40-47.

Armitage, D., F. Berkes, A. Dale, E. Kocho-Schellenberg, and E. Patton, 2011: Co-management and the co-production of knowledge: Learning to adapt in Canada's Arctic. *Global Environmental Change*, **21(3)**, 995-1004.

Arora-Jonsson, S., 2011: Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, **21**, 744-751.

Artur, L. and D. Hilhorst, 2012: Everyday realities of climate change adaptation in Mozambique. *Global Environmental Change*, **22(2)**, 529.

Ashton, A.D., J.P. Jeffrey P. Donnelly, and R.L. Evans, 2008: A discussion of the potential impacts of climate change on the shorelines of the Northeastern USA. *Mitig Adapt Strat Glob Change*, **13(7)**, 719-743.

Awuor, C.B., V.A. Orindi, and A.A. Ochieng, 2008: Climate change and coastal cities: The case of Mombasa, Kenya. . *Environment and Urbanization*, **20(1)**, 231-242.
Ayers, J.M. and S. Huq, 2009: The value of linking mitigation and adaptation: A case study of Bangladesh. *Environmental Management*, **43(5)**, 753-764.
Badjeck, M., E. Allison, A. Halls, and N. Dulvy, 2010: Impacts of climate variability and change on fishery-based livelihoods. *Marine Policy*, **34(3)**, 375-383.
Badjeck, M., J. Mendo, M. Wolff, and H. Lange, 2009: Climate variablility and the Peruvian scallop fishery: the role of formal insitutions in resilience building. *Climatic Change*, **94(1-2)**, 211-232.
Badjeck, M., E.H. Allison, A.S. Halls, and N.K. Dulvy, 2010: Impacts of climate variability and change on fishery-based livelihoods. *Marine Policy*, **34(3)**, 375-383.
Ballua, V., M. Bouinc, P. Siméonid, W.C. Crawford, S. Calmante, J. Boréf, T. Kanasg, and B. Pelletiera, Comparing the role of absolute sea-level rise and vertical tectonic motions in coastal flooding, Torres Islands (Vanuatu). *Proceedings of the National Academy of Sciences of the United States of America*, **108(32)**, 13019-13022.
Barbieri, A.F., E. Domingues, B.L. Queiroz, R.M. Ruiz, J.I. Rigotti, J.A.M. Carvalho, and M.F. Resende, 2010: Climate change and population migration in Brazil's Northeast: Scenarios for 2025-2050. *Population and Environment*, **31(5)**, 344-370.
Bardsley, D.K. and G.J. Hugo, 2010: Migration and climate change: Examining thresholds of change to guide effective adaptation decision-making. *Population and Environment*, **32(2)**, 238-262.
Barnett, J., 2001: *The Meaning of Environmental Security: Ecological Politics and Policy in the New Secutity Era.* Zed Books Ltd, New York, .
Barnett, J., 2003: Security and climate change. *Global Environmental Change*, **13(1)**, 7-17.
Barnett, J., 2006: Climate change, insecurity, and injustice. In: *Fairness in adaptation to climate change.* [Adger, W.N., J. Paavola, S. Huq, and M. Mace(eds.)]. MIT Press, Cambridge MA, pp. 115-130.
Barnett, J., 2007: The geopolitics of climate change. *Geography Compass*, **1(6)**, 1361-1375.
Barnett, J., 2010: Adapting to climate change: three key challenges for research and policy–an editorial essay. *Wiley Interdisciplinary Reviews: Climate Change*, **1(3)**, 314-317.
Barnett, J., 2010: Human rights and vulnerability to climate change. In: *Human Rights and Climate Change.* [Humphreys, S. (ed.)]. Cambridge University Press, pp. 257-271.
Barnett, J. and W.N. Adger, 2007: Climate change, human security and violent conflict. *Political Geography*, **26(6)**, 639-655.
Barnett, J. and J. Campbell, 2010: *Climate Change and Small Island States: Power, Knowledge and the South Pacific*. Earthscan, London.
Barnett, J., R.A. Matthew, and K.L. O'Brien, 2010: Global environmental change and human security: an introduction. In: ***Global Environmental Change and Human Security***. [Matthew, R., B. McDonald, and K. O'Brien(eds.)]. MIT Press, Cambridge, MA, pp. 3-31.
Barnett, J. and S. O'Neill, 2010: Maladaptation. *Global Environmental Change*, **20(2)**, 211-213.
Barnett, J. and S.J. O'Neill, 2011: Islands, resettlement and adaptation. *Nature Climate Change*, **2(1)**, 8-10.
Barnett, J. and M. Webber, 2010: Migration as adaptation: Opportunities and limits. In: *Climate change and displacement: Multidisciplinary perspectives.* [McAdam, J. (ed.)]. Hart Publishing, Oxford, pp. 37-56.
Barrett, C., K. Smith, and P. Box, 2001: Not necessarily in the same boat: heterogeneous risk assessment among east african pastoralists. *Journal of Development Studies*, **37(5)**, 1-30.
Barrios, S., L. Bertinelli, and E. Strobl, 2006: Climatic change and rural-urban migration: The case of sub-Saharan Africa. *Journal of Urban Economics*, **60(3)**, 357-371.
Bates, D.C., 2002: Environmental refugees? Classifying human migrations caused by environmental change. *Population and Environment*, **23(5)**, 465-477.
Battisti, D.S. and R.L. Naylor, 2009: Historical warnings of future food insecurity with unprecedented seasonal heat. *Science*, **323(5911)**, 240-244.
Becker J, Johnston D, Lazrus H, Crawford G, and Nelson D, 2008: Use of traditional knowledge in emergency management for tsunami hazard: A case study from Washington State, USA. *Disaster Prevention and Management*, **17(4)**, 488-502.
Bell, D., 2004: Environmental refugees: What rights? which duties? *Res Publica*, **10(2)**, 135-152.
Bellona, M.R., D. Hodson, and J. Hellin, 2011: Assessing the vulnerability of traditional maize seed systems in Mexico to climate change. *Proceedings of the National Academy of Sciences*, **108(33)**, 13432-13437.

Béné, C., A. Neiland, T. Jolley, B. Ladu, S. Ovie, O. Sule, M. Baba, E. Belal, K. Mindjimba, F. Tiotsop, L. Dara, A. Zakara, and J. Quensiere, 2003: Natural-resource institutions and property rights in inland African fisheries: The case of the Lake Chad Basin region. *International Journal of Social Economics,* **30(3)**, 275-301.

Benjaminsen, T.A., K. Alinon, H. Buhaug, and J.T. Buseth, 2012: Does climate change drive land-use conflicts in the Sahel? *Journal of Peace Research,* **49(1)**, 97-111.

Bergholt, D. and P. Lujala, 2012: Climate-related natural disasters, economic growth, and armed civil conflict. *Journal of Peace Research,* **49(1)**, 147-162.

Berhe, A.A., 2007: The contribution of landmines to land degradation. *Land Degradation & Development,* **18(1)**, 1-15.

Berkes F and Armitage D, 2010: Co-management institutions, knowledge, and learning: Adapting to change in the Arctic. *Études Inuit Studies,* **34(1)**, 109-131.

Berkes F, 2012: *Sacred Ecology.* New York, Routledge, Third Edition ed., pp. 205.

Berkes, F., T. Hughes, R. Steneck, J.A. Wilson, D. Bellwood, B. Crona, C. Folke, L. Gunderson, H. Leslie, and J. Norberg, 2006: Globalization, roving bandits, and marine resources. *Science,* **311(5767)**, 1557-1558.

Berkman, P.A., 2010: *Environmental Security in the Arctic Ocean.* Routledge, London.

Bernauer, T., T. Böhmelt, and V. Koubi, 2012: Environmental changes and violent conflict. *Environmental Research Letters,* **7(1)**, 015601.

Bernauer, T. and T. Siegfried, 2012: Climate change and international water conflict in Central Asia. *Journal of Peace Research,* **49(1)**, 227-239.

Berrang-Ford, L., Ford, J.D. and Paterson, J. 2011: Are we adapting to climate change? *Global Environmental Chang*e, **21**, 25-33.

Betancourt, T.S., M.K.S. Fawzi, C. Bruderlein, C. Desmond, and J.Y. Kim, 2010: Children affected by HIV/AIDS: SAFE, a model for promoting their security, health, and development. *Psychology, Health & Medicine,* **15(3)**, 243-265.

Bettini, G., 2012: Climate Barbarians at the Gate?: A critique of apocalyptic narratives on 'climate refugees'. *Geoforum,* **45**, 63-72.

Beymer-Farris, B.A. and T.J. Bassett, 2012: The REDD menace: Resurgent protectionism in Tanzania's mangrove forests. *Global Environmental Change,* **22(2)**, 332-341.

Biermann, F. and I. Boas, 2008: Protecting climate refugees: The case for a global protocol. *Environment: Science and Policy for Sustainable Development,* **50(6)**, 8-17.

Bilbao, B.A., A.V. Leal, and C.L. Méndez, 2010: Indigenous Use of Fire and Forest Loss in Canaima National Park, Venezuela. Assessment of and Tools for Alternative Strategies of Fire Management in Pemón Indigenous Lands. *Human Ecology,* **38(5)**, 663-673.

Black, D.R. and L.A. Swatuk, 2009: Human Security in North America: A Canadian Perspective. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú.O. Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer, Berlin, pp. 1087-1096.

Black, R., W.N. Adger, N.W. Arnell, S. Dercon, A. Geddes, and D. Thomas, 2011: The effect of environmental change on human migration. *Global Environmental Change,* **21(SUPPL. 1)**, S3-S11.

Black, R., S.R.G. Bennett, S.M. Thomas, and J.R. Beddington, 2011: Climate change: Migration as adaptation. *Nature,* **478(7370)**, 447-449.

Black, R., D. Kniveton, and K. Schmidt-Verkerk, 2011: Migration and climate change: towards an integrated assessment of sensitivity. *Environment and Planning A,* **43(2)**, 431-450.

Black, R., Adger, W. N., Arnell, N. W., Geddes, A. and Thomas, D. 2013: Migration, immobility and displacement outcomes of extreme events in nature and society. *Environmental Science and Policy* 10.1016/j.envsci.2012.09.001.

Blattman, C. and E. Miguel, 2010: Civil war. *Journal of Economic Literature,* **48(1)**, 3-57.

Bogale, A. and B. Korf, 2007: To share or not to share?(non-) violence, scarcity and resource access in Somali Region, Ethiopia. *Journal of Development Studies,* **43(4)**, 743-765.

Bogale, A. and B. Korf, 2009: Resource Entitlement and Mobility of Pastoralists in the Yerer and Daketa Valleys, Eastern Ethiopia. *Human Ecology,* **37(4)**, 453-462.

Bohra-Mishra, P. and D.S. Massey, 2011: Environmental degradation and out-migration: evidence from Nepal. In: *Migration and climate change.* [Piguet, E., A. Pécoud, and P.d. Guchteneire(eds.)]. Cambridge University Press, Cambridge, pp. 74-101.

Borgerson, S.G., 2008: Arctic Meltdown: The Economic and Security Implications of Global Warming. *Foreign Affairs*, **87(2)**, 63-77.

Borras Jr, S.M., P. McMichael, and I. Scoones, 2010: The politics of biofuels, land and agrarian change: editors' introduction. *Journal of Peasant Studies*, **37(4)**, 575-592.

Boyle, M., Y. Racine, K. Georgiades, D. Snelling, S. Hong, W. Omariba, P. Hurley, and P. Rao-Melacini, 2006: The influence of economic development level, household wealth and maternal education on child health in the developing world. *Social Science & Medicine*, **63(8)**, 2242-2254.

Brauch, H.G., 2009: Securitizing Global Environmental Change. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú. Oswald Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer, Berlin, pp. 65-102.

Brauch, H.G., Ú. Oswald Spring, C. Mesjasz, J. Grin, P. Dunay, N.C. Behera, B. Chourou, P. Kameri-Mbote, P.H. Liotta, and C. Mesjasz (eds.), 2008: *Globalization and Environmental Challenges: Reconceptualizing Security in the 21st Century.* Springer, Berlin, .

Brauch, H.G., Ú. Oswald Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera, B. Chourou, and H. Krummenacher (eds.), 2009: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* Springer, Berlin, pp. 1546.

Brauch, H.G., Ú. Oswald Spring, C. Mesjasz, J. Grin, P. Kameri-Mbote, B. Chourou, P. Dunay, and J. Birkmann (eds.), 2011: Hexagon Series on Human and Environmental Security and Peace. In: *Coping with Global Environmental Change, Disasters and Security: Threats, Challenges, Vulnerabilities and Risks.* Springer, Berlin.

Breetzke, G.D. and E.G. Cohn, 2012: Seasonal Assault and Neighborhood Deprivation in South Africa Some Preliminary Findings. *Environment and Behavior*, **44(5)**, 641-667.

Brklacich, M., M. Chazan, and H.G. Bohle, 2010: Human Security, Vulnerability, and Global Environmental Change. In: *Global environmental change and human security.* [Matthew, R., J. Barnett, B. McDonald, and K. O'Brien(eds.)]. MIT Press, Cambridge, Massachusetts, pp. 35-76.

Brochmann, M. and P.R. Hensel, 2009: Peaceful management of international river claims. *International Negotiation*, **14(2)**, 393-418.

Bronen, R., 2010: Forced migration of Alaskan indigenous communities due to climate change. In: *Environment, Forced Migration and Social Vulnerability.* [Afifi, T. and J. Jager(eds.)]. Springer, Berlin, pp. 87-98.

Bronen, R., 2011: Climate-induced community relocations: creating an adaptive governance framework based in human rights doctrine. *NYU Review of Law & Social Change*, **35**, 357.

Brook, T., 2010: *The Troubled Empire: China in the Yuan and Ming Dynasties.* Belknap Press, Cambridge, MA, .

Brosnan, I.G., T.M. Leschine, and E.L. Miles, 2011: Cooperation or conflict in a changing Arctic? *Ocean Development and International Law*, **42(1-2)**, 173-210.

Brown, H.C.P., B. Smit, D.J. Sonwa, O.A. Somorin, and J. Nkem, 2011: Institutional perceptions of opportunities and challenges of REDD in the Congo Basin. *Journal of Environment & Development*, **20(4)**, 381-404.

Brown, H.C., 2009: Climate change and Ontario forests: Prospects for building institutional adaptive capacity. *Mitigation and Adaptation Strategies for Global Change*, **14(6)**, 513-536.

Brown, I.A., 2010: Assessing eco-scarcity as a cause of the outbreak of conflict in Darfur: a remote sensing approach. *International Journal of Remote Sensing*, **31(10)**, 2513-2520.

Brown, S. and F. Bean, 2005: International migration. In: *Handbook of Population.* [Poston, D.L. and M. Micklin(eds.)]. Kluwer, Dordrecht, pp. 347-382.

Brückner, M. and A. Ciccone, 2010: International Commodity Prices, Growth and the Outbreak of Civil War in Sub-Saharan Africa. *Economic Journal*, **120(544)**, 519-534.

Brückner, M. and A. Ciccone, 2011: Rain and the democratic window of opportunity. *Econometrica*, **79(3)**, 923-947.

Brzoska, M., 2012: Climate Change as a Driver of Security Policy. In: *Climate Change, Human Security and Violent Conflict.* [Scheffran, J., M. Brzoska, H.G. Brauch, P.M. Link, and J. Schilling(eds.)]. Springer, Berlin, pp. 165-184.

Buckley, B.M., K.J. Anchukaitis, D. Penny, R. Fletcher, E.R. Cook, M. Sano, L.C. Nam, A. Wichienkeeo, T.T. Minh, and T.M. Hong, 2010: Climate as a contributing factor in the demise of Angkor, Cambodia. *Proceedings of the National Academy of Sciences*, **107(15)**, 6748-6752.

Buechler, S., 2009: Gender, water, and climate change in Sonora, Mexico: Implications for policies and programmes on agricultural income-generation. *Gender and Development*, **17(1)**, 51-66.

Buhaug, H., 2010: Climate not to blame for African civil wars. *Proceedings of the National Academy of Sciences,* **107(38)**, 16477-16482.

Buhaug, H. and O.M. Theisen, 2012: On Environmental Change and Armed Conflict. In: *Climate Change, Human Security and Violent Conflict.* [Scheffran, J., M. Brzoska, H.G. Brauch, P.M. Link, and J. Schilling(eds.)]. Springer, Berlin, pp. 43-55.

