

Chapter 12. Human Security**Coordinating Lead Authors**

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6 12.3: Will climate change cause war between countries?

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10
11 **Executive Summary**

12
13 **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].

21
22 **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.

30
31 **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].

39
40 **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].

48
49 **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

1 enhance human security. Observations of implementation of planned resettlement show that legitimate and inclusive
2 planning processes help alleviate the conflict and insecurity that individuals and communities may experience.
3

4 **Some of the factors that increase the risk of violent conflict including civil wars are sensitive to climate**
5 **change (medium agreement, medium evidence).** The evidence on the direct effect of climate change and
6 variability on violence is contested. Though there is little agreement about causality, there is robust evidence that
7 shows that low per capita incomes, economic contraction, and inconsistent state institutions are associated with the
8 incidence of civil wars. These factors are sensitive to climate change. Climate change policy responses, particularly
9 those associated with changing property rights to land, water and resources, can increase the risk of violent conflict.
10 A range of policies and institutions at multiple scales has been demonstrated to reduce the effects of environmental
11 change on the risk of violent conflict. Economic growth, high per capita incomes, strong democratic institutions,
12 social protection during economic and climate shocks, and robust institutional structures that protect property rights
13 and manage conflict all reduce the risk that climate variability and extremes will lead to violence.
14

15 **People living in places affected by violent conflict are particularly vulnerable to climate change (high**
16 **agreement, modest evidence).** Evidence shows that large-scale violent conflict harms infrastructure, institutions,
17 natural capital, social capital, and livelihood opportunities. Since these assets facilitate adaptation to climate change,
18 there are strong grounds to infer that conflict drives vulnerability to climate change impacts [12.5.2].
19

20 **Climate change will lead to new challenges to states and will shape both conditions of security and national**
21 **security policies (medium agreement, medium evidence).** Physical aspects of climate change, such as sea level
22 rise, extreme events, and hydrologic disruptions, pose major challenges to vital transportation, water, and energy
23 infrastructure [12.6]. Some states are experiencing major challenges to their territorial integrity, including Arctic
24 countries, small island states, and other states highly vulnerable to sea level rise [12.5.4]. Some impacts of climate
25 change, such as changes in sea ice, transboundary and shared water resources, and the migration of pelagic fish
26 stocks, have the potential to increase rivalry among states. There is evidence that the presence of robust institutions
27 can manage many of these rivalries such that human security is not severely eroded [12.6]. These threats to national
28 security will affect the capacity of states and communities to provide human security.
29
30

31 **12.1. Concepts and Evidence**

32 **12.1.1. Human Security in the IPCC Assessment Reports**

33 This chapter assesses the risks climate change poses to individuals and communities, including threats to
34 livelihoods, culture, and political stability. These issues were raised by Working Group II (WGIIAR4) in the Fourth
35 Assessment Report (AR4). That report identified the risk climate change poses to livelihoods (chapters 5, 7, 9 10,
36 16, and 17), cultures and indigenous peoples globally, but this Chapter is the first systematic assessment across the
37 dimensions of human security.
38
39

40 Both WGIIAR4 and the Special Report on Extremes (SREX) noted the risks climate change poses to: water, soil,
41 food, health and individual well-being. Chapter 7 of WGIIAR4 referred to security as a fundamental social goal, and
42 Chapter 11 noted that the risks climate change poses to national security were poorly understood. It was also noted
43 that migration, crises and violent conflicts increase vulnerability to climate change (Chapter 19). Chapters 7, 16 and
44 17 of WGIIAR4 noted that migration has the potential to enhance the adaptive capacity.
45
46

47 New research since AR4 has addressed the linkages between climate change and human security (Matthew et al.,
48 2010; O'Brien et al., 2010; Oswald Spring, 2011; Scheffran et al., 2012a; Gleditsch, 2012). Specific dimensions of
49 human security, such as food security; public health and well-being; livelihoods; and regional perspectives are
50 examined systematically in Chapters 11, 13 and 19, and in chapters 22-29 of this report and this Chapter cross-refers
51 to those assessments.
52
53
54

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 Gao 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.

_____ START BOX 12-1 HERE _____

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).

_____ END BOX 12-1 HERE _____

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

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

4
5 _____ START BOX 12-2 HERE _____

6 7 **Box 12-2. The Nature of Evidence about Climate Change and Human Security**

8
9 Understanding the effects of climate change on human security requires evidence about social and environmental
10 processes across multiple scales and sectors. This process-based evidence is not coherent and contiguous; it comes
11 in different forms, and is collected through a wide array of methods used in different academic disciplines. For
12 example, this Chapter assesses anthropological research where culture influences responses to climate change or
13 may be shaped by climate change; alongside political and economic studies which use data sets to test for
14 correlations between climatic factors and violent conflicts; and historical observations using documentary and
15 archaeological methods. These diverse sources strengthen the robustness of the conclusions for this assessment (Van
16 de Noort, 2011; Nielsen and Reenberg, 2012)

17
18 Research on human security and climate change relies on theories, models and evidence on how climate variability,
19 anthropogenic climate change and environmental risks affect human security. There is some evidence on causal
20 links in empirical studies.

21
22 This Chapter reviews empirical studies from the social sciences using both quantitative and qualitative data,
23 including case studies. Some studies examine the interactions between environmental changes and social outcomes.
24 Few explicitly address climate change and human security links, but some provide evidence of climate change
25 impacts on human security (Ford et al., 2010). Individual case studies often explain causality in given contexts, but
26 their results may not be generalized. Where evidence from multiple comparative case studies agree, generalization is
27 sometimes possible.

28
29 This Chapter also assesses quantitative studies about large social units with correlations among different factors.
30 Correlations alone do not explain causality, although they may test theories of causality. The absence of a
31 correlation does not necessarily disprove a causal theory.

32
33 Given the complexity of the links between climate change and human security; uncertainties in the research on the
34 biophysical dimensions of climate change; and the nature of the social science, highly confident statements about the
35 effects of climate change on human security are not meaningful (Scheffran et al., 2012a). Yet there is robust
36 evidence about many of the links between climate change and human security: in this Chapter the standardized
37 IPCC language of uncertainty is applied to those areas where appropriate.

38
39 _____ END BOX 12-2 HERE _____

40
41 Human security and insecurity are universal issues. In every country there are individuals and groups who are
42 insecure (Mahoney and Pinedo, 2007; Pietsch and McAllister, 2010). Much research suggests that while the impacts
43 of climate change on human security will be experienced most in developing countries, human security is at risk for
44 vulnerable populations everywhere (Naess et al., 2006; Leichenko and O'Brien, 2008; Berrang-Ford et al., 2011;).

45
46 The Chapter also evaluates research on the interaction between the state and human security, suggesting that
47 increased human insecurity may rise with an inability to adapt to climate change, thus creating risks to national
48 security through migration and violent conflicts. The analysis extends to assess how states protect the human
49 security of their citizens. In other words, this chapter examines the security of the state insofar as it affects human
50 security by affecting the ability of states to protect their citizens.

51
52 The framing of climate change as a security issue has been controversial. Some authors suggest that discourses on
53 climate change and national security tend to downplay human security dimensions, and skew mitigation and
54 adaptation responses towards state interests rather than the most vulnerable (Barnett 2007 and 2009; Brauch, 2009;

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

8 **12.2. Economic and Livelihood Dimensions of Human Security at Risk from Climate Change**

10 **12.2.1. Climate Change Impacts on Material Aspects of Livelihood Security**

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

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

33 _____ START BOX 12-3 HERE _____

35 **Box 12-3. Gender Dimensions of Human Insecurity**

37 A growing body of evidence indicates that human insecurity associated with climate variability and change is
 38 differentiated by gender as well as other social factors (Antwi-Agyei et al., 2012; Arora-Jonsson, 2011; Buechler,
 39 2009; Terry, 2009; Ahmed and Fajber, 2009). In many regions of the world, women have less access to financial
 40 resources, land, education, health and other basic rights, and are excluded from decision making processes, making
 41 them less able to cope with and adapt to climate change impacts (Djoudi and Brockhaus, 2011; Demetriades and
 42 Esplen, 2008; Paavola, 2008). Evidence shows how poor women in developing countries are struggling to protect
 43 their lives, homes, assets and livelihoods from weather related hazards . Socially ascribed gender responsibilities for
 44 so-called reproductive work, such as childcare, healthcare and domestic work, including the collection of water and
 45 firewood, is directly affected by impacts of climate change on nutrition, disease burden and water availability
 46 (Denton, 2002).

48 _____ END BOX 12-3 HERE _____

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

1 indicates that climate variability and change disrupts production and income, reduces spending, or alters other
2 common practices of resource-dependent households (Chapter 13). Adverse impacts of climate change on the health
3 and education of children can eventually lead to the erosion of human capability (Costello et al., 2009; UNDP,
4 2007). Similarly, evidence based on projections using various socio-economic and climate change scenarios
5 indicates an increase in economic and health risks, including loss of lives in both less developed and developed
6 countries (Hall et al., 2003; Tang et al., 2009; Kainuma et al., 2004).

7
8 [INSERT TABLE 12-1 HERE

9 Table 12-1: Observed and projected impacts of climate variability and change on basic needs and livelihoods, and
10 their role in undermining human security.]
11

12 13 **12.2.2. Impacts of Adaptation Actions on Livelihood Dimensions of Human Security**

14
15 Established research methods and evaluations of development interventions provide robust evidence on how
16 livelihoods can be secured in the context of external shocks and how opportunities can be enhanced through
17 adaptation. Much of this research comes from development economics and related disciplines (Ellis, 2000; Dercon,
18 2004), and is increasingly applied to climate change adaptation studies. Livelihoods can provide people with
19 opportunity (Chapter 13.2.1) and adaptation options that can be transformed into capabilities and assets (Chapter
20 13.2.1). Adaptation interventions and strategies that have been documented to reduce risks to human security
21 include: 1) diversification of income-generating activities in agricultural and fishing systems (Paavola, 2008; Galvin,
22 2009; Tolossa, 2008; Badjeck et al., 2010; Coulthard, 2008; West and Hovelsrud, 2010); 2) migration for risk-
23 spreading among pastoralists (Galvin, 2009) and fishers (Badjeck et al., 2009; Perry and Sumaila, 2007); 3) the
24 development of insurance systems (Badjeck et al., 2010); and 4) education of women (Boyle et al., 2006,
25 Rammohan and Johar, 2009).

26
27 There is emerging evidence, however, that some adaptation interventions in specific circumstances can decrease
28 human security. For instance, agricultural intensification can initially minimize decline in yield, but may extend
29 household production to marginal and steep lands that can in turn increase soil erosion, nutrient loss or landslides
30 (Deligiannis, 2012).
31

32 33 **12.3. Cultural Dimensions of Human Security**

34 35 **12.3.1. How Culture Interacts with Climate Impacts**

36
37 Culture is analysed in this Chapter as dynamic and encompassing knowledge, worldviews, beliefs, norms, values,
38 social relationships, perceptions of risk, power relations and responses to the world (Crate, 2008; 2011; Heyd, 2008;
39 Roncoli *et al.*, 2009; Strauss, 2009; O'Brien and Wolf, 2010; Tingley *et al.*, 2010; Rudiak-Gould, 2012; Sudmeier-
40 Rieux, 2012). In this definition culture shapes resilience, and drives both adaptive and maladaptive responses
41 (Siurua and Swift, 2002; Pearce *et al.*, 2009; Nielsen and Reenberg, 2010; Petheram *et al.*, 2010; Buikstra *et al.*,
42 2010; Paul and Routray, 2011). This assessment focuses on the dimensions of culture that maintain identity and a
43 sense of belonging, and that carry potential for creating unequal power relations and conflict.
44

45 Climate change is driven by, embedded in, and acts upon culture in myriad ways: consumption and energy use that
46 drives anthropogenic emissions of greenhouse gases, are culturally embedded. And the phenomenon of climate
47 change is perceived through scientific as well as other cultural expressions (Norgaard, 2011). Similarly, there are
48 widely different cultural expressions of weather, risk and the need for adaptation to such hazards (Hulme, 2008;
49 Adger et al., 2013). Since climate change has consequences for people there is high confidence that it also has
50 significant cultural implications (Crate, 2011; Strauss 2012), with knock-on effects for human security.
51

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

1 weather patterns, extreme events, extreme drought and flood cycles, sea level rise, erosion, subsidence, coral
2 bleaching, salinization, species abundance and composition, relocation and increasingly dangerous travel conditions
3 (Oswald Spring *et al.*, 2013). Many of these anthropological studies suggest that further significant changes in the
4 natural resource base upon which many cultures depend, would directly affect the cultural core, worldviews,
5 cosmologies and mythological symbols of indigenous cultures (Crate, 2008; Gregory and Trousdale, 2009; Jacka,
6 2009). Conversely many cultures have adapted to significant societal and environmental changes throughout history
7 and colonial encounters (Nuttall, 2009; Cameron, 2012; Strauss, 2012). Much research in this area concludes that
8 analysis of cultural understanding of environment, risk and social practices increases the explanatory power of
9 models of risk (Ifejika Speranza *et al.*, 2008; Jacka, 2009; Adger *et al.*, 2011).

10
11 A further set of research examines cultural, local and individual perceptions and narratives of risk, resilience and
12 adaptive capacity. It finds mixed results: that culturally embedded perceptions in some cases increase human
13 security and in some cases are negative to human security outcomes by way of facilitating or hindering adaptation
14 (Rudiak-Gould, 2012; Gómez-Baggethun *et al.*, 2012; Burningham *et al.*, 2008; West and Hovelsrud, 2010; Zamani
15 *et al.*, 2006; Nursey-Bray *et al.*, 2012). In scientific studies of how resource-dependent communities articulate
16 climate change, anthropological studies have shown that perception of climate change is often based on how English
17 language terms are translated and understood in the local language (Rudiak-Gould, 2012), and the perception is
18 interpreted through personal lifestories and culture (Kuruppu and Liverman, 2011). Anthropological studies have
19 analysed how the concept of climate change is translated in various cultures and have observed both denial,
20 particularly in situations where religions or cognitive frames do not perceive changing climate (Rudiak-Gould, 2012;
21 Kuruppu and Liverman, 2011; Sánchez-Cortés and Chavero, 2011; Lipset, 2011). This denial of climate change is
22 observed across all societies, and explained by sociological analysis as resulting from paralysis in the face of
23 externally-imposed change (O'Brien and Wolf, 2010; Norgaard, 2011).