Buhaug, H. and H. Urdal, 2013: An Urbanization Bomb? Population Growth and Social Disorder in Cities. *Global Environmental Change,* **23(1)**, 1-10.

Buikstra, E., H. Ross, C.A. King, P.G. Baker, D. Hegney, K. McLachlan, and C. Rogers-Clark, 2010: The components of resilience—Perceptions of an Australian rural community. *Journal of Community Psychology,* **38(8)**, 975-991.

Bumpus, A.G. and D.M. Liverman, 2008: Accumulation by decarbonization and the governance of carbon offsets. *Economic Geography,* **84(2)**, 127-155.

Burch, S., 2010: Transforming barriers into enablers of action on climate change: Insights from three municipal case studies in British Columbia, Canada. *Global Environmental Change,* **20(2)**, 287-297.

Burke, M.B., E. Miguel, S. Satyanath, J.A. Dykema, and D.B. Lobell, 2009: Warming increases the risk of civil war in Africa. *Proceedings of the National Academy of Sciences,* **106(49)**, 20670-20674.

Burningham, K., Fielding J, and Thrush D, 2008: 'It'll never happen to me': understanding public awareness of local flood risk. *Disasters,* **32(2)**, 216-238.

Burns, R., P. Robinson, and P. Smith, 2010: From hypothetical scenario to tragic reality: A salutary lesson in risk communication and the Victorian 2009 bushfires. *Australian and New Zealand Journal of Public Health,* **34(1)**, 24-31.

Butke, P. and S.C. Sheridan, 2010: An analysis of the relationship between weather and aggressive crime in Cleveland, Ohio. *Weather, Climate, and Society,* **2(2)**, 127-139.

Butler, C.K. and S. Gates, 2012: African range wars: Climate, conflict, and property rights. *Journal of Peace Research,* **49(1)**, 23-34.

Butzer, K.W., 2012: Collapse, environment, and society. *Proceedings of the National Academy of Sciences,* **109(10)**, 3632.

Byravan, S. and S.C. Rajan, 2006: Providing new homes for climate change exiles. *Climate Policy,* **6(2)**, 247-252.

Cameron, E.S., 2012: Securing Indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. *Global Environmental Change,* **22(1)**, 103-114.

Caney, S., 2010: Climate change, human rights and moral thresholds. In: *Human rights and climate change.* [Humphreys, S. (ed.)]. Cambridge University Press, Cambridge, pp. 69-90.

Carlarne, C. and M. Depledge, 2007: Sick of the Weather: Climate Change, Human Health and International Law. *Envtl. l. Rev.,* **9**, 231, 237-38.

Carmack, E., F. McLaughlin, G. Whitemanand, and T. Homer-Dixon, 2012: Detecting and Coping with Disruptive Shocks in Arctic Marine Systems: A Resilience Approach to Place and People. *Ambio,* **(41)**, 56-65.

Carter, M., P. Little, T. Mogues, and W. Negatu, 2007: Poverty traps and natural disasters in Ethiopia and Honduras. *World Development,* **35(5)**, 835-856.

Catto, N.R. and K. Parewick, 2008: Hazard and vulnerability assessment and adaptive planning: mutual and multilateral community–researcher communication, Arctic Canada. *Geological Society, London, Special Publications,* **305(1)**, 123-140.

Chase, M.J. and C.R. Griffin, 2011: Elephants of south-east Angola in war and peace: their decline, re-colonization and recent status. *African Journal of Ecology,* **49(3)**, 353-361.

Chourou, B., 2009: Human Security in the Arab World: A Perspective from the Maghreb. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú.O. Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer, Berlin, pp. 1021-1035.

Cohen, I.S., Ú. Oswald Spring, G.D. Padilla, J.C. Paredes, M.A. Inzunza Ibarra, R.L. López, and J.V. Díaz, 2012: Forced Migration, Climate Change, Mitigation and Adaptive Policies in Mexico: Some Functional Relationships. *International Migration,* .

Cole, J.H. and A.M. Gramajo, 2009: Homicide Rates in a Cross-Section of Countries: Evidence and Interpretations. *Population and Development Review,* **35(4)**, 749-776.

Commission on Human Security, 2003: *Human Security Now, Protecting and empowering people.* UN Commission on Human Security, New York, .

Conca, K., 2005: *Governing water: Contentious transnational politics and global institution building.* MIT Press, Cambridge MA, .

Conca, K., F. Wu, and C. Mei, 2002: Global regime formation or complex institution building? the principled content of international river. *International Studies Quarterly,* **(50)**, 263-285.

Conca, K., and G. Dabelko (eds.). 2002: *Environmental Peacemaking.* Johns Hopkins University Press, Baltimore.

Conca, K., and J. Wallace, 2009: Environment and Peacebuilding in War-torn Societies: Lessons from the UN Environment Programme's Experience with Postconflict Assessment. *Global Governance* 15(4), 185-105.

Corner, A. and N. Pidgeon, 2010: Geoengineering the Climate: The Social and Ethical Implications. *Environment: Science and Policy for Sustainable Development,* **1(52)**, 24-37.

Costello, A., M. Abbas, A. Allen, S. Ball, S. Bell, R. Bellamy, S. Friel, N. Groce, A. Johnson, M. Kett, M. Lee, C. Levy, M. Maslin, D. McCoy, B. McGuire, H. Montgomery, D. Napier, C. Pagel, J.Patel, J.A.P.d. Oliveira, N. Redclift, H. Rees, D. Rogger, J. Scott, J. Stephenson, J. Twigg, J. Wolff, and C. Patterson, 2009: Managing the Health effects of Climate Change. *The Lancet,* **373(9676)**, 1693-1733.

Coulthard, S., 2008: Adapting to environmental change in artisanal fisheries - insights from a south Indian Lagoon. *Global Environmental Change*, **18(3)**, 479-489.

Cournil, C., 2011: The protection of environmental refugees in international law. In: *Climate Change and Migration.* [Piguet, E., A. Pecoud, and P. de Guchteneire(eds.)]. Cambridge University Press, Cambridge, pp. 359-387.

Crate, S.A., 2008: Gone the bull of winter? Grappling with the cultural implications of and anthropology's role(s) in global climate change. *Current Anthropology,* **49(4)**, 569-595.

Crate, S.A. and M. Nuttall, 2009: *Anthropology and climate change : from encounters to actions.* Left Coast Press, Walnut Creek, CA, .

Crate, S.A., 2011: Climate and Culture: Anthropology in the Era of Contemporary Climate Change. *Annual Review of Anthropology,* **40**, 175-194.

Crona, B.I., 2006: Supporting and enhancing development of heterogeneous ecological knowledge among resource users in a Kenyan seascape. *Ecology and Society,* **11(1)**, 32-55.

Curtis, K. and A. Schneider, 2011: Understanding the demographic implications of climate change: estimates of localized population predictions under future scenarios of sea-level rise. *Population and Environment,* **33(1)**, 28-54.

Dabelko, G.D., 2009: Planning for climate change: the security community's precautionary principle. *Climatic Change,* **96(1)**, 13-21.

Dalby, S., 2009: *Security and Environmental Change.* Polity, Cambridge, .

Dauvergne, P. and K.J. Neville, 2010: Forests, food, and fuel in the tropics: the uneven social and ecological consequences of the emerging political economy of biofuels. *Journal of Peasant Studies,* **37(4)**, 631-660.

Davidson, D.J., T. Williamson, and J.R. Parkins, 2003: Understanding climate change risk and vulnerability in northern forest-based communities. *Canadian Journal of Forest Research,* **33(11)**, 2252-2261.

de Moel, H., J.C.J.H. Aerts, and E. Koomen, 2011: Development of flood exposure in the Netherlands during the 20th and 21st century. *Global Environmental Change,* **21(2)**, 620-627.

de Sherbinin, A., M. Levy, S. Adamo, K. MacManus, G. Yetman, V. Mara, L. Razafindrazay, B. Goodrich, T. Srebotnjak, C. Aichele, and L. Pistolesi, 2012: Migration and risk: net migration in marginal ecosystems and hazardous areas. *Environmental Research Letters,* **7(4)**, 045602.

de Sherbinin, A., M. Castro, F. Gemenne, M. Cernea, S. Adamo, P. Fearnside, G. Krieger, S. Lahmani, A. Oliver-Smith, and A. Pankhurst, 2011: Preparing for resettlement associated with climate change. *Science,* **334(6055)**, 456-457.

de Sherbinin, A., L.K. VanWey, K. McSweeney, R. Aggarwal, A. Barbieri, S. Henry, L.M. Hunter, W. Twine, and R. Walker, 2008: Rural household demographics, livelihoods and the environment. *Global Environmental Change,* **18(1)**, 38-53.

de Stefano, L., J. Duncan, S. Dinar, K. Stahl, K.M. Strzepek, and A.T. Wolf, 2012: Climate change and the institutional resilience of international river basins. *Journal of Peace Research,* **49(1)**, 193-209.

De Stefano, L., P. Edwards, L. De Silva, and A.T. Wolf, 2010: Tracking cooperation and conflict in international basins: historic and recent trends. *Water Policy,* **12(6)**, 871-884.

de Waal, A., 1993: War and famine in Africa. *IDS Bulletin,* **24(4)**, 33-40.

De Weijer, F., 2007: Afghanistan's kuchi pastoralists: Change and adaptation. *Nomadic Peoples,* **11(1)**, 9-37.

Deligiannis, T., 2012: The Evolution of Environment-Conflict Research: Toward a Livelihood Framework. *Global Environmental Politics*, **12(1)**, 78-100.
Dellapena, J.W. and J. Gupta (eds.), 2009: *The Evolution of the Law and Politics of Water*. Spinger, Berlin, .
DeMenocal, P.B., 2001: Cultural responses to climate change during the late Holocene. *Science*, **292(5517)**, 667-673.
Demetriades, J. and E. Esplen, 2008: The gender dimensions of poverty and climate change adaptation. *IDS Bulletin*, **39(4)**, 24-31.
Deng, L.B., 2008: Are non-poor households always less vulnerable? The case of households exposed to protracted civil war in Southern Sudan. *Disasters*, **32(3)**, 377-398.
Deng, L.B., 2010a: Livelihood diversification and civil war: Dinka communities in Sudan's civil war. *Journal of Eastern African Studies*, **4(3)**, 381-399.
Deng, L.B., 2010b: Social capital and civil war: The Dinka communities in Sudan's civil war. *African Affairs*, **109(435)**, 231-250.
Denton, F., 2002: Climate change vulnerability, impacts, and adaptation: Why does gender matter? *Gender and Development*, **10(2)**, 10-20.
Depledge, M. and C. Carlane, 2007: Sick of the Weather: Climate Change, Human Health and International Law. *Environmental Law Review*, **9(4)**, 231-240.
Dercon, S. (ed.), 2004: *Insurance Against Poverty*. Oxford University Press, Oxford, .
Deressa, T.T. and R.M. Hassan, 2009: Economic Impact of Climate Change on Crop Production in Ethiopia: Evidence from Cross-section Measures. *Journal of African Economies*, **18(4)**, 529-554.
Desta, S. and D.L. Coppock, 2004: Pastoralism Under Pressure: Tracking System Change in Southern Ethiopia. *Human Ecology*, **32(4)**, 465-486.
Detraz, N., 2009: Environmental security and gender: Necessary shifts in an evolving debate. *Security Studies*, **18(2)**, 345-369.
Dinar, S., A. Dinar, and P. Kurukulasuriya, 2011: Scarcity and Cooperation along International Rivers: An Empirical Assessment of Bilateral Treaties1. *International Studies Quarterly*, **55(3)**, 809-833.
Dixon, J., 2009: What causes civil wars? Integrating quantitative research findings. *International Studies Review*, **11(4)**, 707-735.
Djoudi, H. and M. Brockhaus, 2011: Is adaptation to climate change gender neutral? Lessons from communities dependent on livestock and forests in northern Mali. *International Forestry Review*, **13(2)**, 123-135.
Docherty, B. and T. Giannini, 2009: Confronting a rising tide: A proposal for a convention on climate change refugees. *Harvard Environmental Law Review*, **33(2)**, 349-403.
Downing, T.E., 2002: Linking Sustainable Livelihoods and Global Climate Change in Vulnerable Food Systems. . *Die Erde*, **133(4)**, 363-378.
Drimie, S. and S. Gillespie, 2010: Adaptation to climate change in Southern Africa: Factoring in AIDS. *Environmental Science and Policy*, **13(8)**, 778-784.
Duarte, C.M., T.M. Lenton, P. Wadhams, and P. Wassmann, 2012: Abrupt climate change in the Arctic. *Nature Climate Change*, **2(2)**, 60-62.
Duffy, R., 2002: Peace parks: The paradox of globalisation? *Geopolitics*, **6(2)**, 1-26.
Dumaru, P., 2010: Community-based adaptation: enhancing community adaptive capacity in Druadrua Island, Fiji. *Wiley Interdisciplinary Reviews: Climate Change*, **1(5)**, 751-763.
Dun, O., 2011: Migration and Displacement Triggered by Floods in the Mekong Delta. *International Migration*, **49(SUPPL.1)**, e200-e223.
Eakin, H., K. Benessaiah, J. Barrera, G. Cruz-Bello, and H. Morales, 2012: Livelihoods and landscapes at the threshold of change: disaster and resilience in a Chiapas coffee community. *Regional Environmental Change*, **12(3)**, 475-488.
Eboli, F., R. Parrado, and R. Roson, 2010: Climate-change feedback on economic growth: explorations with a dynamic general equilibrium model. *Environment and Development Economics*, **15(5)**, 515-533.
Eira, I.M.G., C. Jaedicke, O.H. Magga, N.G. Maynard, D. Vikhamar-Schuler, and S.D. Mathiesen, 2013: Traditional Sámi snow terminology and physical snow classification—Two ways of knowing. *Cold Regions Science and Technology*, **85**, 117-130.
Ellemor, H., 2005: Reconsidering emergency management and indigenous communities in Australia. *Environmental Hazards*, **6(1)**, 1-7.