24
25 Scientific information on weather variability and change is framed through cultural practices: climate forecast or
26 downscaling results are presented but not necessarily understood and assimilated well by, for example, local farmers
27 (Roncoli, 2006). Local perceptions of what kind of knowledge is trustworthy may in fact question both scientific
28 findings (Burns *et al.*, 2010; Ingram *et al.*, 2002) and how to deal with uncertain climate information (Roncoli *et al.*,
29 2011). Human security is further weakened if (climate) policy does not consider the cosmologies and epistemologies
30 embedded in culture (Jacka, 2009; Stadel, 2008). Table 12-2 illustrates the different dimensions in which climate
31 change is interpreted and against which human security is affected.

32
33 [INSERT TABLE 12-2 HERE

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

35 36 37 **12.3.2. Community and Culture at Risk**

38
39 Cultural dimensions of climate change are manifest in collective action and community. Community is a contested
40 term in various disciplines (Gibson and Cameron, 2011). Community, as used here, refers to place-based groups that
41 exhibit some form of unity and obligation among the members.

42
43 There is a significant body of research that analyses community and collective action for adaptation. Its principal
44 finding is that community-led action is effective for reducing risks and building capacity for adaptation (Davidson *et al.*,
45 2003; Catto and Parewick, 2008; Harries and Penning-Rowsell, 2011; Gero *et al.*, 2011; Fazey *et al.*, 2010;
46 Furgal and Seguin, 2006; Sudmeier-Riuex *et al.*, 2012; Anik and Khan, 2011; Adler, *et al.*, 2012). Specifically this
47 literature finds that community participation in risk and vulnerability assessments produces more sustainable
48 solutions (Ardalan *et al.*, 2010; Gero *et al.*, 2011) and that so-called co-management and learning, increases adaptive
49 capacity (Fazey *et al.*, 2010; Armitage *et al.*, 2011; Dumar, 2010; Ford *et al.*, 2007). Caveats to such analysis
50 highlight structural barriers to community-led action and shows that participation in collective action is limited by
51 hierarchical power relations (Singleton, 2000; Herbert, 2005; Davidson *et al.*, 2003; King, 2008; Ensor and Berger,
52 2009; Nielsen and Reenberg, 2010; Onta and Resurrection, 2011).

1 Table 12-2 reports on evidence across issues of culturally-determined perceptions of climate risks and responses. It
2 highlights major findings that flexibility and livelihood diversification are two key factors in successful adaptation to
3 variability in resource abundance (de Sherbinin *et al.*, 2008; Desta and Coppock, 2004; Ford *et al.*, 2006; Kalikoski
4 *et al.*, 2010; Hovelsrud *et al.*, 2010a,b; Rybråten and Hovelsrud, 2010; McNeeley, 2011; Marshall 2011; Eakin *et*
5 *al.*, 2012; Ford and Goldhar, 2012; Berkes and Armitage, 2010). Further evidence suggests that changing socio-
6 economic and environmental conditions may constrain existing coping community mechanisms (Rattenbury *et al.*,
7 2009; West and Hovelsrud, 2010; Quinn *et al.*, 2011). Local community responses are also shaped by political and
8 economic globalization, in terms of a decoupling of production- and political networks from the local level
9 (Keskitalo, 2009), and by colonial history (Marino, 2012).

12.3.3. *Indigenous Peoples*

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

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

40 Climate change poses challenges for indigenous peoples, including to their knowledge systems, cultural practices,
41 adaptive strategies, and post-colonial power relations. The extensive literature on the Arctic shows that for
42 indigenous peoples the changing ice conditions pose risks in terms of access to food, and dangerous travel
43 conditions (Ford *et al.*, 2008; Ford *et al.*, 2009; Hovelsrud *et al.*, 2011a). Additionally there are uneven societal
44 consequences related to sea ice use, local physiological setting and community socio-cultural dynamics (Ford *et al.*,
45 2008), illustrating the heterogeneity within indigenous groups found elsewhere (Barrett, 2001).

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

1 Much research with indigenous peoples concludes that lack of involvement in resource management decreases
2 resilience and thereby human security, and that it is necessary to focus on indigenous perceptions of risk and
3 traditional knowledge of change, hazards and coping strategies and collective responses (Ellemor, 2005; Finucane,
4 2009; Turner and Clifton 2009; Sánchez-Cortés and Chavero, 2011; Brown, 2009). Tourism development and
5 industrial activities are particular risks for indigenous peoples when they are not involved in decision-making
6 (Petheram *et al.*, 2010). Lack of formal participation in international policy and management negotiations may pose
7 risks for indigenous peoples because their perspectives may not be heard (Schroeder, 2010), and there are examples
8 of successful indigenous lobbying and advocacy in the case managing persistent organic pollutants and heavy metals
9 in the Arctic (Selin and Selin, 2008).

12.3.4. *Local and Traditional Forms of Knowledge*

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

24 Although some studies warn that the emphasis on the value of local/traditional knowledge may be overrated, such
25 knowledge is increasingly seen as a critical source for understanding change, for identifying socio-economic
26 aspects, for developing adaptation strategies and policies, as critical input to climate scientists. For example, such
27 knowledge serve as a basis for forecasting local weather, and provide the necessary insights about the local climate
28 elements needed for relevant meteorological forecasting (Nyong *et al.*, 2007; Tyler *et al.*, 2007; Gearheard *et al.*,
29 2010; Hovelsrud and Smit, 2010; Orlove *et al.*, 2000). Local and traditional knowledge are often not included in
30 adaptation planning (King *et al.*, 2007; Ifejika Speranza *et al.*, 2008; Tàbara *et al.*, 2003), or not valued or pursued
31 properly in scientific studies (Huntington: 2011).

33 Local and traditional knowledge about historical changes and events, and adaptation strategies to changing
34 conditions are valuable for evaluating responses to change and policy (Angassa and Oba, 2008; Desta and Coppock,
35 2004; Eira *et al.*, 2013; Ford *et al.*, 2008; Lefale, 2010; Osbahr *et al.*, 2010; Orlove *et al.*, 2000; Fernández-Giménez,
36 *et al.*, 2012). It is an important contribution for mitigating natural disasters (Rautela, 2005), maintaining domestic
37 biodiversity (Emperaire and Peroni, 2007), and developing sustainable adaptation and mitigation strategies (Nyong
38 *et al.*, 2007). Among the Borana in Africa indigenous pastoralists' technical and organizational practices have been
39 ignored in development, which has contributed to progressive land degradation, erosion of social structures, and
40 poverty (Homann *et al.*, 2008). Evidence from mountain regions exposed to floods illustrates that incorporation of
41 local knowledge into policy and decision-making reduces risk (Alcántara-Ayala *et al.*, 2004).