Elliott, J.R. and J. Pais, 2006: Race, class, and Hurricane Katrina: Social differences in human responses to disaster. *Social Science Research*, **35(2)**, 295-321.
Ellis, F., 2000: *Rural Livelihoods and Diversity in Developing Countries.* Oxford University Press, Oxford, .
Emperaire L. and Peroni N., 2007: Traditional Management of Agrobiodiversity in Brazil: A Case Study of Manioc. *Human Ecology*, **35(6)**, 761-768.
Ensor, J. and R. Berger, 2009: Community-based adaptation and culture in theory and practice. In: *Adapting to Climate Change: Thresholds, Values and Governance.* [Adger, W.N., I. Lorenzoni, and K. O'Brien(eds.)]. Cambridge University Press, Cambridge, pp. 227-239.
Eriksen, S. and J. Lind, 2009: Adaptation as a political process: Adjusting to drought and conflict in Kenya's drylands. *Environmental Management*, **43(5)**, 817-835.
Fairhead, J., M. Leach, and I. Scoones, 2012: Green Grabbing: a new appropriation of nature? *Journal of Peasant Studies*, **39(2)**, 237-261.
Fajnzylber, P., D. Lederman, and N. Loayza, 2002: What causes violent crime? *European Economic Review*, **46(7)**, 1323-1357.
Falk, W.W., M.O. Hunt, and L.L. Hunt, 2006: Hurricane Katrina and New Orleanians' sense of place. *Du Bois Review*, **3(1)**, 115-128.
Farbotko, C., 2010: Wishful sinking: Disappearing islands, climate refugees and cosmopolitan experimentation. *Asia Pacific Viewpoint*, **51(1)**, 47-60.
Farbotko, C. and H. Lazrus, 2011: The first climate refugees? Contesting global narratives of climate change in Tuvalu. *Global Environmental Change*, **22(2)**, 382-390.
Fazey, I., M. Kesby, A. Evely, I. Latham, D. Wagatora, J. Hagasua, M.S. Reed, and M. Christie, 2010: A three-tiered approach to participatory vulnerability assessment in the Solomon Islands. *Global Environmental Change*, **20(4)**, 713-728.
Feitelson, E., A. Tamimi, and G. Rosenthal, 2012: Climate change and security in the Israeli–Palestinian context. *Journal of Peace Research*, **49(1)**, 241-257.
Feng, S., A.B. Krueger, and M. Oppenheimer, 2009: Linkages among climate change, crop yields and Mexico-US cross-border migration. *Proceedings of the National Academy of Sciences of the United States of America*, **107(32)**, 14257-14262.
Fernández-Giménez, M.E., B. Batkhishig, and B. Batbuyan, 2012: Cross-boundary and cross-level dynamics increase vulnerability to severe winter disasters (dzud) in Mongolia. *Global Environmental Change*, **22(4)**, 836-851.
Fernando, N., K. Warner, and J. Birkmann, 2010: Migration and natural hazards: is relocation a secondary disaster or an opportunity for vulnerability reduction? In: *Environment, Forced Migration and Social Vulnerability.* [Afifi, T. and J. Jager(eds.)]. Springer, Berlin, pp. 145-156.
Field, S., 1992: The effect of temperature on crime. *British Journal of Criminology*, **32(3)**, 340-351.
Findley, S.E., 1994: Does Drought Increase Migration? A Study of Migration from Rural Mali during the 1983-1985 Drought. *International Migration Review*, **28(3)**, 539-553.
Finucane, M.L., 2009: Why science alone won't solve the climate crisis: Managing climate risks in the Pacific. *Asia Pacific Issues*, **(89)**, 1-8.
Fisher, P.B., 2011: Climate change and human security in Tuvalu. *Global Change, Peace & Security*, **23(3)**, 293-313.
Fleming, J.R., 2010: *Fixing the Sky: The Checkered History of Weather and Climate Control.* . Columbia University Press, New York, .
Flint, C.G., E.S. Robinson, J. Kellogg, G. Ferguson, L. BouFajreldin, M. Dolan, I. Raskin, and M.A. Lila, 2011: Promoting Wellness in Alaskan Villages: Integrating Traditional Knowledge and Science of Wild Berries. *Ecohealth*, **8(2)**, 1-11.
Floyd, R., 2008: The environmental security debate and its significance for climate change. *The International Spectator*, **43(3)**, 51-65.
Forbes, B.C., 2007: Equity, vulnerability and resilience in social–ecological systems: a contemporary example from the Russian Arctic. In: *Equity and the Environment.* [Freudenburg, W.R. and R. Wilkinson(eds.)]. Elsevier, Oxford, pp. 203-236.
Ford J and Goldhar C, 2012: Climate change vulnerability and adaptation in resource dependent communities: a case study from West Greenland. *Climate Research*, **54**, 181-196.

Ford, J., T. Pearce, B. Smit, J. Wandel, M. Allurut, K. Shappa, H. Ittusujurat, and K. Qrunnut, 2007: Reducing vulnerability to climate change in the Arctic: The case of Nunavut, Canada. *Arctic,* **60(2)**, 150-166.

Ford, J.D., B. Smit, J. Wandel, and J. MacDonald, 2006: Vulnerability to climate change in Igloolik, Nunavut: what we can learn from the past and present. *Polar Record,* **42(02)**, 127-138.

Ford, J.D., T. Pearce, J. Gilligan, B. Smit, and J. Oakes, 2008: Climate Change and Hazards Associated with Ice Use in Northern Canada. *Arctic, Antarctic, and Alpine Research,* **40(4)**, 647-659.

Ford, J.D., W. Gough, G. Laidler, J. MacDonald, C. Irngaut, and K. Qrunnut, 2009: Sea ice, climate change, and community vulnerability in northern Foxe Basin, Canada. *Climate Research,* **38(2)**, 137-154.

Ford, J.D., T. Pearce, F. Duerden, C. Furgal, and B. Smit, 2010: Climate change policy responses for Canada's Inuit population: The importance of and opportunities for adaptation. *Global Environmental Change,* **20(1)**, 177-191.

Foresight, 2011: *Migration and Global Environmental Change.* [UK Government Office for Science (ed.)], London.

Fox, S. and J. Beall, 2012: Mitigating conflict and violence in African cities. *Environment and Planning C: Government and Policy,* **30(6)**, 968-981.

Frazier, T.G., N. Wood, and B. Yarnal, 2010: Stakeholder perspectives on land-use strategies for adapting to climate-change-enhanced coastal hazards: Sarasota, Florida. *Applied Geography,* **30(4)**, 506-517.

Frey, W.H. and A. Singer, 2006: *Katrina and Rita impacts on Gulf coast populations: First census findings.* Brookings Institution, Metropolitan Policy Program, .

Furgal, C. and J. Seguin, 2006: Climate Change, Health and Vulnerability in Canadian Northern Aboriginal Communities. *Environmental Health Perspectives,* **114(2)**, 1964-1970.

Fussell, E., N. Sastry, and M. VanLandingham, 2010: Race, socioeconomic status, and return migration to New Orleans after Hurricane Katrina. *Population and Environment,* **31(1-3)**, 1-23.

Galvin, K., 2009: Transitions: pastoralists living with change. *Anu. Rev. Anthropol.,* **38**, 185-198.

Gamble, J.L. and J.J. Hess, 2012: Temperature and violent crime in Dallas, Texas: relationships and implications of climate change. *Western Journal of Emergency Medicine,* **13(3)**, 239-246.

Gartzke, E., 2012: Could climate change precipitate peace? *Journal of Peace Research,* **49(1)**, 177-192.

Gasper, D., 2005: Securing humanity: Situating 'human security'as concept and discourse. *Journal of Human Development,* **6(2)**, 221-245.

Gaurav, K., R. Sinha, and P. Panda, 2011: The Indus flood of 2010 in Pakistan: a perspective analysis using remote sensing data. *Natural Hazards,* **59(3)**, 1815-1826.

Gausset, Q., 2005: Agro-pastoral Conflicts in theTikar Plain. In: *Beyond Territory and Scarcity: Exploring Conflicts Over Natural Resource Management.* [Guasset, Q., M. Whyte, and T. Birch-Thomsen(eds.)]. Nordiska Afrikainstitutet, Stockholm, pp. 90-111.

Gausset, Q. and M. Whyte, 2005: Introduction. In: *Beyond territory and scarcity: Exploring conflicts over natural resource management.* [Guasset, Q., M. Whyte, and T. Birch-Thomsen(eds.)]. Nordiska Afrikainstitutet, Stockholm, pp. 7-26.

Gearheard, S., M. Pocernich, R. Stewart, J. Sanguya, and H. Huntington, 2010: Linking Inuit knowledge and meteorological station observations to understand changing wind patterns at Clyde River, Nunavut. *Climatic Change,* **100(2)**, 267-294.

Geddes, A., W.N. Adger, N.W. Arnell, R. Black, and D.S.G. Thomas, 2012: Migration, environmental change, and the 'challenges of governance'. *Environment and Planning C: Government and Policy,* **30**, 951-967.

Gemenne, F., 2011: Climate-induced population displacements in a 4C+ world. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences,* **369(1934)**, 182-195.

Gero, A., K. Méheux, and D. Dominey-Howes, 2011: Integrating community based disaster risk reduction and climate change adaptation: Examples from the Pacific. *Natural Hazards and Earth System Science,* **11(1)**, 101-113.

Gibson K. and Cameron J., 2001: Transforming communities: Towards a research agenda. *Urban Policy and Research,* **19(1)**, 7-24.

Gila, O.A., A.U. Zaratiegui, and V.L. De Maturana DiÃ©guez, 2011: Western Sahara: Migration, Exile and Environment. *International Migration,* **49(SUPPL.1)**, e146-e163.

Glantz, M. and D. Jamieson, 2000: Societal response to Hurricane Mitch and intra- versus intergenerational equity issues: Whose norms should apply? *Risk Analysis,* **20**, 869-882.

Gleditsch, N.P., K. Furlong, H. Hegre, B. Lacina, and T. Owen, 2006: Conflicts over shared rivers: Resource scarcity or fuzzy boundaries? *Political Geography,* **25(4)**, 361-382.

Gleditsch, N.P., 2012: Whither the weather? Climate change and conflict. *Journal of Peace Research,* **49(1)**, 3-9.

Goldstein, J.S., 2011: *Winning the War on War: the decline of armed conflict worldwide.* Penguin, New York, .
Goldsworthy, H., 2010: Microfinance, Human Security, and Millennium Development Goal No. 7. *Perspectives on Global Development and Technology*, **9(3-4)**, 3-4.
Gómez-Baggethun, E., V. Reyes-García, P. Olsson, and C. Montes, 2012: Traditional ecological knowledge and community resilience to environmental extremes: A case study in Doñana, SW Spain. *Global Environmental Change*, **22(3)**, 640-650.
Goodhand, J., 2003: Enduring disorder and persistent poverty: a review of the linkages between war and chronic poverty. *World Development*, **31(3)**, 629-646.
Goulden, M., D. Conway, and A. Persechino, 2009: Adaptation to climate change in international river basins in Africa: a review. *Hydrological Sciences Journal*, **54(5)**, 805-828.
Gray, C.L., 2010: Gender, natural capital, and migration in the southern Ecuadorian Andes. *Environment and Planning A*, **42(3)**, 678.
Gray, C.L., 2011: Soil quality and human migration in Kenya and Uganda. *Global Environmental Change*, **21(2)**, 421.
Gray, C. and V. Mueller, 2012: Drought and population mobility in rural Ethiopia. *World Development*, **40(1)**, 134-145.
Green, D., L. Alexander, K. Mclnnes, J. Church, N. Nicholls, and N. White, 2010: An assessment of climate change impacts and adaptation for the Torres Strait Islands, Australia. *Climatic Change*, **102(3-4)**, 405-433.
Gregory, R. and W. Trousdale, 2009: Compensating aboriginal cultural losses: An alternative approach to assessing environmental damages. *Journal of Environmental Management*, **90(8)**, 2469-2479.
Grimm, N.B., S.H. Faeth, N.E. Golubiewski, C.L. Redman, J. Wu, X. Bai, and J.M. Briggs, 2008: Global Change and the Ecology of Cities. *Science*, **319(5864)**, 756-760.
Hadipuro, W., 2007: Water supply vulnerability assessment for sustainable livelihood. *Journal of Environmental Assessment Policy and Management*, **9(1)**, 121-135.
Hagan, J. and J. Kaiser, 2011: The displaced and dispossessed of Darfur: explaining the sources of a continuing state-led genocide. *British Journal of Sociology*, **62(1)**, 1-25.
Hall, J.W., E.P. Evans, E.C. Penning-Rosell, P.B. Sayers, C.R. Thorne, and A.J. Saul, 2003: Quantified scenarios analysis of drivers and impacts of changing flood risk in England and Wales: 2030-2100. *Environmental Hazards*, **5(3-4)**, 51-65.
Hallegatte, S., F. Henriet, and J. Corfee-Morlot, 2011: The Economics of Climate Change Impacts and Policy Benefits at City Scale: A Conceptual Framework. *Climatic Change*, **104(1)**, 51-87.
Hallegatte, S., 2012: A framework to investigate the economic growth impact of sea level rise. *Environmental Research Letters*, **7(1)**, 015604-015611.
Hammill, A. and R. Matthew, 2012: Peacebuilding and Climate Change Adaptation. In: *Peacebuilding and Climate Change Adaptation.* [Bruch, C., W.C. Muffett, and S. Nichols(eds.)]. Earthscan, London, .
Hanson, S., R. Nicholls, N. Ranger, S. Hallegatte, J. Corfee-Morlot, C. Herweijer, and J. Chateau, 2011: A global ranking of port cities with high exposure to climate extremes. *Climate Change*, **104(1)**, 89-111.
Harries, T. and E. Penning-Rowsell, 2011: Victim pressure, institutional inertia and climate change adaptation: The case of flood risk. *Global Environmental Change*, **21(1)**, 188-197.
Hartmann, B., 2010: Rethinking climate refugees and climate conflict: Rhetoric, reality and the politics of policy discourse. *Journal of International Development*, **22(2)**, 233-246.
Hassan, M.K.R., 2010: Urban environmental problems in cities of the Kurdistan region in Iraq. *Local Environment*, **15(1)**, 59-72.
Haug, R., 2002: Forced migration, processes of return and livelihood construction among pastoralists in Northern Sudan. *Disasters*, **26(1)**, 70-84.
Hegre, H. and N. Sambanis, 2006: Sensitivity analysis of empirical results on civil war onset. *Journal of Conflict Resolution*, **50(4)**, 508-535.
Hendrix, C.S. and S.M. Glaser, 2007: Trends and triggers: Climate, climate change and civil conflict in Sub-Saharan Africa. *Political Geography*, **26(6)**, 695-715.
Hendrix, C.S. and I. Salehyan, 2012: Climate change, rainfall, and social conflict in Africa. *Journal of Peace Research*, **49(1)**, 35-50.
Henry, S., B. Schoumaker, and C. Beauchemin, 2004: The impact of rainfall on the first out-migration: A multi-level event-history analysis in Burkina Faso. *Population and Environment*, **25(5)**, 423-460.

Herbert, S., 2005: The Trapdoor of Community. *Annals of the Association of American Geographers,* **95(4)**, 850-865.
Hertel, T.W., M.B. Burke, and D.B. Lobell, 2010: The poverty implications of climate-induced crop yield changes by 2030. *Global Environmental Change,* **20(4)**, 577-585.
Heyd, T., 2008: Cultural Responses to Natural Changes such as Climate Change. *Espace Populations Societes*, **1**, 83-88.
Hidalgo, F.D., S. Naidu, S. Nichter, and N. Richardson, 2010: Economic determinants of land invasions. *Review of Economics and Statistics,* **92(3)**, 505-523.
Hilson, G. and S. Van Bockstael, 2011: Diamond Mining, Rice Farming And A 'Maggi Cube': A Viable Survival Strategy In Rural Liberia? *Journal of International Development*, **23(8)**, 1042-1053.
Hitchcock, R.K., 2009: From local to global: Perceptions and realities of environmental change among Kalahari San. In: *Anthropology and climate change: From encounters to actions.* [Crate, S.A. and M. Nuttall(eds.)]. Left Coast Press, Walnut Creek, CA, pp. 250-265.
Holland, M.M., C.M. Bitz, and B. Tremblay, 2006: Future abrupt reductions in the summer Arctic sea ice. *Geophysical Research Letters*, **33(23)**, L23503.
Homann, S., B. Rischkowsky, J. Steinbach, M. Kirk, and E. Mathias, 2008: Towards Endogenous Livestock Development: Borana Pastoralists' Responses to Environmental and Institutional Changes. *Human Ecology,* **36(4)**, 503-520.
Hoogensen, G. and K. Stuvøy, 2006: Gender, resistance and human security. *Security Dialogue,* **37(2)**, 207-228.
Hori, M. and M.J. Schafer, 2009: Social costs of displacement in Louisiana after Hurricanes Katrina and Rita. *Population and Environment,* **31(1-3)**, 64-86.
Houghton, K.J., A.T. Vafeidis, B. Neumann, and A. Proelss, 2010: Maritime boundaries in a rising sea. *Nature Geoscience,* **3(12)**, 813-816.
Hovelsrud G, Poppel B, Oort B, and Reist J, 2011a: Arctic Societies, Cultures, and Peoples in a Changing Cryosphere. *Ambio,* **40(1)**, 100-110.
Hovelsrud, G.K., M. S. Olsen, M. S., T.V. Callaghan, J.D. Reist, O.L. Reiersen, D. Dahl-Jensen, M.A. Granskog, B. Goodison, M. Johansson, R. Kallenborn, J. Key, A. Klepikov, W. Meier, J.E. Overland, T.D. Prowse, M. Sharp, W.F. Vincent, and J. Walsh, 2011b: The Changing Arctic Cryosphere and Likely Consequences: An Overview. *Ambio,* **40(1)**, 111-118.
Hovelsrud, G.K., H. Dannevig, J. West, and H. Amundsen, 2010a: Adaptation in fisheries and municipalities: Three communities in northern norway. In: *Community adaptation and vulnerability in arctic communities.* [Hovelsrud, G.K. and B. Smit(eds.)]. Springer, Berlin, pp. 23-62.
Hovelsrud, G.K. and B. Smit (eds.), 2010: *Community adaptation and vulnerability in arctic regions.* Springer, Berlin, pp. 353.
Hovelsrud, G.K., J. White, M. Andrachuk, and B. Smit, 2010b: Community adaptation and vulnerability integrated. In: *Community adaptation and vulnerability in arctic communities.* [Hovelsrud, G.K. and B. Smit(eds.)]. Springer, Berlin, pp. 335-348.
Howitt, R., O. Havnen, and S. Veland, 2011: Natural and Unnatural Disasters: Responding with Respect for Indigenous Rights and Knowledges. *Geographical Research,* **50(1)**, 47-59.
Hsiang, S.M., K.C. Meng, and M.A. Cane, 2011: Civil conflicts are associated with the global climate. *Nature,* **476(7361)**, 438-441.
Hughes, G., P. Chinowsky, and K. Strzepek, 2010: The costs of adaptation to climate change for water infrastructure in OECD countries. *Utilities Policy,* **18(3)**, 142-153.
Hugo, G., 2011: Lessons from past forced resettlement for climate change migration. In: *Climate change and migration.* [Piguet, E., A. Pecoud, and P.d. Guchteneire(eds.)]. Cambridge University Press, Cambridge, pp. 260-288.
Hulme, M., 2008: The conquering of climate: discourses of fear and their dissolution. *Geographical Journal,* **174(1)**, 5-16.
Humphreys, S., 2010: *Human rights and climate change.* Cambridge University Press, Cambridge, 348 pp.
Hunter, L.M. and E. David, 2011: Displacement, climate change and gender. In: *Migration and climate change.* [Piguet, E., A. Pecoud, and P.d. Guchteneire(eds.)]. Cambridge University Press, Cambridge, pp. 306-330.
Huntington, H.P., 2011: Arctic science: The local perspective. *Nature*, **478(7368)**, 182-183.
Hurlimann, A. and S. Dolnicar, 2011: Voluntary relocation–An exploration of Australian attitudes in the context of drought, recycled and desalinated water. *Global Environmental Change,* **21(3)**, 1084-1094.

Ifejika Speranza, C., B. Kiteme, and U. Wiesmann, 2008: Droughts and famines: The underlying factors and the causal links among agro-pastoral households in semi-arid Makueni district, Kenya. *Global Environmental Change,* **18(1)**, 220-233.

Inglehart, R.F. and P. Norris, 2012: The Four Horsemen of the Apocalypse: Understanding Human Security. *Scandinavian Political Studies,* **35(1)**, 71-96.

Ingram, K.T., M.C. Roncoli, and P.H. Kirshen, 2002: Opportunities and constraints for farmers of west Africa to use seasonal precipitation forecasts with Burkina Faso as a case study. *Agricultural Systems,* **74(3)**, 331-349.

Jacka, J., 2009: Global averages, local extremes: The subtleties and complexities of climate change in papua new guinea. In: *Anthropology and climate change: From encounters to actions.* [Crate, S.A. and M. Nuttall(eds.)]. Left Coast Press, Walnut Creek, CA, pp. 197-208.

Jakobeit, C. and C. Methmann, 2012: 'Climate Refugees' as Dawning Catastrophe? A Critique of the Dominant Quest for Numbers. In: *Climate Change, Human Security and Violent Conflict.* [Scheffran, J., M. Brzoska, H.G. Brauch, P.M. Link, and J. Schilling(eds.)]. Springer, Berlin, pp. 301-314.

Johnson, C.A. and K. Krishnamurthy, 2010: Dealing with displacement: Can " social protection" facilitate long-term adaptation to climate change? *Global Environmental Change,* **20(4)**, 648-655.

Johnson, C.A., 2012: Governing climate displacement: the ethics and politics of human resettlement. *Environmental Politics,* **21(2)**, 308-328.

Johnstone, S. and J. Mazo, 2011: Global warming and the Arab Spring. *Survival,* **53(2)**, 11-17.

Jones, P. G. and P. K. Thornton 2003: The potential impacts of climate change on maize production in Africa and Latin America in 2055. *Global Environmental Change*, **13**, 51-59.

Jones, P.G. and P.K. Thornton, 2009: Croppers to livestock keepers: livelihood transitions to 2050 in Africa due to climate change. *Environmental Science and Policy,* **12(4)**, 427-437.

Jülich, S., 2011: Drought triggered temporary migration in an East Indian village. *International Migration,* **49(s1)**, e189-e199.

Kabubo-Mariara, J., 2009: Global warming and livestock husbandry in Kenya: impacts and adaptations. *Ecological Economics,* **68(7)**, 1915-1924.

Kabubo-Mariara, J., 2008: Climate change adaptation and livestock activity choices in Kenya: An economic analysis. *Natural Resources Forum,* **32(2)**, 131-141.

Kainuma, M., Y. Matsuoka, T. Morita, T. Masui, and K. Takahashi, 2004: Analysis of global warming stabilization scenarios: the Asian-Pacific integrated model. *Energy Economics,* **26(4)**, 709-719.

Kalabokidis, K., T. Iosifides, M. Henderson, and B. Morehouse, 2008: Wildfire policy and use of science in the context of a socio-ecological system on the Aegean Archipelago. *Environmental Science & Policy,* **11(5)**, 408-421.

Kalanda-Joshua, M., C. Ngongondo, L. Chipeta, and F. Mpembeka, 2011: Integrating indigenous knowledge with conventional science: Enhancing localised climate and weather forecasts in Nessa, Mulanje, Malawi. *Physics and Chemistry of the Earth,* **36(14-15)**, 996-1003.

Kaldor, M., 2007: *Human Security.* Polity, Cambridge, pp. 239.

Kalikoski, D.C., P. Quevedo Neto, and T. Almudi, 2010: Building adaptive capacity to climate variability: The case of artisanal fisheries in the estuary of the Patos Lagoon, Brazil. *Marine Policy,* **34(4)**, 742-751.

Karstedt, S., 2001: Comparing cultures, comparing crime: Challenges, prospects and problems for a global criminology. *Crime, Law and Social Change,* **36(3)**, 285-308.

Kartiki, K., 2011: Climate change and migration: a case study from rural Bangladesh. *Gender & Development,* **19(1)**, 23-38.

Kawachi, I., B.P. Kennedy, and R.G. Wilkinson, 1999: Crime: social disorganization and relative deprivation. *Social Science & Medicine,* **48(6)**, 719-731.

Kebede, A.S., R.J. Nicholls, S. Hanson, and M. Mokrech, 2012: Impacts of Climate Change and Sea-Level Rise: A Preliminary Case Study of Mombasa, Kenya. *Journal of Coastal Research,* **28(1)**, 8-19.

Keen, D.J., 2008: *Complex emergencies.* Polity Press, Cambridge, .

Keith, D., 2000: Geoengineering the climate: history and prospect. *Annu. Rev. Energy Environ.,* **25**, 245-284.

Kesavan, P.C. and M.S. Swaminathan, 2006: Managing extreme natural disasters in coastal areas. *Philosophical Transactions of the Royal Society of London,* **364(1845)**, 2191-2216.

Keskitalo, E.C.H., 2009: Governance in vulnerability assessment: the role of globalising decision-making networks in determining local vulnerability and adaptive capacity. *Mitigation and Adaptation Strategies for Global Change,* **14(2)**, 185-201.

Kevane, M. and L. Gray, 2008: Darfur: rainfall and conflict. *Environmental Research Letters,* **3(3)**, 034006.
King, D.N. and J. Goff, 2010: Benefitting from differences in knowledge, practice and belief: Māori oral traditions and natural hazards science. *Natural Hazards and Earth System Sciences,* **10(9)**, 1927-1940.
King, D.N.T., J. Goff, and A. Skipper, 2007: Māori environmental knowledge and natural hazards in Aotearoa-New Zealand. *Journal of the Royal Society of New Zealand,* **37(2)**, 59-73.
King, D., 2008: Reducing hazard vulnerability through local government engagement and action. *Natural Hazards,* **47(3)**, 497-508.
Kingsbury, D., 2007: Peace processes in Aceh and Sri Lanka: a comparative assessment. *Security Challenges Journal,* **3(2)**, 93-112.
Klein, R.J., E.L.F. Schipper, and S. Dessai, 2005: Integrating mitigation and adaptation into climate and development policy: three research questions. *Environmental Science & Policy,* **8(6)**, 579-588.
Klintenberg, P., M. Seely, and C. Christiansson, 2007: Local and national perceptions of environmental change in central Northern Namibia: Do they correspond? *Journal of Arid Environments,* **69(3)**, 506-525.
Kniveton, D., C. Smith, and S. Wood, 2011: Agent-based model simulations of future changes in migration flows for Burkina Faso. *Global Environmental Change,* **21(Supp 1)**, S34-S40.
Kofinas G, the communities of Aklavik, Arctic Village, Old Crow, and McPherson F, 2002: Community contributions to Ecological Monitoring: Knowledge Co-production in the U.S.-Canada Arctic Borderlands. In: *The earth is faster now: Indigenouse Observations of arctic Environmental Change.* [Krupnik I and J. D.(eds.)]. Fairbanks Alaska, Arctic Resesearch Consortium of the United Sttates., pp. 55-92.
Kolmannskog, V., 2010: Climate Change, Human Mobility, and Protection: Initial Evidence from Africa. *Refugee Survey Quarterly,* **29(3)**, 103-119.
Koubi, V., T. Bernauer, A. Kalbhenn, and G. Spilker, 2012: Climate variability, economic growth, and civil conflict. *Journal of Peace Research,* **49(1)**, 113-127.
Krause, K. and O. Jütersonke, 2005: Peace, security and development in post-conflict environments. *Security Dialogue,* **36(4)**, 447-462.
Kuhlicke, C., 2010: The dynamics of vulnerability: some preliminary thoughts about the occurrence of 'radical surprises' and a case study on the 2002 flood (Germany). *Natural Hazards,* **55(3)**, 671-688.
Kumssa, A. and J.F. Jones, 2011: Climate change and human security in Africa. *International Journal of Sustainable Development and World Ecology,* **17(6)**, 453-461.
Kuruppu N and Liverman D, 2011: Mental preparation for climate adaptation: The role of cognition and culture in enhancing adaptive capacity of water management in Kiribati. *Global Environmental Change,* **21(2)**, 657-669.
Kwiatkowski, R.E., 2011: Indigenous community based participatory research and health impact assessment: A Canadian example. *Environmental Impact Assessment Review,* **31(4)**, 445-450.
Lal, P., 2010: Vulnerability to natural disasters: An economic analysis of the impact of the 2009 floods on the Fijian sugar belt. *Pacific Economic Bulletin,* **25(2, 2010)**, 62-77.
Landry, C.E., O. Bin, P. Hindsley, J.C. Whitehead, and K. Wilson, 2007: Going home: Evacuation-migration decisions of Hurricane Katrina survivors. *Southern Economic Journal,* **74(2)**, 326-343.
Larsen, P.H., S. Goldsmith, O. Smith, M.L. Wilson, K. Strzepek, P. Chinowsky, and B. Saylor, 2008: Estimating future costs for Alaska public infrastructure at risk from climate change. *Global Environmental Change,* **18(3)**, 442-457.
Laukkonen, J., P.K. Blanco, J. Lenhart, M. Keiner, B. Cavric, and C. Kinuthia-Njenga, 2009: Combining climate change adaptation and mitigation measures at the local level. *Habitat International,* **33(3)**, 287-292.
Le, T.V.H., Nguyen, H.N., Wolanski, E., Tran, T.C. and Haruyama, S. 2007: The combined impact on the flooding in Vietnam's Mekong River delta of local man-made structures, sea level rise, and dams upstream in the river catchment. *Estuarine, Coastal and Shelf Science,* **71**, 110-116.
Leary, N., C. Conde, J. Kulkarni, A. Nyong, and J. Pulhin, 2008: *Climate Change and Vulnerability.* Earthscan, London, pp. 428.
Lefale, P., 2010: Ua 'afa le Aso Stormy weather today: traditional ecological knowledge of weather and climate. The Samoa experience. *Climatic Change,* **100(2)**, 317-335.
Leichenko, R. and K. O'Brien, 2008: *Environmental change and globalization: Double exposures.* Oxford University Press, USA, .
Lind, J. and S. Eriksen, 2006: The impacts of conflict on household coping strategies: Evidence from Turkana and Kitui Districts in Kenya. *Die Erde,* **137(3)**, 249-270.

Lindsell, J.A., E. Klop, and A.M. Siaka, 2011: The impact of civil war on forest wildlife in West Africa: mammals in Gola Forest, Sierra Leone. *Oryx,* **45(1)**, 69-77.
Lindsey, P.A., S.S. Romanach, C.J. Tambling, K. Chartier, and R. Groom, 2011: Ecological and financial impacts of illegal bushmeat trade in Zimbabwe. *Oryx,* **45(1)**, 96-111.
Lipset, D., 2011: The tides: Masculinity and climate change in coastal Papua New Guinea. *Les Marées : Masculinité Et Changement Climatique Sur Les Côtes De Papouasie-Nouvelle-Guinée,* **17(1)**, 20-43.
López-Carr, D., 2012: Agro-ecological drivers of rural out-migration to the Maya Biosphere Reserve, Guatemala. *Environmental Research Letters,* **7(4)**, 045603.
Lusthaus, J., 2010: Shifting sands: Sea level rise, maritime boundaries, and inter-state conflict. *Politics,* **30(2)**, 113-118.
Maaskant, B., S.N. Jonkman, and L.M. Bouwer, 2009: Future risk of flooding: an analysis of changes in potential loss of life in South Holland (The Netherlands). *Environmental Science and Policy,* **12(2)**, 157-169.
MacNeil, M.A., N.A.J. Graham, J.E. Cinner, N.K. Dulvy, P.A. Loring, S. Jennings, N.V.C. Polunin, A.T. Fisk, and T.R. McClanahan, 2010: Transitional states in marine fisheries: adapting to predicted global change. *Philosophical Transactions of the Royal Society B,* **365(1558)**, 3753-3763.
Mahoney, C.O. and T.M. Pinedo, 2007: Human security in communities in Costa Rica and the United States. *Journal of Social Issues,* **63(2)**, 353-368.
Marfai, M., L. King, J. Sartohadi, S. Sudrajat, S. Budiani, and F. Yulianto, 2008: The impact of tidal flooding on a coastal community in Semarang, Indonesia. *The Environmentalist,* **28(3)**, 237-248.
Marin, A., 2010: Riders under storms: Contributions of nomadic herders' observations to analysing climate change in Mongolia. *Global Environmental Change,* **20(1)**, 162-176.
Marino, E. and J. Ribot, 2012: Adding insult to injury: Climate change and the inequities of climate intervention. *Global Environmental Change,* **22(2)**, 323-328.
Marino, E., 2012: The long history of environmental migration: Assessing vulnerability construction and obstacles to successful relocation in Shishmaref, Alaska. *Global Environmental Change,* **22(2)**, 374-381.
Mark, B., G. Bury, J. McKenzie, A. French, and M. Baraer, 2010: Climate Change and Tropical Andean Glacier Recession: Evaluating Hydrologic Changes and Livelihood Vulnerability in the Cordillera Blanca, Peru. *Annals of the Association of American Geographers,* **100(4)**, 794-805.
Marshall, N.A., 2011: Assessing resource dependency on the rangelands as a measure of climate sensitivity. *Society and Natural Resources,* **24(10)**, 1105-1115.
Martin, S., 2009: Climate change, migration, and governance. *Global Governance,* **16(3)**, 397-414.
Martin, S.F., 2012: Environmental change and migration: legal and political frameworks. *Environment and Planning C: Government and Policy,* **30(6)**, 1045-1060.
Massey, D.S., W.G. Axinn, and D.J. Ghimire, 2010: Environmental change and out-migration: Evidence from Nepal. *Population and Environment,* **32(2)**, 109-136.
Matthew, R.A., J. Barnett, B. McDonald, and K.L. O'Brien (eds.), 2010: *Global Environmental Change and Human Security: Understanding Environmental Threats to Wellbeing and Livelihoods.* MIT Press, Cambridge, .
Mazo, J., 2009: Climate Change and Security. *The Adelphi Papers,* **49(409)**, 73-86.
McAdam, J., 2011: Refusing refuge in the Pacific: Deconstructing climate-induced displacement in international law. In: *Migration and climate change.* [Piguet, E., A. Pécoud, and P.d. Guchteneire(eds.)]. Cambridge University Press, Cambridge, pp. 102-137.
McCaffrey, S., 2000: An Overview of the U.N. Convention on the Law of the Non-Navigational Uses of International Watercourses. *Land Resources and Environmental Law,* **20**, 57-75.
McDonald-Wilmsen, B. and M. Webber, 2010: Dams and displacement: Raising the standards and broadening the research agenda. *Water Alternatives,* **3(2)**, 142-161.
McEvoy, J. and M. Wilder, 2012: Discourse and desalination: Potential impacts of proposed climate change adaptation interventions in the Arizona–Sonora border region. *Global Environmental Change,* **22(2)**, 353-363.
McLeman, R. and B. Smit, 2006: Migration as an adaptation to climate change. *Climatic Change,* **76(1)**, 31-53.
McLeman, R., 2009: Climate change and adaptive human migration: Lessons from rural North America. In: *Adapting to climate change: Thresholds, values, governance.* [Adger, W.N., I. Lorenzoni, and K. O'Brien(eds.)]. Cambridge University Press, Cambridge, pp. 296-310.
McLeman, R.A. and L.M. Hunter, 2010: Migration in the context of vulnerability and adaptation to climate change: insights from analogues. *Wiley Interdisciplinary Reviews: Climate Change,* **1(3)**, 450-461.