43 Local and traditional knowledge are living resources (Nakashima and Roué 2002; Berkes 2012;) and can be retained
44 through intergenerational transmission, its integration with other forms of knowledge (King and Goff, 2010;
45 Kalanda-Joshua *et al.*, 2011), and its utilization in monitoring and assessments (Klintenberg *et al.*, 2007;
46 Kalabokidis *et al.*, 2008) and in disaster risk management (Becker *et al.*, 2008; Mercer *et al.*, 2009; Pareek and
47 Trivedi, 2011; Bilbao *et al.*, 2010; Kalabokidis *et al.*, 2008). There is *strong evidence* that mutual integration and co-
48 production of local and traditional and scientific knowledge will enhance resilience, increase adaptive capacity and
49 reduce vulnerability (Kofinas, 2002; Oberthür *et al.*, 2004; Tyler *et al.*, 2007; Anderson *et al.*, 2007; Vogel *et al.*,
50 2007; West *et al.*, 2008; Armitage *et al.*, 2010; Frazier *et al.*, 2010; Marfai *et al.*, 2008; Flint *et al.*, 2011; Ravera *et al.*,
51 2011; Nakashima *et al.*, 2012; Eira *et al.*, 2013).

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

1 between scientific and local, traditional or indigenous knowledge can be seen as a source of inventiveness rather
2 than where validity of knowledge is contested (King and Goff, 2010). Conversely, projects integrating climate
3 projections and local observations reveal different results or discontinuities, often attributed to different perspectives
4 and cultures (Marin, 2010; Mark *et al.*, 2010). This creates barriers for integration (Kwiatkowski, 2011; Ravera *et*
5 *al.*, 2011), illustrating the need for incorporating local and indigenous knowledge and observations into climatology,
6 and for creating locally relevant and trustworthy climate projections (Ingram *et al.*, 2002; Ifejika Speranza *et al.*,
7 2008; Smit *et al.* 2010).

8
9 There are many challenges in managing, utilizing, acknowledging and incorporating these forms of knowledge
10 (Huntington 2011), and the participatory approach may not be sufficient because of the cultural and social dynamics
11 of power and interpretation (Roncoli *et al.*, 2011). Some studies suggest that local/traditional knowledge may not be
12 sufficient to provide the proper response to surprising or infrequent risks, hazards or events (Nunn, 2000;
13 Burningham *et al.*, 2008; Kuhlicke, 2010). Additionally if local/traditional knowledge is perceived to be less reliable
14 because of changing environmental conditions (Ingram *et al.*, 2002; Ford *et al.*, 2006), or because of extreme or new
15 events that are beyond the current local knowledge and cultural repertoire (Valdivia *et al.*, 2010; Hovelsrud *et al.*,
16 2010a), then community vulnerability, and the vulnerability of local/traditional knowledge itself, may increase
17 (Kalanda-Joshua *et al.*, 2011). In the case of coastal communities in India, the societal and environmental conditions
18 have changed to the point at which local knowledge is no longer as applicable as it was in the past (Kesavan and
19 Swaminathan, 2006). In the Himalayas erosion of local/traditional knowledge occurs through government
20 regulations of traditional building materials and practices. The social cohesion embedded in such practices is
21 weakened because of a move towards concrete construction which changes the reliance on and usefulness of
22 traditional knowledge about wood as building material (Rautela, 2005). New conditions may require new knowledge
23 to facilitate and maintain flexibility and improving livelihoods (see also Homann *et al.*, 2008).

24 25 26 **12.4. Migration and Mobility Dimensions of Human Security**

27 28 **12.4.1. Impacts of Climate Change on Displacement, Migration, and Mobility**

29 30 *12.4.1.1. Nature of Evidence on Climate Change and Migration*

31
32 Migration is prevalent in every part of the world, driven by economic and other imperatives. Existing migration
33 systems may be significantly disrupted by impacts of climate change in a number of important dimensions.
34 Migration, defined in terms of temporal and spatial characteristics, is generally classed as a permanent or semi-
35 permanent move by a person of at least one year that involves crossing an administrative but not necessarily a
36 national border. As a result, migrants alter their baseline population of reference and their local networks (Brown
37 and Bean, 2005).

38
39 The most significant contemporary trend in migration by volume of movement continues to be major movements of
40 people from rural to urban settlements. The proportion of the global population that is urban has risen from 10
41 percent in 1900 to over 50 percent in 2009 and is projected to reach 59 percent by 2030 (UNDP 2009; Grimm *et al.*,
42 2008). Around 80 percent of all migration is presently within countries. Existing global migration trends mapped
43 onto ecological zones by de Sherbinin *et al.* (2012) show that the past four decades have seen out-migration from
44 mountain regions and from drylands. Net migration to coastal zones was over 70 million people in the 1990-2000
45 census period, even though cities and coastal zones themselves are at risk from the impacts of climate change.

46
47 As with other elements of human security, the dynamics of interaction with climate change are multi-faceted and
48 direct causation is difficult to establish. There is a growing literature on the demographic, economic and social
49 processes of climate migration interactions (Afifi and Jäger 2010; Pigué *et al.*, 2011; Serrano Oswald *et al.*, 2013).
50 The major emphases are on disentangling causation and multiple drivers of migration; displacement of populations
51 from extreme events; governance challenges and the rights of international migrants and displaced peoples; and on
52 the challenges of migration for urban sustainability and climate impacts (Foresight 2011; Black *et al.*, 2011a,c;
53 White, 2011a; Parnell and Walawege, 2011; Seto, 2011 Geddes *et al.*, 2012;).

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

11 12 13 *12.4.1.2. Do Climate Change Impacts Increase Displacement or Restrict Mobility?*

14
15 It is widely established that extreme weather events displace populations because of their loss of place of residence
16 or economic disruption. This Section reviews evidence on how displacement is highly differentiated socially and has
17 significant economic and social costs (Hallegatte, 2012). Much of the literature, such as reviewed in IPCC SREX
18 report, concludes that with an increasing incidence and changing intensity of extreme weather events due to climate
19 change, there may be increased levels of displacement.

20
21 Much evidence shows a distinct temporal dimension to displacement ranging from localised and short-term
22 movement of people, through intra-regional migration to international displacement as a result of large-scale events.
23 The Pakistan floods of 2010 caused primarily localised displacement for large numbers of people across a wide area
24 (Gaurav et al., 2011). The evidence on displacement as a result of climate-related extremes suggests that most
25 displaced people attempt to return to their original residence and rebuild as soon as practical.

26
27 In general, structural causes of vulnerability, such as income inequality, race, class, and discrimination, deeply affect
28 the livelihood drivers of displacement and the consequences of return. The migration associated with Hurricane
29 Katrina, for example, shows that in New Orleans economically disadvantaged populations were displaced in the
30 immediate aftermath and have not returned (Myers et al., 2008). Fussell et al. (2010) found that 14 months later
31 black residents returned more slowly, because they had suffered greater housing damage. Adams et al. (2009)
32 identified factors that have led to a ‘chronic disaster syndrome’ where some populations are unlikely to return, and
33 Hori and Shaefer (2010) suggest that displacement affected human security through housing, economic and health
34 outcomes. There is also evidence of gender differentials in displacement from extreme events, especially when they
35 lose their social networks or their social capital, and are often affected by adverse mental health outcomes in
36 situations of displacement (Tunstall et al., 2006; Oswald Spring, 2008; Hunter and David, 2011).