McLeman, R.A. and S.K. Ploeger, 2012: Soil and its influence on rural drought migration: insights from Depression-era Southwestern Saskatchewan, Canada. *Population & Environment,* **33(4)**, 304-332.
McMichael, C., J. Barnett, and A.J. McMichael, 2012: An Ill Wind? Climate Change, Migration, and Health. *Environmental Health Perspectives,* **120(5)**, 646-654.
McNamara, K.E. and C. Gibson, 2009: 'We do not want to leave our land': Pacific ambassadors at the United Nations resist the category of 'climate refugees'. *Geoforum,* **40(3)**, 475-483.
McNeeley, S.M., 2012: Examining barriers and opportunities for sustainable adaptation to climate change in Interior Alaska. *Climatic Change,* **111(3-4)**, 835-857.
McSweeney, K. and O.T. Coomes, 2011: Climate-related disaster opens a window of opportunity for rural poor in northeastern Honduras. *Proceedings of the National Academy of Sciences,* **108(13)**, 5203-5208.
Mehrotra, S., C. Rosenzweig, and W.D. Solecki, 2011: Cities, disaster and climate risk. In: *Climate change and cities.* [Rosenzweig, C., W.D. Solecki, S.A. Hammer, and S. Mehrotra(eds.)]. Cambridge University Press, Cambridge, pp. 15-42.
Mehta, L., 2010: *The limits to scarcity: contesting the politics of allocation.* Earthscan, London, .
Melick, D., 2010: Credibility of REDD and experiences from Papua New Guinea. *Conservation Biology,* **24(2)**, 359-361.
Mendelsohn, R., W. Morrison, M.E. Schlesinger, and N.G. Andronova, 2000: Country-specific market impacts of climate change. *Climatic Change,* **45(3)**, 553-569.
Mendelsohn, R., A. Dinar, and L. Williams, 2006: The distributional impact of climate change on rich and poor countries. *Environment and Development Economics,* **11(02)**, 159-178.
Mendelsohn, R., A. Basist, P. Kurukulasuriya, and A. Dinar, 2007: Climate and rural income. *Climatic Change,* **81(1)**, 101-118.
Mercer, J., I. Kelman, S. Suchet-Pearson, and K. Lloyd, 2009: Integrating indigenous and scientific knowledge bases for disaster risk reduction in Papua New Guinea. *Geografiska Annaler. Series B, Human Geography,* **91(2)**, 157-183.
Mercer, K.L., H.R. Perales, and J.D. Wainwright, 2012: Climate change and the transgenic adaptation strategy: Smallholder livelihoods, climate justice, and maize landraces in Mexico. *Global Environmental Change,* **22(2)**, 495-504.
Mertz, O., C. Mbow, A. Reenberg, and A. Diouf, 2009: Farmers' Perceptions of Climate Change and Agricultural Adaptation Strategies in Rural Sahel. *Environmental Management,* **43(5)**, 804-816.
Messer, E. and M.J. Cohen, 2011: Understanding and responding to the links between conflict and hunger. *Development in Practice,* **21(4-5)**, 481-487.
Meze-Hausken, E., 2000: Migration caused by climate change: how vulnerable are people inn dryland areas? *Mitigation and Adaptation Strategies for Global Change,* **5(4)**, 379-406.
Mideksa, T.K., 2010: Economic and distributional impacts of climate change: The case of Ethiopia. *Global Environmental Change,* **20(2)**, 278-286.
Miguel, E., S. Satyanath, and E. Sergenti, 2004: Economic shocks and civil conflict: An instrumental variables approach. *Journal of Political Economy,* **112(4)**, 725-753.
Molony, T. and J. Smith, 2010: Biofuels, food security, and Africa. *African Affairs,* **109(436)**, 489-498.
Molua, E.L., J. Benhin, J. Kabubo-Mariara, M. Ouedraogo, and S. El-Marsafawy, 2010: Global climate change and vulnerability of African agriculture: implications for resilience and sustained productivity. *Quarterly Journal of International Agriculture,* **49(3)**, 183-211.
Mortreux, C. and J. Barnett, 2009: Climate change, migration and adaptation in Funafuti, Tuvalu. *Global Environmental Change,* **19(1)**, 105-112.
Moser, S.C., 2012: Adaptation, mitigation, and their disharmonious discontents: An essay. *Climatic Change,* **111(2)**, 165-175.
Mubaya, C.P., J. Njuki, E.P. Mutsvangwa, F.T. Mugabe, and D. Nanja, 2012: Climate variability and change or multiple stressors? Farmer perceptions regarding threats to livelihoods in Zimbabwe and Zambia. *Journal of Environmental Management,* **102**, 9-17.
Murtinho, F. and T.M. Hayes, 2012: Adaptation in Resource-Dependent Communities: A Call for Greater Methodological Clarity in Adaptation Field Research. *Society & Natural Resources,* **25(5)**, 513-522.
Myers, C.A., T. Slack, and J. Singelmann, 2008: Social vulnerability and migration in the wake of disaster: The case of Hurricanes Katrina and Rita. *Population and Environment,* **29(6)**, 271-291.

Myers, N., 2002: Environmental refugees: a growing phenomenon of the 21st century. *Philosophical Transactions of the Royal Society B,* **357(1420)**, 609-613.
Næss, L.O., I.T. Norland, W.M. Lafferty, and C. Aall, 2006: Data and processes linking vulnerability assessment to adaptation decision-making on climate change in Norway. *Global Environmental Change,* **16(2)**, 221-233.
Najam, A., 2003: Environment and Security: Exploring the Links. In: *Environment, Development, and Human Security: Perspectives from South Asia.* [Najam, A. (ed.)]. University Press of America, Lanham, pp. 1-24.
Nakashima D. and Rou´e M., 2002: Indigenous Knowledge, Peoples and Sustainable Practice. In: *Social and economic dimensions of global environmental change.* [Timmerman, M.P. (ed.)]. John Wiley, Chichester, pp. 314–324.
Nakashima, D.J., K. Galloway McLean, H.D. Thulstrup, A. Ramos Castillo, and J.T. Rubis, 2012: *Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation.* UNESCO, Paris, pp. 120.
Neumayer, E., 2003: Good policy can lower violent crime: Evidence from a cross-national panel of homicide rates, 1980–97. *Journal of Peace Research,* **40(6)**, 619-640.
New, M., D. Liverman, H. Schroder, and K. Anderson, 2011: Four degrees and beyond: the potential for a global temperature increase of four degrees and its implications. *Philosophical Transactions of the Royal Society A,* **369(1934)**, 6-19.
Ng, W. and R. Mendelsohn, 2005: The impact of sea level rise on Singapore. *Environment and Development Economics,* **10**, 201-215.
Nicholls, R.J., N. Marinova, J.A. Lowe, S. Brown, P. Vellinga, D. de Gusmão, J. Hinkel, and R.S.J. Tol, 2011: Sea-level rise and its possible impacts given a 'beyond 4 C world' in the twenty-first century. *Philosophical Transactions of the Royal Society A,* **369(1934)**, 161-181.
Nielsen, J.Ø. and A. Reenberg, 2012: Exploring causal relations: the societal effects of climate change. *Danish Journal of Geography,* **112(2)**, 89-92.
Nielsen, J.Ø. and A. Reenberg, 2010: Cultural barriers to climate change adaptation: A case study from Northern Burkina Faso. *Global Environmental Change,* **20(1)**, 142-152.
Nigel, J., 2009: Livelihoods in a conflict setting. *Norsk Geografisk Tidsskrift-Norwegian Journal of Geography,* **63(1)**, 23-34.
Norgaard, K.M., 2011: *Living in denial: Climate change, emotions, and everyday life.* Mit Press, Cambridge, MA, .
Nunn, P.D., 2000: Coastal Changes Over the Past 200 Years Around Ovalau and Moturiki Islands, Fiji: Implications for coastal zone management. *Australian Geographer,* **31(1)**, 21-39.
Nursey-Bray, M., G.T. Pecl, S. Frusher, C. Gardner, M. Haward, A.J. Hobday, S. Jennings, A.E. Punt, H. Revill, and I. van Putten, 2012: Communicating climate change: Climate change risk perceptions and rock lobster fishers, Tasmania. *Marine Policy,* **36(3)**, 753-759.
Nuttall, M., 2012: Tipping Points and the Human World: Living with Change and Thinking about the Future. *Ambio,* **(41)**, 96-105.
Nuttall, M., 2009: Living in a world of movement human resilience to environemntal instability in Greenland. In: *Anthropology and climate change : from encounters to actions.* [Crate, S.A. and M. Nuttall(eds.)]. Left Coast Press, Walnut Creek, CA, pp. 292-310.
Nyong, A., F. Adesina, and B. Osman Elasha, 2007: The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitigation and Adaptation Strategies for Global Change,* **12(5)**, 787-797.
O'Brien, K., 2006: Are we missing the point? Global environmental change as an issue of human security. *Global Environmental Change,* **16(1)**, 1-3.
O'Loughlin, J., F.D.W. Witmer, A.M. Linke, A. Laing, A. Gettelman, and J. Dudhia, 2012: Climate variability and conflict risk in East Africa, 1990–2009. *Proceedings of the National Academy of Sciences,* **109(45)**, 18344-18349.
Oberthür, T., E. Barrios, S. Cook, H. Usma, and G. Escobar, 2004: Increasing the relevance of scientific information in hillside environments through understanding of local soil management in a small watershed of the Colombian Andes. *Soil Use and Management,* **20(1)**, 23-31.
O'Brien, K., A.L. St Clair, and B. Kristoffersen (eds.), 2010: *Climate Change, Ethics and Human Security.* Cambridge University Press, Cambridge, UK, pp. 247.
O'Brien, K.L. and J. Wolf, 2010: A values-based approach to vulnerability and adaptation to climate change. *Wiley Interdisciplinary Reviews: Climate Change,* **1(2)**, 232-242.

Oels, A., 2013: Rendering climate change governable by risk: From probability to contingency. *Geoforum*, **45**, 17-29.
Oliver-Smith, A., 2011: Sea level rise, local vulnerability and involuntary migration. In: *Migration and climate change.* [Piguet, E., A. Pécoud, and P.d. Guchteneire(eds.)]. Cambridge University Press, Cambridge, .
Olson, R.S. and V.T. Gawronski, 2010: From Disaster Event to Political Crisis: A "5C A" Framework for Analysis. *International Studies Perspectives*, **11(3)**, 205-221.
Oluoko-Odingo, A.A., 2011: Vulnerability and adaptation to food insecurity and poverty in Kenya. *Annals of the Association of American Geographers*, **101(1)**, 1-20.
Onta, N. and B.P. Resurreccion, 2011: The role of gender and caste in climate adaptation strategies in Nepal: emerging change and persistent inequalities in the far-western region. *Mountain Research and Development*, **31(4)**, 351-356.
Orlove, B.S., J.C.H. Chiang, and M.A. Cane, 2000: Forecasting Andean rainfall and crop yield from the influence of El Niño on Pleiades visibility. *Nature*, **403(6765)**, 68-71.
Orlove, B., C. Roncoli, M. Kabugo, and A. Majugu, 2010: Indigenous climate knowledge in southern Uganda: the multiple components of a dynamic regional system. *Climatic Change*, **100(2)**, 243-265.
Osbahr H., Twyman C., Adger W. N., and Thomas D. S. G., 2010: Evaluating successful livelihood adaptation to climate variability and change in southern Africa. *Ecology and Society*, **15(2)**, 27.
Oswald Spring, Ú., 2008: Gender and Disasters: Human, Gender and Environmental Security: A HUGE Challenge. Source 8. United Nations University, Institute for Environment and Human Security, Bonn. pp. 52.
Oswald Spring, Ú., 2011: Reconceptualizar la seguridad ante los riesgos del cambio climático y la vulnerabilidad social. In: *Las Dimensiones sociales del cambio climáticos. Un Panorama desde México. ¿Cambio Social o Crisis Ambiental?* [Lucatello, S. and D.R. Velázquez(eds.)]. Instituto Mora and UNAM, Mexico D.F., pp. 23-47.
Oswald Spring, Ú., 2012: Can Health be Securitized?, *Human evolution* **27(1-3)**: 21-29.
Othman, Z., 2009: Human Security Concepts, Approaches and Debates in Southeast Asia. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú. Oswald Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al*.(eds.)]. Springer, Berlin, pp. 1037-1047.
Owen, T., 2004: Human Security - Conflict, Critique and Consensus: Colloquium Remarks and a Proposal for a Threshold-Based Definition. *Security Dialogue*, **35(3)**, 373-387.
Owens, J., 2008: Environmental refugees, corrective justice and a system of compensation. *International Journal of Green Economics*, **2(3)**, 311-328.
Paavola, J., 2008: Livelihoods, vulnerability and adaptation to climate change in Morogoro, Tanzania. *Environmental Science and Policy*, **11(7)**, 642-654.
Pareek A. and Trivedi P.C., 2011: Cultural values and indigenous knowledge of climate change and disaster prediction in Rajasthan, India. *Indian Journal of Traditional Knowledge*, **10(1)**, 183-189.
Paris, R., 2001: Human security: paradigm shift or hot air? *International Security*, **26(2)**, 87-102.
Parker, G., 2008: Crisis and catastrophe: the global crisis of the seventeenth century reconsidered. *The American Historical Review*, **113(4)**, 1053-1079.
Parnell, S. and R. Walawege, 2011: Sub-Saharan African urbanisation and global environmental change. *Global Environmental Change*, **21(Supp 1)**, S12-S20.
Paul, B.K., 2005: Evidence against disaster-induced migration: The 2004 tornado in north-central Bangladesh. *Disasters*, **29(4)**, 370-385.
Paul, S. K. and J. K. Routray 2010: Flood proneness and coping strategies: the experiences of two villages in Bangladesh. *Disasters*, **34**, 489-508.
Paul, S.K. and J.K. Routray, 2011: Household response to cyclone and induced surge in coastal Bangladesh: Coping strategies and explanatory variables. *Natural Hazards*, **57(2)**, 477-499.
Pearce, T., 2010: Inuit vulnerability and adaptive capacity to climate change in Ulukhaktok, Northwest Territories, Canada. *Polar Record*, **46(237)**, 157.
Pearce, T.D., 2009: Community collaboration and climate change research in the Canadian Arctic. *Polar Research*, **28(1)**, 10-27.
Pelling, M. and K. Dill, 2010: Disaster politics: tipping points for change in the adaptation of sociopolitical regimes. *Progress in Human Geography*, **34(1)**, 21-37.
Peluso, N.L. and M. Watts (eds.), 2001: *Violent environments.* Cornell University Press, Ithaca NY, .

Penning-Rowsell, E.C., P. Sultana, and P.M. Thompson, 2013: The 'last resort'? Population movement in response to climate-related hazards in Bangladesh. *Environmental Science & Policy,* , doi: 10.1016/j.envsci.2102.03.009.

Peras, R.J., J.M. Pulhin, R.D. Lasco, R.V.O. Cruz, and F.B. Pulhin, 2008: Climate Variability and Extremes in the Pantabangan-Carranglan Watershed, Philippines: Assessment of Impacts and Adaptation Practices. *Journal of Environmental Science and Management,* **11(2)**, 14-31.

Perry, R. and U. Sumaila, 2007: Marine ecosystem variability and human community responses: the example of Ghana, West Africa. *Marine Policy,* **31(2)**, 125-134.