37
38 Structural vulnerabilities affect the ability to cope with climate change and extreme events without migrating.
39 Hurricane Mitch in 1990 affected different Central American countries and displaced up to two million people either
40 temporarily or permanently. The impact was highly differentiated by country, with much lower displacement rates in
41 Belize compared to Nicaragua, Honduras and El Salvador, with large scale displacement and an increase in
42 international migration of 300 percent from Honduras (Glantz and Jamieson, 2000; McLeman and Hunter, 2010).
43 But the impacts of such events are highly uneven. While the poorest households in Honduras were hardest hit by the
44 hurricane (McSweeney and Coomes, 2011), they were less vulnerable to storms a decade later due to changes in
45 land tenure and better early warning systems (Villagrán, 2009).

46
47 Not all populations are displaced by extreme weather events. A further strand of evidence on migration shows social
48 differentiation in access to the resources necessary to migrate (Renaud et al., 2011; Black et al., 2012). A review by
49 Black et al. (2012) proposed that populations that are trapped through lack of mobility. Figure 12-1 illustrates these
50 dynamics, showing how vulnerability is inversely correlated with mobility, leading to those being most exposed and
51 vulnerable to the impacts of climate change having the least capability to migrate. Therefore, climate change risks
52 may be most significant when they reduce and constrain opportunities.

1 [INSERT FIGURE 12-1 HERE

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

4
5 One consistent theme of the hazards literature is that while migration responses are common, movement is costly
6 and disruptive and hence may only be used as an ‘adaptation of last resort’ (McLeman, 2009). Paul (2005) found
7 that there was little displacement in Bangladesh as a result of flooding in affected villages and that residents
8 perceived an influx of migrants due to the reconstruction. Hurlimann and Dolnicar (2011) showed for eight
9 Australian settlements that relocation and migration was perceived to be the least desirable adaptation. Haug (2002)
10 showed that pastoralists displaced due to drought in Sudan in the 1990s attempted to return to their previous
11 settlements after the drought, notwithstanding conflict and other factors. McLeman and Hunter (2010) reviewed
12 historical cases of displacement migration and concluded that non-migration or rapid return migration significantly
13 outweighs permanent migration following hurricane impacts in the Caribbean, Dust Bowl migration in the 1930s
14 USA, or dry season migration in the West African Sahel.

15
16 Table 12-3 summarises studies on weather extremes and long-term environmental change with migration outcomes
17 showing that some events and trends lead to increased displacement of populations (column 1); while others lead to
18 reduce mobility and significant trapped populations (column 2). Table 12-3 also demonstrates that in many
19 circumstances (column 3) sections of populations are differentially affected, on the basis of ethnicity, wealth or
20 gender (Elliot and Pais, 2006; Gray and Muller, 2012; Upton, 2012). Table 12-3 therefore demonstrates that the key
21 impacts of climate change include increased displacement; reduced mobility and trapped populations; and migrant
22 populations moving towards destinations likely to be more hazardous due to the impacts of climate change (Black et
23 al., 2011a).

24
25 [INSERT TABLE 12-3 HERE

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

28
29 Studies highlight that long distance migration is reduced by drought in pastoral systems and hence is experienced as
30 reduced mobility (Findley, 1994; van der Geest, 2011; Sánchez et al., 2012). All pioneer migration to urban centres
31 requires significant human and financial capital and hence is restricted to wealthier populations. Henry et al. (2004)
32 confirmed in a multi-year study of Burkina Faso that the movement to other rural areas increased in dry years, but
33 long distance or international migration was limited to years of high agricultural productivity. Kniveton et al. (2011)
34 model migration movements from the 1980s in Burkina Faso and project that future scenarios of decreased rainfall
35 would significantly increase rates of out-migration from rural areas.

36
37 Displacement migration as an adaptation to environmental change has a potential interaction with conflict: increased
38 demands on local resources and services can create competition with resident populations, or where there is ethnic
39 tension and distrust between migrants and residents (Reuveny, 2007; Warner et al., 2010; Hendrix and Salehyan,
40 2012). Evidence in this area is mixed. There is no established consensus on relationships between resource scarcity
41 (whether the initial state or resulting from immigration) and conflict (Section 12.5; Hendrix and Salehyan, 2012). An
42 analysis of multiple cases of large scale population displacement in Africa (from causes such as civil war and
43 conflict) report that significant conflict emerged in receiving areas in around 50 percent of cases, and is less likely
44 when migrants and residents are of the same ethnicity and religion (Reuveny, 2007). Conversely, conflict,
45 particularly large-scale violent conflict, can lead to displacement. This is most common where much of the
46 population is dependent on the environment for livelihoods, as conflict impacts the ability of communities to access
47 resources and respond to environmental variation, increasing the propensity for migration out of the area (Raleigh,
48 2011). That such displacement may initiate new conflict in receiving areas indicates the complex nature of conflict,
49 and that migration will simply be one contributing factor.

50
51 There is some evidence that new migrants are more at risk in cities for two reasons. First, low income migrants are
52 vulnerable to labour market discrimination, access to services such as health care and to crime and violence
53 (McMichael et al., 2012; Fox and Beall, 2012). Second, low-income migrants cluster in high-density areas with
54 exposure to flooding and landslides, with these risks increasing with climate change (Chatterjee, 2010; McMichael

1 et al., 2012). Migrants in Buenos Aires, Lagos, Mumbai and Dakar (Chatterjee, 2010; World Bank, 2010; Mehrotra
2 et al., 2011) are more likely to be exposed to weather-related hazards than long-term residents. In Dakar (1998-
3 2008), 40 percent of new migrants resided in areas with high flood risk. Wang et al. (2012) found that migrants had
4 less knowledge about typhoon risks in Shanghai. Tompkins et al. (2009) showed that new migrants in the Cayman
5 Islands are most vulnerable to tropical cyclones as they are least likely to prepare for cyclones, live in locations with
6 high exposure to cyclone impacts, and interact mostly with expatriates without previous cyclone experience. There
7 is no established evidence that rapid urbanization itself is a source of conflict: Buhaug and Urdal (2013) test
8 hypotheses on social disorder and population growth in 55 cities in Africa and find that rapid growth of city
9 populations does not drive urban unrest.

10 11 12 *12.4.1.3. Migration Trends and Long-Term Climate Change*

13
14 Long-term environmental change, sea-level rise, coastal erosion, and loss of agricultural productivity (Table 12-3)
15 will have a significant impact on displacement. Barbieri et al. (2010) estimated emigration rates in Brazil from
16 affected rural areas and found that de-population occurs with relatively modest rates of warming. In their scenarios
17 the biggest increase in migration comes from productive agricultural areas that support a large labour force.
18 Medelsohn et al. (2007) concluded that in dryland Brazil urban migration is highly likely due to agricultural income
19 loss.

20
21 Longer term environmental change caused by climate change also amplifies existing trends such as rural to urban
22 migration, though results diverge on the importance of climate change and resource scarcity. Modelling studies with
23 future projections on Mexico-US migration rates (Feng et al., 2009), and on Brazilian internal migration (Barbieri et
24 al., 2011) show that projections of drying increase emigration in established migration routes and de-population of
25 rural areas (Kniveton et al., 2011). Barrios et al. (2006) used statistical modelling of changes in rainfall to explain
26 migration rates to African cities. They observed rainfall decreases during the past fifty years and showed statistically
27 they only partially explained differences in urbanization rates, with shortages in rainfall increasing urbanization in
28 sub-Saharan Africa, but often propelled by simultaneous liberalization and policy change.

29
30 Nicholls et al. (2011) estimate displacements based on potential sea-level changes till 2100. A 0.5m sea-level change
31 implies a likely land loss of 0.877 million km² by 2100, displacing 72 million people, with no adaptation investment
32 and with 2.0 metres, 1.789 million km² would be lost, displacing 187 million people, or 2.4 percent of global
33 population, mostly in Asia. If all coasts were protected with dikes and beach nourishment, these estimates fall to
34 0.041-0.305 million people displaced by 0.5-2.0 m of sea level rise. Hallegatte et al. (2011) assume that such
35 protection measures are very likely as the cost of not investing in protecting urban land and infrastructure is so great.
36 Existing migration trends are also likely to exacerbate impacts of climate change and vulnerability themselves.
37 There is a well-documented drift of population into coastal and regional settlements. Curtis and Schneider (2011)
38 project 12 million people to be affected by sea-level rise by 2030 in four major coastal areas in the US.

39
40 Even in areas under threat from long-term climate change, individual migration decisions and aggregate flows are
41 embedded in economic and cultural imperatives. Mortreux and Barnett (2009) found that migration from Tuvalu
42 was not driven by perceptions of climate change and that despite forecasts that the island could become
43 uninhabitable, residents have remained for reasons of culture and identity. Shen and Gemenne (2011) concur that
44 both Tuvalu residents and migrants from Tuvalu in New Zealand did not cite climate change as a reason for
45 movement. Both studies also argue that environmental risks directly affect perceptions of potential well-being and
46 economic opportunities: hence the impacts of climate change may be a more significant driver of future international
47 migration. Observational studies of international migration show that past migration flows are the greatest predictors
48 of future flows because of identity and cultural linkages in both source and destination regions (Serrano Oswald,
49 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.

START BOX 12-4 HERE

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).

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

10 _____
11 END BOX 12-4 HERE _____
12
13

14 **12.5. Dimensions of Conflict and Vulnerability to Climate Change**

16 **12.5.1. Climate Change as a Cause of Violent Conflict**

17
18 In the past decade there has been a significant increase in research investigating the interactions between climate
19 change and violent conflict, reflecting policy discourses that climate change impacts and resource scarcity could
20 escalate conflict risks. Changes in climate will bring groups of people into conflict over property rights, markets,
21 and public goods. Offsetting those risks, there is evidence that in specific circumstances resource scarcity drives
22 adaptation and innovation (Butzer 2012, Gausset and Whyte 2005, Mehta 2010). And resource scarcity rarely
23 escalate to violence, and violent conflict itself has generally become less common and less intense since 1991
24 (Goldstein 2011, Themnér and Wallensteen 2012). Risks between climate change and conflict are defined as
25 emerging in Chapter 19 (19.4) as this is a new area of research. This Chapter concludes that there are multiple
26 interactions between conflict and climate change impacts, and that some well established contributing factors to
27 conflict are sensitive to climate variability and change.
28

29 There is a modest amount of research that explores the relationship between large-scale disruptions in climate and
30 the collapse of past empires (using statistical analysis and data derived from archaeological and other historical
31 records). For example, the timing of the collapse of the Khmer empire in the Mekong basin in the early 15th century
32 corresponds to an unusually severe prolonged drought (Buckley et al 2010). DeMenocal (2001) summarizes
33 evidence that suggests that major changes in weather patterns coincided with the collapse of several previously
34 powerful civilizations, including the Anasazi, the Akkadian, Classic Maya, Mochica, and Tiwanaku empires. The
35 precise causal pathways that linked these changes in climate to changes in civilizations are not well understood due
36 to data limitations. This evidence from historical antecedents cannot be taken to mean future changes in climate will
37 lead to large-scale political collapse due to diverse changes and globalization in the contemporary world (Butzer
38 2012).
39

40 A modest body of research shows that the Little Ice Age was associated with more cases of political upheaval and
41 warfare than in any other period (Parker 2008, Zhang et al 2011), including in Europe (Tol and Wagner 2010),
42 China (Brook 2010), and the Ottoman empire (White 2011b). These studies all show that climate change can
43 exacerbate major political changes given certain social conditions, including a predominance of subsistence
44 producers, conflict over territory, and autocratic systems of government with limited power in peripheral regions.
45

46 There is very little research that explores the risks that climate change poses to violent conflict between states in the
47 past half century. Most recent studies agree that systemic trends towards peace between countries are unlikely to be
48 affected by the impacts of climate change, even with respect to expected changes in transboundary rivers (Bernauer
49 and Siegfried 2012, Brochmann and Hensel 2009, Dinar et al 2011, Feitelson et al 2012, Gartzke 2012, Goulden et
50 al., 2010, Tir and Stinnett 2012, Wolf 2007). All studies show that there are robust institutions that mediate
51 information and create commitments to shared solutions to manage the transboundary impacts of climate variability.
52 The growth and improved capacity of these institutions is major reason why war between states is increasingly rare
53 (Goldstein 2011).
54

1 There is a modest amount of research that finds an association between increases in temperature and violent crime
2 (Anderson 1987, Anderson 2001, Breetzke and Cohn 2012, Butke and Sheridan 2010, Field 1992, Gamble and Hess
3 2012, Rotton and Cohn 2001). Theories that explain that pathways between higher temperatures and violent crime
4 are contested (Breetzke and Cohn 2012, Gamble and Hess), and there is also debate about the effect of very high
5 temperatures on violent crime, with some evidence showing that violent crime falls in conditions of extreme heat
6 (Gamble and Hess 2012, Rotton and Cohn 2001). These debates highlight uncertainties that limit conclusions about
7 the effects of climate change on violent crime. Evidence for this relationship between temperature and violent crime
8 is mostly from cities within the United States, and from crime data in recent decades, whereas historically, and
9 globally, rates of violent crime generally fall as per capita wealth increases (Cole and Gramajo 2009, Neumayer
10 2003). Studies that seek to discover the major causes of violent crime do not identify temperature and other climate
11 variables are significant, with factors relating to culture, income, and policy explaining most of the variation
12 between countries and over time (Cole and Gramajo 2009, Fajnzylber et al 2002, Karstedt 2001, Kawachi et al 1999,
13 Neumayer 2003).

14
15 Most of the research on the connections between climate change and violent conflict focuses on the connections
16 between climate change and civil war. For the most part this research examines rainfall or temperature variability as
17 proxies for the kinds of longer-term changes that might occur due to climate change (see also Chapter 19). One
18 study examines the relationship between temperature and violent conflict (Burke et al. 2009), although this has been
19 challenged (Buhaug 2010). The vast majority of studies seek evidence from Africa, and using satellite-enhanced
20 rainfall data collected since 1980. A global study by Hsiang et al (2011), finds that since 1950 and in countries that
21 are teleconnected to ENSO the risk of war within countries rises during an ENSO period. This study is supported by
22 some studies that find associations between deviations in rainfall and civil war (Miguel et al. 2004, Hendrix and
23 Glaser 2007), but contradicted by others that find no significant association between droughts and floods and civil
24 war (Buhaug 2010, Buhaug and Theisen 2012, Theisen et al., 2012, Slettebak 2012). Examination of individual
25 conflict shows that there is no prospect of identifying specific civil wars as being primarily driven by climate. Box
26 12-5 demonstrates multiple resource and political dimensions of the Darfur conflict with no studies concluding that
27 the conflict was climate-driven.