Petheram, L., K.K. Zander, B.M. Campbell, C. High, and N. Stacey, 2010: 'Strange changes': Indigenous perspectives of climate change and adaptation in NE Arnhem Land (Australia). *Global Environmental Change,* **20(4)**, 681-692.

Phillips, M.R.l. and A.L. A. L. Jones, 2006: Erosion and tourism infrastructure in the coastal zone: Problems, consequences and management. *Tourism Management,* **27(3)**, 517-524.

Pietsch, J. and I. McAllister, 2010: Human security in Australia: public interest and political consequences. *Australian Journal of International Affairs,* **64(2)**, 225-244.

Piguet, E., 2010: Linking climate change, environmental degradation, and migration: a methodological overview. *Wiley Interdisciplinary Reviews: Climate Change,* **1(4)**, 517-524.

Piguet, E., A. Pécoud, and P. de Guchteneire (eds.), 2011: *Migration and climate change.* Cambridge University Press, Cambridge, .

Pike, I., 2004: The biosocial consequences of life on the run: a case study from Turkana District, Kenya. *Human Organization,* **63(2)**, 221-235.

Poku, N.K. and B. Sandkjaer, 2009: Human Security in Sub-Saharan Africa. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú. Oswald Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer, Berlin, pp. 1057-1070.

Posner, E., 2007: Climate Change and International Human Rights Litigation: A Critical Appraisal. *University of Pennsylvania Law Review,* **155**, 1925 at 1925.

Preston, C.J. 2013: Ethics and geoengineering: reviewing the moral issues raised by solar radiation management and carbon dioxide removal. *Wiley Interdisciplinary Reviews: Climate Change* **4**, 23-37.

Quinn, C.H., Ziervogel G, Taylor A., Takama T, and Thomalla F., 2011: Coping with multiple stresses in rural South Africa. *Ecology and Society,* **16(3)**, 2.

Raddad, S., A.G. Salleh, and N. Samat, 2010: Determinants of Agriculture Land Use Change in Palestinian Urban Environment: Urban planners at Local Governments Perspective. *American-Eurasian Journal of Sustainable Agriculture,* **4(1)**, 30-38.

Raleigh, C. and D. Kniveton, 2012: Come rain or shine: An analysis of conflict and climate variability in East Africa. *Journal of Peace Research,* **49(1)**, 51-64.

Raleigh, C., 2011: The search for safety: The effects of conflict, poverty and ecological influences on migration in the developing world. *Global Environmental Change,* **21(Supp 1)**, S82-S93.

Rammohan, A. and M. Johar, 2009: The determinants of married women's autonomy in Indonesia. *Feminist Economics,* **15(4)**, 31-55.

Rattenbury, K., K. Kielland, G. Finstad, and W. Schneider, 2009: A reindeer herder's perspective on caribou, weather and socio-economic change on the Seward Peninsula, Alaska. *Polar Research,* **28(1)**, 71-88.

Rautela, P., 2005: Indigenous technical knowledge inputs for effective disaster management in the fragile Himalayan ecosystem. *Disaster Prevention and Management,* **14(2)**, 233-241.

Ravera, F., D. Tarrasón, and E. Simelton, 2011: Envisioning adaptive strategies to change: Participatory scenarios for agropastoral semiarid systems in Nicaragua. *Ecology and Society,* **16(1)**.

Renaud, F.G., O. Dun, K. Warner, and J. Bogardi, 2011: A decision framework for environmentally induced migration. *International Migration,* **49(s1)**, e5-e29.

Reuveny, R., 2007: Climate change-induced migration and violent conflict. *Political Geography,* **26(6)**, 656-673.

Revi, A., 2005: Lessons from the deluge: priorities for multi-hazard risk mitigation. *Economic and Political Weekly,* **40(36)**, 3911-3916.

Ribot, J., 2011: Vulnerability before adaptation: Toward transformative climate action. *Global Environmental Change,* **21(4)**, 1160-1162.

Ricke, K.L., M.G. Morgan, and M.R. Allen, 2010: Regional climate response to solar-radiation management. *Nature Geoscience,* **3**, 537-541.

Robock, A., 2008: Whither Geoengineering. *Science*, **320**, 1166-1167.
Rojas, A.F., 2009: Human Security: A South American Perspective. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú.O. Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer Berlin Heidelberg, Berlin, pp. 1077-1086.
Roncoli, C., B.S. Orlove, M.R. Kabugo, and M.M. Waiswa, 2011: Cultural styles of participation in farmers' discussions of seasonal climate forecasts in Uganda. *Agriculture and Human Values*, **28(1)**, 123-138.
Roncoli, C., 2006: Ethnographic and participatory approaches to research on farmers' responses to climate predictions. *Climate Research*, **33(1)**, 81-99.
Roncoli, C., C. Jost, P. Kirshen, M. Sanon, K. Ingram, M. Woodin, L. Somé, F. Ouattara, B. Sanfo, C. Sia, P. Yaka, and G. Hoogenboom, 2009: From accessing to assessing forecasts: an end-to-end study of participatory climate forecast dissemination in Burkina Faso (West Africa). *Climatic Change*, **92(3-4)**, 433-460.
Rosenzweig, C., W.D. Solecki, S.A. Hammer, and S. Mehrotra (eds.), 2011: *Climate Change and cities.* Cambridge University Press, Cambridge, .
Rotton, J. and E.G. Cohn, 2001: Temperature, routine activities, and domestic violence: A reanalysis. *Violence and Victims*, **16(2)**, 203-215.
Rowhani, P., O. Degomme, D. Guha-Sapir, and E.F. Lambin, 2011: Malnutrition and conflict in East Africa: the impacts of resource variability on human security. *Climatic Change*, **105(1)**, 207-222.
Rudiak-Gould, P., 2012: Promiscuous corroboration and climate change translation: A case study from the Marshall Islands. *Global Environmental Change*, **22(1)**, 46-54.
Rybråten, S. and G.K. Hovelsrud, 2010: Local Effects of Global Climate Change: Differential Experiences of Sheep Farmers and Reindeer Herders in Unjarga/Nesseby, a Coastal Sámi Community in Northern Norway. In: *Community Adaptation and Vulnerability in Arctic Communities.* [Hovelsrud, G.K. and B. Smit(eds.)]. Springer, Berlin, pp. 313-333.
Sabur, A.K.M.A., 2009: Theoretical Perspective on Human Security: A South Asian View. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú.O. Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer, Berlin, pp. 1003-1011.
Sadoff, C. and D. Grey, 2002: Beyond the River: The Benefits of Cooperation on International Rivers. *Water Policy*, **5(4)**, 389-404.
Saldana-Zorrilla, S.O., 2008: Stakeholders' views in reducing rural vulnerability to natural disasters in Southern Mexico: Hazard exposure and coping and adaptive capacity. *Global Environmental Change*, **18(4)**, 583-597.
Salick, J. and N. Ross, 2009: Traditional peoples and climate change. *Global Environmental Change*, **19(2)**, 137-139.
Sánchez-Cortés, M. and E. Chavero, 2011: Indigenous perception of changes in climate variability and its relationship with agriculture in a Zoque community of Chiapas, Mexico. *Climatic Change*, **107(3-4)**, 363-389.
Scheffran, J. and A. Battaglini, 2011: Climate and conflicts: the security risks of global warming. *Regional Environmental Change*, **11**, 27-39.
Scheffran, J., M. Brzoska, H.G. Brauch, P.M. Link, and J. Schilling (eds.), 2012a: *Climate change, human security and violent conflict: challenges for societal stability.* Springer, Berlin.
Scheffran, J., M. Brzoska, J. Kominek, P.M. Link, and J. Schilling, 2012b: Disentangling the Climate-conflict Nexus: Empirical and Theoretical Assessment of Vulnerabilities and Pathways. *Review of European Studies*, **4(5)**, 1-13.
Scheffran, J., M. Brzoska, J. Kominek, P.M. Link, and J. Schilling, 2012c: Climate change and violent conflict. *Science*, **336(6083)**, 869-871.
Schlenker, W. and D.B. Lobell, 2010: Robust negative impacts of climate change on African agriculture. *Environmental Research Letters*, **5(1)**, 014010.
Schroeder, H., 2010: Agency in international climate negotiations: the case of indigenous peoples and avoided deforestation. *International Environmental Agreements: Politics, Law and Economics*, **10(4)**, 317-332.
Seixas, C.S. and F. Berkes, 2003: Dynamics of social-ecological changes in a lagoon fishery in southern Brazil. In: *Navigating social–ecological systems: building resilience for complexity and change.* [Berkes, F., J. Colding, and C. Folke(eds.)]. Cambridge University Press, Cambridge, pp. 271-298.
Selin, H. and N.E. Selin, 2008: Indigenous Peoples in International Environmental Cooperation: Arctic Management of Hazardous Substances. *Review of European Community & International Environmental Law*, **17(1)**, 72-83.

Serrano Oswald, Eréndira, S. , H.G. Brauch, and U. Oswald Spring, 2013: Teorías sobre migración. In: *Vulnerabilidad social y migración ambiental rural en México.* [Oswald Spring, U. (ed.)]. CRIM-UNAM, Cuernavaca, México, .

Serrano Oswald, S.E., 2013: Migration, Woodcarving, and Engendered Identities in San Martín Tilcajete, Oaxaca, Mexico. In: *Migration, Gender, Social Justice, and Human Insecurity*. [Truong, T.-D., Bergh, S.I., Gasper, D. and Handmaker, J. (eds.)] Springer, Berlin, pp.173-192.

Seto, K.C., 2011: Exploring the dynamics of migration to mega-delta cities in Asia and Africa: Contemporary drivers and future scenarios. *Global Environmental Change*, **21(Supp 1)**, S94-S107.

Shah, A. and O.G. Sajitha, 2009: Dwindling forest resources and economic vulnerability among tribal communities in a dry/ sub-humid region in India. *Journal of International Development*, **21(3)**, 419-432.

Shen, S. and F. Gemenne, 2011: Contrasted views on environmental change and migration: the case of Tuvaluan migration to New Zealand. *International Migration*, **49(s1)**, e224-e242.

Shomar, B., 2011: Water scenarios in the Gaza Strip, Palestine: thirst, hunger and disease. *International Journal of Environmental Studies*, **68(4)**, 477-493.

Singleton S, 2000: Cooperation or capture? The paradox of co-management and community participation in natural resource management and environmental policy-making. *Environmental Politics*, **9(2)**, 1-21.

Siurua, H. and J. Swift, 2002: Drought and Zud but No Famine (Yet) in the Mongolian Herding Economy. *IDS Bulletin*, **33(4)**, 88-97.

Skoulikidis, N.T., 2009: The environmental state of rivers in the Balkans—a review within the DPSIR framework. *Science of the Total Environment*, **407(8)**, 2501-2516.

Slade, N., 2007: Climate Change: The human rights implications for small island developing states. *Environmental Policy and Law*, **37**, 215-219.

Slettebak, R.T., 2012: Don't blame the weather! Climate-related natural disasters and civil conflict. *Journal of Peace Research*, **49(1)**, 163-176.

Smit, B., G.K. Hovelsrud, J. Wandel, and M. Andrachuk, 2010: Introduction to the CAVIAR Project and Framework Community Adaptation and Vulnerability in Arctic Regions. In: [Hovelsrud, G.K. and B. Smit(eds.)]. Springer, Berlin, pp. 1-22.

Smith, P.J., 2011: The geopolitics of climate change: power transitions, conflict and the future of military activities. *Conflict, Security and Development*, **11(3)**, 309-334.

Smith, C., M. Nagarajan, K. Warner, and T. Afifi, 2013: Modeling migration futures in Tanzania: Development and testing of the Rainfalls Agent-Based Migration Model. *Climate and Development*, Submitted. Available from the authors at UNU-EHS.

Socolow, R.H. and A. Glaser, 2009: Balancing risks: nuclear energy & climate change. *Daedalus*, **138(4)**, 31-44.

Stadel, C., 2008: Resilience and adaptations of rural communities and agricultural land use in the tropical Andes: Coping with environmental and socio-economic changes. *Pirineos*, **163(0)**, 15-36.

Stephenson, S.R., L.C. Smith, and J.A. Agnew, 2011: Divergent long-term trajectories of human access to the Arctic. *Nature Climate Change*, **1(3)**, 156-160.

Stern, N., 2007: *The economics of climate change: the Stern review*. Cambridge University Press, Cambridge, .

Stevens, K., L. Campbell, G. Urquhart, D. Kramer, and J. Qi, 2011: Examining complexities of forest cover change during armed conflict on Nicaragua's Atlantic Coast. *Biodiversity and Conservation*, **20(12)**, 2597-2613.

Stewart, F. and V. Fitzgerald (eds.), 2001: *War and underdevelopment: volume 1, the economic and social consequences of conflict*. Oxford University Press, Oxford, .

Stewart, F., C. Huang, and M. Wang, 2001: Internal wars in developing countries: An empirical overview of economic and social consequences. In: *War and underdevelopment: volume 1, the economic and social consequences of conflict*. [Stewart, F. and V. Fitzgerald(eds.)]. Oxford University Press, Oxford, pp. 67-103.

Strauss, S., 2009: Global models, local risks: responding to climate change in the Swiss alps. In: *Anthropology and climate change : from encounters to actions.* [Crate, S.A. and M. Nuttall(eds.)]. Left Coast Press, Walnut Creek, CA, pp. 166-174.

Strauss, S., 2012: Are cultures endangered by climate change? Yes, but…. *Wiley Interdisciplinary Reviews: Climate Change*, **3(4)**, 371-377.

Suarez, P., W. Anderson, V. Mahal, and T.R. Lakshman, 2005: Impacts of flooding and climate change on urban transportation: A system wide performance assessment of the Boston Metro Area. *Transportation Research Part D: Transport and Environment*, **10(3)**, 231-244.

Sudmeier-Rieux, K., S. Jaquet, M.H. Derron, M. Jaboyedoff, and S. Devkota, 2012: A case study of coping strategies and landslides in two villages of Central-Eastern Nepal. *Applied Geography*, **32(2)**, 680-690.
Sunga, L.S., 2011: Does climate change kill people in Darfur? *Journal of Human Rights and the Environment*, **2(1)**, 64-85.
Tabara, D., Saurí D, and Cerdan R, 2003: Forest Fire Risk Management and Public Participation in Changing Socioenvironmental Conditions: A Case Study in a Mediterranean Region. *Risk Analysis*, **23(2)**, 249-260.
Tacoli, C., 2009: Crisis or adaptation? Migration and climate change in a context of high mobility. *Environment and Urbanization*, **21(2)**, 513-525.
Tang, K.K., D. Petrie, and D.S.P. Rao, 2009: The income-climate trap of health development: a comparative analysis of African and Non-African countries. *Social Science and Medicine*, **69(7)**, 1099-1106.
Tanner, T. and T. Mitchell, 2008: Entrenchment for enhancement: Could climate change adaptation help to reduce chronic poverty? *IDS Bulletin*, **39(4)**, 6-15.
Terry, G., 2009: *Climate Change and Gender Justice.* Practical Action Publishing, Rugby, .
Theisen, O.M., 2012: Climate clashes? Weather variability, land pressure, and organized violence in Kenya, 1989–2004. *Journal of Peace Research*, **49(1)**, 81-96.
Theisen, O.M., H. Holtermann, and H. Buhaug, 2012: Climate wars? Assessing the claim that drought breeds conflict. *International Security*, **36(3)**, 79-106.
Themnér, L. and P. Wallensteen, 2012: Armed Conflicts, 1946–2011. *Journal of Peace Research*, **49(4)**, 565-575.
Tignino, M., 2011: The right to water and sanitation in post-conflict peacebuilding. *Water International*, **36(2)**, 242-249.
Tingley D, Ásmundsson J, Borodzicz E, Conides A, Drakeford B, Rúnar Eðvarðsson I, Holm D, Kapiris K, Kuikka S, and Mortensen B, 2010: Risk identification and perception in the fisheries sector: Comparisons between the Faroes, Greece, Iceland and UK. *Marine Policy*, **34(6)**, 1249-1260.
Tir, J. and D.M. Stinnett, 2012: Weathering climate change: Can institutions mitigate international water conflict? *Journal of Peace Research*, **49(1)**, 211-225.
Tol, R.S.J. and S. Wagner, 2010: Climate change and violent conflict in Europe over the last millennium. *Climatic Change*, **99**, 65-79.
Tolossa, D., 2008: Livelihood transformation from pastoralism to agro-pastoralism as an adaptation strategy among the Urrane of north-eastern Ethiopia. *Quarterly Journal of International Agriculture.*, **2**, 145-165.
Tompkins, E.L., L.A. Hurlston, and W. Poortinga, 2009: Foreignness as a constraint on learning: The impact of migrants on disaster resilience in small islands. *Environmental Hazards*, **8(4)**, 263-277.
Trombetta, M.J., 2012: Climate Change and the Environmental Conflict Discourse. In: *Climate Change, Human Security and Violent Conflict.* [Scheffran, J., M. Brzoska, H.G. Brauch, P.M. Link, and J. Schilling(eds.)]. Springer, Berlin, pp. 151-164.
Trotman, A., R.M. Gordon, S.D. Hutchinson, R. Singh, and D. McRae-Smith, 2009: Policy responses to global environmental change impacts on food availability and affordability in the Caribbean community. *Environmental Science and Policy*, **12(4)**, 529-541.
Tunstall, S., S. Tapsell, C. Green, P. Floyd, and C. George, 2006: The health effects of flooding: social research results from England and Wales. *Journal of Water and Health*, **4**, 365-380.
Turner, N.J. and H. Clifton, 2009: "It's so different today": Climate change and indigenous lifeways in British Columbia, Canada. *Global Environmental Change*, **19(2)**, 180-190.
Tyler, N.J.C., J.M. Turi, M.A. Sundset, K. StrÃ¸m Bull, M.N. Sara, E. Reinert, N. Oskal, C. Nellemann, J.J. McCarthy, S.D. Mathiesen, M.L. Martello, O.H. Magga, G.K. Hovelsrud, I. Hanssen-Bauer, N.I. Eira, I.M.G. Eira, and R.W. Corell, 2007: Saami reindeer pastoralism under climate change: Applying a generalized framework for vulnerability studies to a sub-arctic social-ecological system. *Global Environmental Change*, **17(2)**, 191-206.
UN Habitat, 2011: *Cities and Climate Change: Global report on Human Settlements 2011.* . United Nations Human Settlements Programme of the United Nations, Earthscan., London.
United Nations Development Programme, 1994: *Human Development Report 1994.* In: New Dimensions of Human Security. Oxford University Press, New York.
United Nations Development Programme, 2007: *Human Development Report 2007/2008: Fighting climate change: Human solidarity in a divided world.* Palgrave Macmillan, New York.
United Nations Development Programme, 2009: *Human Development Report 2009: Overcoming barriers: Human mobility and devlopment.* Palgrave Macmillan, New York.