28
29 _____ START BOX 12-5 HERE _____
30

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

32
33 Climate variability is popularly reported to be a significant cause of the mass killing in the Darfur region that began
34 in 2003 (see Mazo 2009): long term drought and vulnerability of the population to drought has been identified as the
35 trigger and cause. Five detailed studies of the conflict conclude that climate variability and related environmental
36 changes are proximate but not primary causes of the violence.

37
38 The detailed studies find that the violence in Darfur has multiple causes, notably:

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

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

51
52 All analyses agree that it is not possible to isolate any of these specific causes as being most influential (Hagen and
53 Kaiser 2011, Kevane and Gray 2008, Sunga 2011, Verhoeven 2011). Most authors identify government practices as
54 being far more influential drivers than climate variability, noting also that similar changes in climate did not

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

3
4 These studies therefore dispute the identification of the Darfur conflict as being caused by climate change, arguing
5 that attributing this conflict to climate change masks the culpability of actors and the major drivers of insecurity.

6
7 _____ END BOX 12-5 HERE _____
8

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

13
14 A growing body of research examines the connections between climate variability and smaller scale violent conflicts
15 (communal violence). There is some agreement that both increased rainfall and decreased rainfall in resource-
16 dependent societies enhances the risk of localized violent conflict, particularly in pastoral societies in Africa (Adano
17 et al 2012, Butler and Gates 2012, Hendrix and Salehyan 2012, Raleigh and Kniveton, 2012, Theisen 2012). In all
18 such cases, the presence of institutional structures that protect property rights and manage conflict are highlighted as
19 the critical factors in mediating such risks (Adano et al. 2012, Benjaminsen et al., 2012, Butler and Gates 2012,
20 Hidalgo et al. 2010, O'Loughlin et al 2012, Gausset 2005, Theisen 2012).

21
22 In response to the challenges of finding direct associations between changes in climate and violence, some research
23 has examined the effects of changes in climate on factors that are known to increase the risk of civil war (Berholt
24 and Lujala 2012, Koubi et al. 2012). Civil war has been studied extensively using quantitative and qualitative
25 techniques, and there is strong agreement about factors that increase the risk of civil war, namely: a recent history of
26 civil violence, low levels of per capita income, low rates of economic growth, economic shocks, inconsistent
27 political institutions, and the existence of conflict in neighboring countries (Blattman and Miguel 2010, Brückner
28 and Ciccone 2010, Dixon 2009, Hegre and Sambanis 2006, Miguel et al. 2004, Weede 2004). Nevertheless, almost
29 all studies note that there are few convincing theories that explain the ways these factors cause violence.

30
31 Many of the factors that increase the risk of civil war are sensitive to climate change. For example, there is robust
32 evidence that climate change will slow rates of economic growth and impede efforts to grow per capita incomes,
33 particularly in Africa where the risk of conflict is highest (chapter 10) (Eboli et al 2010, Mendelsohn et al. 2000,
34 Mendelsohn et al. 2006, Stern 2007). Extreme events, which may become more intense due to climate change, can
35 also produce economic shocks (Bergholt and Lujala, 2012; Hallegatte 2012; Adam, 2013), although the direct
36 association between disasters and violent conflict is contested (Bergholt and Lujala 2012, Pelling and Dill 2010,
37 Slettebak 2012). There is some evidence that under certain circumstances disasters can provide critical opportunities
38 to build peace in conflict settings, and to improve governance institutions (Bruckner and Ciccone 2011, Kingsbury
39 2007, Olson and Gawronski 2010). There are theoretical reasons, but limited evidence, to suggest that climate
40 change can lead to more inconsistent political institutions (Barnett and Adger 2007, Scheffran et al. 2012b).

41
42 In summary, there is justifiable common concern that climate change may increase the risk of violent conflict in
43 certain circumstances (Bernauer et al. 2012; Gleditsch, 2012; Scefrran et al., 2012), even if the strength of the effect
44 is uncertain. This concern is justified given robust knowledge of the factors that increase the risk of civil wars, and
45 evidence that some of these factors are sensitive to climate change, There is also general agreement in the literature
46 that there is a need for theories and data that explain the processes that lead from changes in climate to violence,
47 including on the institutions that help avoid violent outcomes (Barnett and Adger, 2007; Sheffran and Battaglini,
48 2011; Buhaug and Theisen 2012, Gleditsch, 2012; Murtinho and Hayes, 2012;). However, confident statements
49 about the effects of future changes in climate on violence of any kind are not possible given the absence of generally
50 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; Borrás 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,

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

3
4 Violent conflict interrupts the ability of resource dependent individuals and communities to access natural resources
5 (Pike, 2004; Detraz, 2009; Kolmannskog 2010; Raleigh, 2011), and in so doing limits their capacity to adapt to
6 climate change. The denial of strategic space as a tactic in violent conflicts (through for example, deliberate
7 destruction of crops and spreading of landmines in conflict affected regions) can reduce the capacity of individuals
8 and communities to access natural capital (Berhe, 2007; Unruh, 2011).

9
10 Conflict disrupts markets and destroys infrastructure, limits education and the development of human capital, causes
11 death and injury among a state's workforce, and decreases the ability of individuals, communities and the state to
12 secure credit (Blattman and Miguel 2010, Goodhand, 2003; Stewart et al., 2001). Conflict thus creates poverty and
13 constrains livelihoods which in turn increases vulnerability to the impacts of climate change (Nigel, 2009; Deng
14 2010a, Hilson and van Bockstael, 2011). Thus violent conflict is a major cause of hunger and famines (de Waal
15 1993, Messer and Cohen 2011, Rowhani et al., 2011).

16
17 The capacity for collective action is a critical determinant of the capacity to adapt to climate impacts, and this too
18 can be undermined by violent conflict, depending on the nature of violence and the strategies households adapt in
19 response (Deng, 2008 and 2010b). When conflict exacerbates existing horizontal inequalities between ethnic or
20 religious groups, foments distrust in local or government institutions, or isolates individuals and households,
21 capacities that are critical to coping with climate impacts are also degraded (Bogale & Korf, 2007). In situations
22 where there is violent conflict, efforts to address climate change that provide financial or resource flows, or political
23 levers that can be captured by local elites or illegitimate institutions, may compound divisions where such efforts
24 (Brown et al., 2011; Verhoeven, 2011).

25
26 Conflict related displacement also creates and exacerbates social isolation and accompanying sources of
27 vulnerability. Isolation from social networks can make it difficult to achieve pillars that underlie traditional
28 livelihoods, such as marriage, access to land, or access to communal social safety nets in times of vulnerability
29 (Raleigh, 2011; Kolmannskog 2010).