Unruh, J.D., 2012: The interaction between landmine clearance and land rights in Angola: A volatile outcome of non-integrated peacebuilding. *Habitat International*, **36(1)**, 117-125.
Upton, C., 2011: Managing Mongolia's Commons: Land Reforms, Social Contexts, and Institutional Change. *Society & Natural Resources*, **25(2)**, 156-175.
Valdivia C, Seth A, Gilles J, García M, Jiménez El, Cusicanqui J, Navia F, and Yucra E, 2010: Adapting to Climate Change in Andean Ecosystems: Landscapes, Capitals, and Perceptions Shaping Rural Livelihood Strategies and Linking Knowledge Systems. *Annals of the Association of American Geographers*, **100(4)**, 818-834.
Van de Noort, R., 2011: Conceptualising climate change archaeology. *Antiquity*, **85**, 1039-1048.
van der Geest, K., 2011: North-south migration in Ghana: What role for the environment? *International Migration*, **49(S1)**, 69-94.
Verhoeven, H., 2011: Climate Change, Conflict and Development in Sudan: Global Neo-Malthusian Narratives and Local Power Struggles. *Development and Change*, **42(3)**, 679-707.
Vermeulen, S. and L. Cotula, 2010: Over the heads of local people: consultation, consent, and recompense in large-scale land deals for biofuels projects in Africa. *Journal of Peasant Studies*, **37(4)**, 899-916.
Villagrán de León, J.C., 2009: Risks in Central America: Bringing Them Under Control. In: *Coping with Global Environmental Change, Disasters and Security – Threats, Challenges, Vulnerabilities and Risks*. [Brauch, H.G., Ú. Oswald Spring, C. Mesjasz, J. Grin, P. Kameri-Mbote, B. Chourou *et al.*(eds.)]. Springer, Berlin, pp. 1147-1158.
Vogel, C., S.C. Moser, R.E. Kasperson, and G.D. Dabelko, 2007: Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global Environmental Change*, **17(3–4)**, 349-364.
Von Storch, H., G. Gönnert, and M. Meine, 2008: Storm surges-an option for Hamburg, Germany, to mitigate expected future aggravation of risk. *Environmental Science and Policy*, **11(8)**, 735-742.
Vuille, M., Francou, B., Wagnon, P., Juen, I., Kaser, G., Mark, B.G. and Bradley, R.S. 2008: Climate change and tropical Andean glaciers: Past, present and future. *Earth Science Reviews*, **89**, 79-96.
Wang, M.Z., M. Amati, and F. Thomalla, 2012: Understanding the vulnerability of migrants in Shanghai to typhoons. *Natural Hazards*, **60(3)**, 1189-1210.
Warner, K., 2010: Global environmental change and migration: Governance challenges. *Global Environmental Change*, **20(3)**, 402-413.
Warner, K., M. Hamza, A. Oliver-Smith, F. Renaud, and A. Julca, 2010: Climate change, environmental degradation and migration. *Natural Hazards*, **55(3)**, 689-715.
Webersik, C., 2010: *Climate Change and Security: A Gathering Storm of Global Challenges.* Prager, Santa Barbara, .
Weede, E., 2004: On Political Violence and its Avoidance. *Acta Politica*, **39(2)**, 152-178.
Wenzel, G.W., 2009: Canadian Inuit subsistence and ecological instability- if the climate changes, must the Inuit? *Polar Research*, **28(1)**, 89-99.
West, C.T., C. Roncoli, and F. Ouattara, 2008: Local perceptions and regional climate trends on the Central Plateau of Burkina Faso. *Land Degradation and Development*, **19(3)**, 289-304.
West, J.J. and G.K. Hovelsrud, 2010: Cross-scale adaptation challenges in the coastal fisheries: Findings from Lebesby, Northern Norway. *Arctic*, **63(3)**, 338-354.
White, G., 2011a: *Climate change and migration: security and borders in a warming world.* Oxford University Press, Oxford, .
White, S., 2011b: *The climate of rebellion in the early modern Ottoman Empire.* Cambridge University Press, New York, .
Williams, A., 2008: Turning the tide: Recognizing climate change refugees in international law. *Law and Policy*, **30(4)**, 502-529.
Williams, J., 2012: The impact of climate change on indigenous people – the implications for the cultural, spiritual, economic and legal rights of indigenous people. *International Journal of Human Rights*, **16(4)**, 648-688.
Wisner, B., 2001: Risk and the Neoliberal State: Why Post-Mitch Lessons Didn't Reduce El Salvador's Earthquake Losses. *Disasters*, **25(3)**, 251-268.
Wittrock, V., S.N. Kulshreshtha, and E. Wheaton, 2011: Canadian prairie rural communities: Their vulnerabilities and adaptive capacities to drought. *Mitigation and Adaptation Strategies for Global Change*, **16(3)**, 267-290.
Wolf, A.T., S.B. Yoffe, and M. Giordano, 2003: International waters: Identifying basins at risk. *Water Policy*, **5(1)**, 29-60.

Wolf, A.T., 2007: Shared waters: conflict and cooperation. *Annual Review of Environment and Resources,* **32**, 241-269.

World Bank, 2010: *World Development Report 2010: Development and Climate Change.* World Bank, Washington DC.

Wun'Gaeo, S., 2009: Environment as an Element of Human Security in Southeast Asia: Case Study on the Thai Tsunami. In: *Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts.* [Brauch, H.G., Ú. Oswald Spring, J. Grin, C. Mesjasz, P. Kameri-Mbote, N.C. Behera *et al.*(eds.)]. Springer, Berlin, pp. 1131-1142.

Yamamoto, L. and M. Esteban, 2010: Vanishing island states and sovereignty. *Ocean & Coastal Management,* **53(1)**, 1-9.

Young, O.R., 2009: Whither the Arctic? Conflict or cooperation in the circumpolar north. *Polar Record*, **45**, 73-82.

Young, O.R., 2012: Arctic Tipping Points: Governance in Turbulent Times. *Ambio*, **41(1)**, 75-84.

Zamani, G.H., M. Gorgievski-Duijvesteijn, and K. Zarafshani, 2006: Coping with Drought: Towards a Multilevel Understanding Based on Conservation of Resources Theory. *Human Ecology*, **34(5)**, 677-692.

Zeitoun, M. and J. Warner, 2006: Hydro-hegemony: A Framework for Analysis of Transboundary Water Conflicts. *Water Policy,* **8(5)**, 435-460.

Zeitoun, M. and N. Mirumachi, 2008: Transboundary Water International I: Reconsidering Conflict and Cooperation. *International Environmental Agreements: Politics, Law and Economics,* **8**, 297-316.

Zeitoun, M., T. Allan, N. Al Aulaqi, A. Jabarin, and H. Laamrani, 2012: Water demand management in Yemen and Jordan: addressing power and interests. *Geographical Journal*, **178(1)**, 54-66.

Zhang, D.D., H.F. Lee, C. Wang, B. Li, Q. Pei, J. Zhang, and Y. An, 2011: The causality analysis of climate change and large-scale human crisis. *Proceedings of the National Academy of Sciences,* **108(42)**, 17296-17301.

Table 12-1: Observed and projected impacts of climate variability and change on basic needs and livelihoods, and their role in undermining human security.

Dimensions of impacts		**Evidence from observations**	**Projections**
Deprivation of immediate basic needs	**Livelihood assets**	• Agricultural households faced with droughts have been observed to engage in environmentally destructive activities, such as reducing fallows, and increasing charcoal and timber production in Tanzania (Paavola 2008) • Household assets such as livestock may be disposed in times of crop failures: for example in the 1999/2000 drought in Ethiopia and the 1999-2004 drought in Afghanistan (Carter et al. 2007; de Weijer 2007). • Riverbank erosion associated with changed hydrological regimes causes loss of agricultural land (Paul and Routray, 2010). • Flooding is another source of crop failure	• Climate volatility is expected to increase with associated impacts on staple grains and an increase in poverty (Ahmed et al, 2009). • Changes in the viability of crops used to feed livestock will have an impact on the poor. In some locations maize yields are projected to decline substantially (Jones and Thornton, 2003). • Riverbanks may be further destabilized by environmental change and human interventions (Le et al, 2007) •
	Water stress and scarcity	• Glaciers and ice caps melts continue to affect water catchments downstream, leading to water stress and scarcity. • Example: glacial retreat of Mount Kilimanjaro is expected to bring acute problem of water scarcity particularly in the arid and semi-Arid regions of Africa (Kumssa and Jones 2011). • Glacier recession in the Cordillera Blanca in Peru is altering the hydrological regime with implications for local livelihoods and water availability in the arid coastal zone (Mark et al, 2010;	• Insecurity of water supply associated with climate change threatens the achievement of Millennium Development Goals to reduce the number people without sustainable access to safe drinking water (Hadipuro 2007). • The reduction in glacier extent and the associated loss of hydrological buffer is expected to increase (Vuille, 2008)
	Destruction of homes and properties	• Floods and related climate shocks destroy shelter and properties and curtail people's ability to meet basic needs. • Examples: A flood in Fiji (2009) brought economic losses of F$24 million affecting at least 25% of farm households (Lal 2010). • Sea level rise and increased frequency of extreme events rise the risk of loss of lives, homes, and properties and damages infrastructure and transport systems (Adrianto and Matsuda, 2002; Suarez et al. 2005; Philips and Jones 2006; Ashton et al. 2008; Von Storch et al. 2008).	• In the Netherlands, the total amount of urban area that can potentially be flooded has increased six-fold during the 20th century and may double again during the 21st century (de Moel et al., 2011). • In England and Wales, projected changes in flood risk mean economic damages may increase up to 20 times by the 2080s (Hall et al. 2003).

Erosion of livelihood and human capabilities	**Agriculture and food security**	• Interaction of climate change with poverty and other political, social, institutional and environmental factors adversely affects agriculture production and exacerbates the problem of food insecurity (Downing 2002; Trotman et al. 2009; Saldana-Zorrilla 2008; Kumssa and Jones 2011). • Examples: most of the studies focus in Africa, due to its dependence on rain-fed agriculture (Kumssa and Jones 2011; in Kenya, Oluoko-Odingo 2011; in Southern Africa, Drimie and Gillespie 2010; in Zimbabwe and Zambia (Mubaya et al. 2012).	• Studies of African agriculture using various climate scenarios indicate that increasing temperature and rainfall variation have serious impacts on crops and livestock production that are likely to lead to increased poverty, vulnerability and loss of livelihoods. • Examples: Ethiopia (Deressa and Hassan 2009); Kenya (Kabubo-Mariara 2009); Burkina Faso, Egypt, Kenya and South Africa (Molua et al. 2010); and sub-Saharan Africa (Jones and Thornton 2009). • Livelihood insecurity among small-scale rain-fed maize farmers in Mexico is predicted due to potential loss of traditional seed sources (Bellona et al. 2011).
	Human capital	Health: • Food shortage, absence of safe and reliable access to clean water and good sanitary conditions, and destruction of shelters and displacements, all have negative bearing on human health (Costello et al. 2009) • Poor nutrition combined with mental health conditions after a disaster can lead in the long run to erosion of human capability (Costello et al. 2009)	Health: • A comparative analysis of African and non-African countries using an 'income-climate trap model' that explains the multi-directional interaction between income, climate and life expectancy, reveals that climate is important in determining both life expectancy and income. • Climate change is likely to worsen localized conditions that could see many less developed countries, particularly from Africa, sinking deeper into an income-climate trap of underdevelopment in health (Tang et al. 2009). • Analysis of the economic and climatic impacts of three emission scenarios and three tax scenarios, estimates the impacts on food productivity and malaria infection to be very severe in some Asian countries (Kainuma et al. 2004).
		Education: • Droughts and floods can intensify the pressure to transfer children to the labour market (Ethiopia and Malawi, UNDP 2007). • - Indian women born during a drought or flood in the 1970s were 19 percent less likely to ever attend primary school, when compared with women of the same age who were not affected by natural disasters (UNDP 2007).	Loss of lives: • Studies of the impacts of future floods using a combination of socio-economic and climate change scenarios for developed countries predict an increase in fatalities. • Example: In the Netherlands, sea level rise combined with other factors potentially increases the number of fatalities four times (Maaskant et al. 2009)

Table 12-2: Cultural dimensions of human security in the context of climate change.

Core climate change dimensions	**Cultural dimensions**	**Role in shaping HS (facilitating - hindering adaptation, action, response)**	**References**
Climate science and policy	Framing of climate change in a dominant language (English) Global climate change policy developments	How concepts and uncertainties are translated, imported and incorporated facilitate or hinder adaptation; Available explanatory tools facilitates adaptation; Successful translation of climate change impacts facilitates adaptation; Lack of trust in science and in policy hinder adaptation; Policy and decision-making that is inclusive of cultural perspectives increases security; Policy not recognizing the connection between nature and culture hinders adaptation; Awareness of culture facilitates adaptation	Ifejika Speranza *et al.*, 2008; Stadel, 2008; Jacka, 2009; Bogale and Korf, 2009; Green, *et* al., 2010; Burch, 2010; Schroeder, 2010; Osbahr *et al.*, 2010; McNeely, 2011; Gero *et al.*, 2011; Sánchez-Cortés and Chavero, 2011; Roncoli, et al, 2011; Kuruppu and Liverman, 2011; Rudiak-Gould 2012
Impacts of environmental conditions and extreme events and changing natural resource base	Elements of cosmology such as: World views Coupling of nature-culture Power relations Heterogeneity within groups and communities	New technologies may facilitate adaptation; Livelihood diversification and flexibility facilitate adaptation; Limitations of local knowledge hinder adaptation; Narratives and history about past changes and current conditions may drive adaptation; Erosion of cultural core may decrease human security; Institutional responses and resource management will impact human security; Co-management of resources increases adaptive capacity; Lack of awareness and understanding of culture constrains action and hinders adaptation; Knowledge and cultural repertoire limited for responding to new challenges will hinder adaptation; Perceptions of resilience may hinder or facilitate adaptation;	Nunn, 2000; Seixas and Berkes, 2003; Davidson *et al.*, 2003; Desta and Coppock, 2004; Herbert, 2005; Zamani *et al*., 2006; Ford *et al.*, 2006, 2008; Crona, 2006; Aguilar *et al.*, 2009; Kuruppu and Liverman 2011, Rudiak-Gould, 2012; Roncoli *et al*., 2011; Gearheard *et al*., 2010; Hovelsrud and Smit, 2010; Nyong *et al.*, 2007; Tyler *et al.*, 2007; Angassa and Oba, 2008; Osbahr *et al.*, 2010; Lefale, 2010 Crate, 2008; Gregory and Trousdale, 2009; Harries and Penning-Rowsell, 2011; Gero *et al.*, 2011; Fazey *et al.*, 2010; Furgal and Seguin, 2006; Sudmeier-Riuex *et al.*, 2012; Anik and Khan, 2012; Kuhlicke, 2010; Valdivia *et al.*, 2010; Kesavan and Swaminathan, 2006; Jacka, 2009; Pearce *et al.*, 2010; Adler, *et al*., 2012; Gómez-Baggethun *et al*., 2012; Burningham *et al.*, 2008; West and Hovelsrud, 2010; Nursey-Bray *et al*., 2012; Armitage *et al.*, 2011; Dumaru, 2010; King, 2008; Nielsen and Reenberg, 2010; Onta and Resurrection, 2011; de Sherbinin *et al.*, 2008; Kalikoski *et al.*, 2010; Hovelsrud *et al.*, 2010a,b; Rybråten and Hovelsrud, 2010; McNeeley, 2011; Marshall 2011; Berkes and Armitage, 2010; Ford and Goldhar, 2012; Eakin *et al*., 2012;
Scientific observations monitoring, models, projections, scenarios	Local, traditional and indigenous knowledge through observations and experience	Mutual integration of traditional, local and scientific knowledge may facilitate adaptation and strengthen human security; Climate projections with local relevance will facilitate adaptation; Knowledge included in climate policy and decision making decreases risks and increases human security: Intergenerational knowledge transfers facilitate adaptation; Knowledge not included in adaptation planning decreases human security	Orlove *et al.*, 2000, 2010; Ingram *et al.*, 2002; Tàbara *et al.*, 2003; Alcántara-Ayala et al., 2004; Gearheard *et al*., 2010; Roncoli, 2006; Forbes, 2007; Anderson *et al.*, 2007; Vogel *et al.*, 2007; Nyong *et al.*, 2007; Tyler *et al.*, 2007; Catto and Parewick, 2008; Frazier *et al.*, 2010; Marfai *et al.*, 2008; Mercer *et al.*, 2009; Pearce *et al.*, 2009; Marin, 2010; Mark *et al.*, 2010; Smit et al 2010; Burns *et al.*, 2010; Hovelsrud and Smit, 2010; Kalanda-Joshua et al., 2011; Flint *et al*., 2011; Ravera *et al.*, 2011; Sánchez-Cortés and Chavero, 2011; Huntington, 2011; Eira *et al.*, 2013.

Table 12-3: Empirical evidence on observed or projected mobility outcomes (migration, immobility, or displacement) associated with weather-related extremes or impacts of longer-term climate change.

	Drought and land degradation
Evidence for increasing migration, mobility or increased displacement.	↑ Ethiopia: Outmigration of household heads due to drought related famine, although different coping strategies lead to variations in the timing of migration (Meze-Hausken, 2000). ↑ Mexico: Increased propensity to migrate to the United States related to years with negative crop productivity (Feng et al., 2010) ↑ Western Sahara: Droughts play a crucial role in patterns of international migration from refugee camps (Gila et al., 2011). ↑ Kenya: Households farming high quality soil are less likely to migrate, especially temporary labour migration (Gray, 2011). ↑ India: Temporary migration identified as 'the most important' coping strategy in times of drought in rural villages (Jülich, 2011). ↑ Burkina Faso: Simulations of dry climate scenario produces increased migration fluxes compared to wet scenarios. Highest international migrant flows are shown with the dry climate scenarios (Kniveton et al., 2011). ↑ Canada: Higher population loss associated with settlements containing areas of poorer quality agricultural soils during droughts of 1930s (McLeman and Ploeger 2011). ↑ Guatemala: Outmigration was commonly attributed to soil degradation, resulting in migration to the expanding agricultural frontiers by open forests (López-Carr, 2012). ↑ Sahel: In three case regions, the pressure to migrate significantly increased since the 1970s possibly as a response to the onset of the persistent droughts. (Scheffran et al., 2012b; 2012c).
Evidence for decreased migration, mobility or significantly trapped populations.	↓ Mali: Reduced international migration during 1980s drought and an increase in cyclical migration (Findley, 1994). ↓ Nepal: Deforestation, population pressure and agricultural decline leads to local mobility, especially among women, but no increases in internal or international migration (Massey et al., 2010; Bohra-Mishra and Massey, 2011) ↓ Uganda: High soil quality marginally increases migration, especially permanent non-labor migration. (Gray, 2011).
Evidence for socially-differentiated mobility outcomes.	⇅ Burkina Faso: Land degradation is associated with less first time migration, but more migration for previous migrants. Land degradation greater influence on migration than rainfall variability (Henry et al., 2004). ⇅ Burkina Faso: Drier region populations more likely to migrate than people from regions with more rainfall. Rainfall deficits have different impacts depending on the duration and distance of the migration (Henry et al., 2004). ⇅ United States: Dustbowl migrants from Oklahoma to California in the 1930s had different social and economic capital endowments to those who stayed within state (McLeman and Smit, 2006). ⇅ Ecuador: Influence of natural capital on migration differed between men and women. Access to land facilitates migration in men; women are less likely to migrate from environmentally degraded areas (Gray, 2010). ⇅ Ethiopia: Male migration increases with drought. However, marriage related moves by women decrease with drought. (Gray and Mueller, 2012). ⇅ Burkina Faso: Labour migration became a key off-farm livelihood strategy after droughts in the 1970s for those groups dependent on rain-fed agriculture. However, those with large cattle herds relied on livestock sales as a coping strategy with negative implications for future resilience (Nielsen and Reenberg, 2010). ⇅ Mongolia: Diversity in herders' mobility strategies to mobility in response to climate change. For a minority, responses entailed greater overall annual mobility. Other herding households experienced significant reductions in mobility (Upton, 2012). ⇅ Tanzania: Agent based models concluded the normalised rate of need-driven migration was greatest under extreme drying, whereas aspirational migration was less sensitive to changes in rainfall (Smith et al., 2013).

	Flooding	
Evidence for increasing migration, mobility or increased displacement.	↑	USA: counties and parishes in Louisiana of the 77 impacted counties experienced 82% of the total population increase in the year following Hurricane Katrina (Frey and Singer, 2006).
	↑	Vietnam: Cumulative impacts of seasonal flooding increases outmigration rates in the Mekong Delta (Dun, 2011).
	↑	Bangladesh: 22% of households affected by tidal-surge floods, and 16% affected by riverbank erosion, moved to urban areas. (Penning-Rowsell et al., 2013).
Evidence for decreased migration, mobility or significantly trapped populations.	↓	Bangladesh: No out-migration detected after 2004 tornado in Bangladesh as a result of the effective distribution of disaster aid (Paul, 2005).
	↓	Senegal: Over 40 percent of new migrant populations located in high risk flood zones in Dakar (Quoted in Black et al., 2011b).
Evidence for socially-differentiated mobility outcomes.	⇅	USA: Emergency evacuation responses and return migration after the event highly differentiated income, race, class and ethnicity (Elliott and Pais, 2006; Falk et al., 2006; Landry et al., 2007).
	⇅	Bangladesh: Wide variation among groups in attitudes and capabilities for migration as an adaptation to the impact of cyclone Aila (Kartiki, 2011)

	Sea level rise	
Evidence for increasing migration, mobility or increased displacement.	↑	United States: Underlying driver of sea level rise caused initial depopulation. Final abandonment was a result of the population falling below levels to support local community services. (Arenstam Gibbons and Nicholls, 2006).
	↑	Vanuatu: Whole village displacement associated with inundation, both from sea level rise and tectonic movement on Torres Islands (Ballu et al., 2011).
	↑	United States: The impact of future sea-level rise will extend beyond the inundated counties through migration networks that link inland and coastal areas and their populations (Curtis and Schneider, 2011).
	↑	Papua New Guinea: Population considering resettlement on Bougainville to the main island due to coastal erosion, land loss, saltwater inundation and food insecurity (Oliver-Smith, 2011).
	↑	United States: Coastal villages in Alaska affected by sea-level rise and coastal erosion. The population as Shishmaref have decided to relocate (Oliver-Smith, 2011; Marino, 2012).
Evidence for decreased migration, mobility or significantly trapped populations.	↓	Tuvalu: On the island of Funafuti, climate change is not a cause for concern nor cited as a reason for migration (Mortreux and Barnett, 2009).

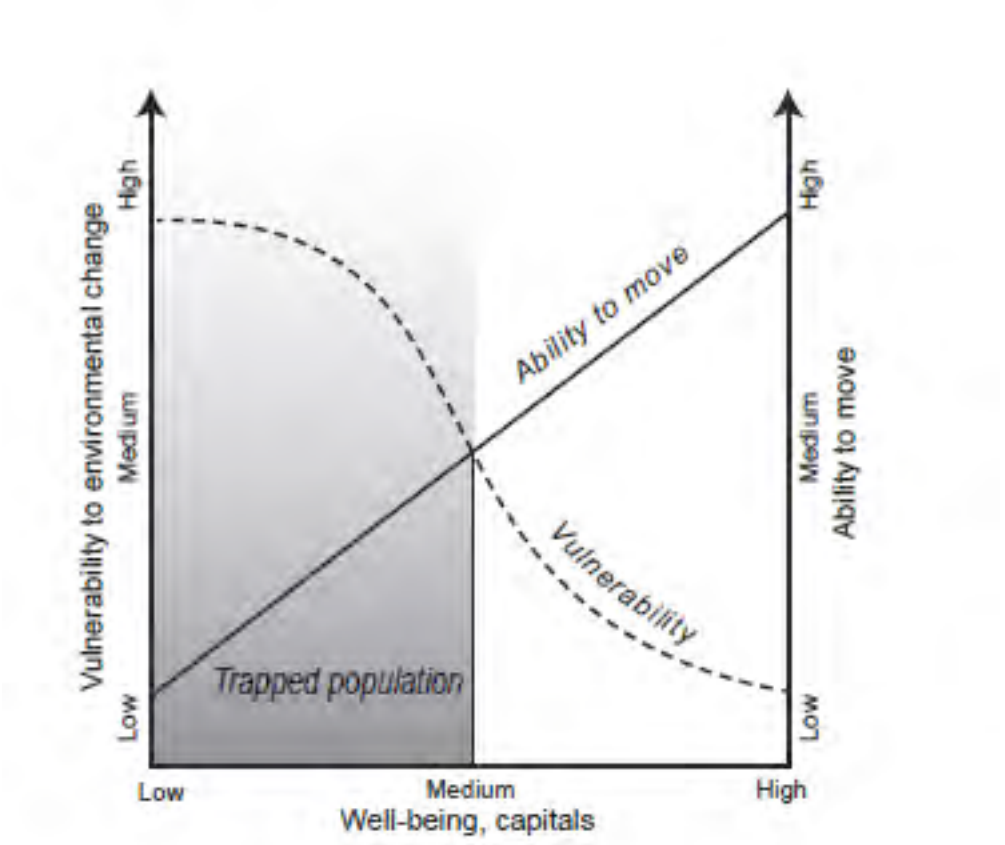

Figure 12-1: Relationship between vulnerability to environmental change and mobility. Lack of mobility and high vulnerability are positively correlated. Adapted from Black et al. (2013).

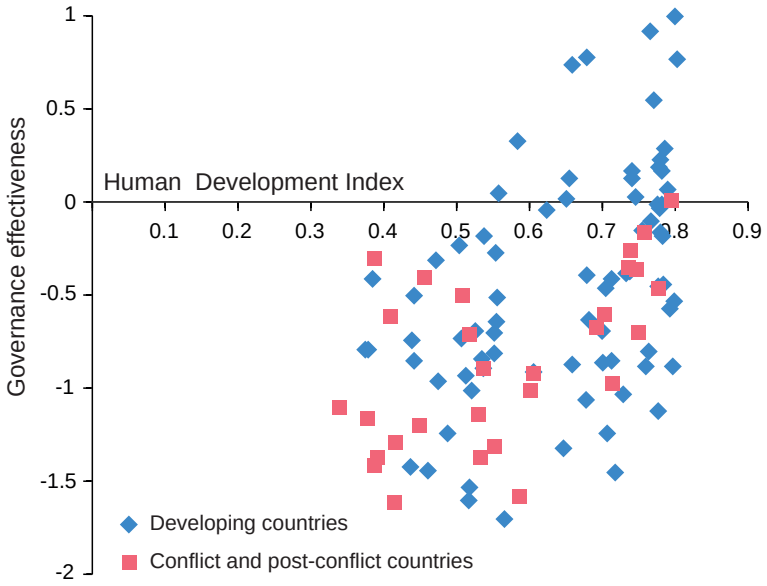

Figure 12-2: Conflict and post-conflict societies exhibit low levels of governance and human development. Source: Adger (2010).

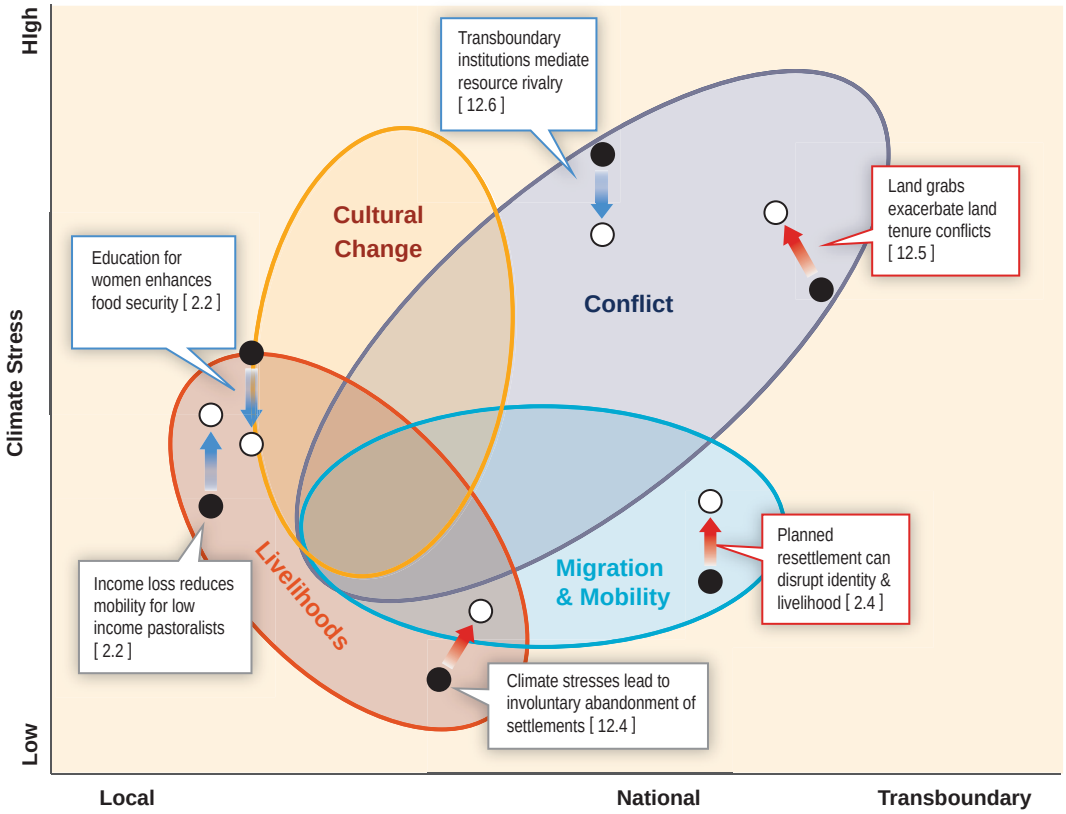

Figure 12-3: Synthesis of evidence on the impacts of climate change on elements of human security and the interactions between elements. Examples of positive and negative changes in security associated with interventions indicated by arrows.