30
31 Violent conflict can decrease the capacity of local and state level institutions to function effectively (Feitelson et al.,
32 2012; Tignino, 2011). For example, chronic political conflict has reduced the ability of governance institutions at
33 many scales to manage water resources in the Gaza Strip effectively (Shomar, 2011), parts of the Balkans
34 (Skoulidakis, 2009), and the Middle East (Zeitoun et al., 2012). Instability has affected planning process around
35 urban land use in Palestine (Raddad et al., 2010) and traditional institutions for governing fishery rights in the Lake
36 Chad Basin have been challenged by the presence of armed groups and illegal taxation systems sustained by non-
37 legitimated government agents (Bene et al., 2003). Political instability has also been shown to contribute to poor
38 urban governance in some regions of Iraq (Hassan, 2010).

39
40 Violent conflict may also undermine the ability of states to prevent and respond to natural disasters and
41 humanitarian crisis (Keen, 2008). A lack of trust in government commitment or capacity to respond, the presence of
42 police or military forces that lack legitimacy, or recent conflict between government and local forces, hampers the
43 ability of these institutions to provide effective relief (Wisner, 2001).

44 45 46 **12.5.4. *Peace-Building Activities in Promoting Adaptation***

47
48 It is widely established that resource management has significant potential to contribute to conflict management by
49 channeling competing interests over resources into non-violent resolutions (Conca and Dabelko, 2002; Conca and
50 Wallace 2009; Hammill and Matthew 2012). This research on environmental peacebuilding and peacemaking
51 considers that natural resource management, and by extension climate change adaptation, can build peace to avoid
52 conflicts, and broker peace in conflict situations.

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

8
9 Beyond water, there is less evidence about the effectiveness of efforts to enhance cooperation and lower conflict
10 around natural resources. Some transboundary conservation areas, referred to as ‘peace parks’, are designed to
11 reduce conflict and enhance cooperation across borders. The evidence of the effectiveness of peace parks is limited
12 and ambiguous, with some studies showing some evidence of political, economic and conservation cooperation (Ali
13 and Marton-LaFevre, 2007), but also conflict generation between local communities, elites and states (Duffy 2002).

14 15 16 **12.6. National Security Dimensions of Climate Change**

17
18 Climate change will affect state security through mechanisms such as impacts on critical infrastructure, threats to
19 territorial integrity, changing access to resources, or responses to climate change. State militaries are active in
20 assessing and responding to these challenges (Dabelko, 2009). These infrastructure and geopolitical impacts directly
21 affect state capacities to provide a range of ecological, economic, social, and political services that fundamentally
22 contribute to human security (Barnett, 2003; Barnett et al., 2010; Webersik, 2010).

23 24 25 **12.6.1. Critical Infrastructure and State Capacity**

26
27 Climate change is expected to damage a range of critical infrastructure, with water and sanitation, energy, and
28 transportation infrastructure posing especially severe vulnerabilities (Chapter 8; Rozenzweig et al., 2011; UN
29 Habitat, 2011). Climate change is expected to exacerbate water supply problems in sensitive urban areas, to limit the
30 ability to cool power plants, to increase energy demand beyond capacity in areas of high temperature increase, to
31 disrupt power supply and telecommunications in areas of increased snow and ice storms, and to damage vital
32 transportation infrastructure in areas subject to flooding and storm surge (see Chapter 8). Areas that are vulnerable
33 to flooding and landslides will have greater risk of such infrastructure damage (Adelekan, 2010; Awuor et al., 2008;
34 Revi 2005).

35
36 Climate change impacts on critical infrastructure will reduce the ability of some states to provide social and public
37 services (see Chapter 8). For example, power outages stemming from water shortages or storms can in turn lead to
38 reductions in service delivery on the part of hospitals, police forces and emergency response forces. Damage to
39 roads, rails, airports, bridges and related transport infrastructure can similarly reduce the ability of governments to
40 provide for citizen needs. Hughes et al. (2010) estimate a modest 1-2 percent additional investment costs to adapt
41 water supply infrastructure to climate change, but with wide variation between countries. Thawing permafrost, for
42 example, will affect water infrastructure but affect the whole viability of settlements and infrastructure in high
43 latitude areas (Chapter 28; Larsen et al., 2008; Marino, 2012). In poorer countries or where economies depend
44 heavily on climate-sensitive activities such as agriculture, climate impacts are expected to lead to significant
45 declines in income and in turn government revenues. Mideksa (2010) estimates losses of nearly ten percent in
46 Ethiopia GDP.

47 48 49 **12.6.2. Geopolitical Issues**

50
51 Analysis of the actions of states and security institutions show that many states view current and anticipated climate
52 changes as contributing to geopolitical concerns (Dabelko 2009; Smith 2011). The ability of states to share resources
53 and provide human security is challenged by climate change impacts. Climate change can create contested terrestrial

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

3
4 For small island states and countries with significant areas of soft low-lying coasts (Hanson et al., 2011) such as
5 Bangladesh, Tanzania (Kebede and Nicholls, 2012), and Singapore (Ng and Mendelsohn, 2005) sea-level rise and
6 extreme events threaten to erode and subsume significant land areas and associated infrastructure and settlements
7 without significant adaptation investment (Chapter 5; Nicholls et al., 2011). For countries comprised entirely of low-
8 lying atolls, sea-level rise, ocean acidification, and increases in episodes of extreme sea-surface temperatures,
9 compromise human security for existing or larger numbers of people (Barnett and Campbell 2010, Fisher 2011).
10 With projected high levels of sea-level rise beyond the end of this century, the physical integrity of low lying islands
11 is under threat (Chapter 29, Houghton et al., 2010). The opening of resources, such as the social, economic and
12 political dimensions of loss of sea ice in the Arctic (Chapter 28), represents an example of climate change impacts
13 being geopolitically significant to states, even in the absence of direct conflict (Box 12-6).

14
15 Productive ocean fisheries are already directly affected by climate change, with loss of yields in the tropics,
16 changing range of important commercial species in temperate regions, and greater variability in productivity and
17 species composition in virtually all oceans (MacNeil et al., 2010). Fishing, as an economic activity often involves
18 changing practices and locations, but the increased globalization of fisheries operations (Berkes et al., 2006) has
19 been suggested to increase transboundary rivalry and threaten the sustainability of some fisheries (MacNeil et al.,
20 2010).

21
22 _____ START BOX 12-6 HERE _____

23 24 **Box 12-6. Evidence on Security and Geopolitical Dimensions of Climate Change Impacts in the Arctic**

25
26 Impacts of climate change on the Arctic region exemplify the multiple interactions of human security with
27 geopolitical risks. System wide changes in the Arctic region affect multiple countries and a global commons
28 resource given Arctic roles in regulating the global climate and ocean systems (Carmack et al., 2012; Duarte et al.,
29 2012). Anticipated changes will contribute to greater geopolitical considerations and human insecurity in the Arctic
30 region. They include: food insecurity affecting specific cultures and knowledge systems (outlined in Section 3);
31 energy security implications through opening of sub-sea oil and gas reserves; increased shipping; and increased
32 presence of militaries in the region.

33
34 Summer Arctic ice has had five of the lowest recorded minima in the period 2007-11 (Duarte et al., 2012), and
35 projections of future loss suggest an ice-free Arctic ocean in summer by mid-century or before, with implications for
36 land based infrastructure, shipping, coastal communities and transport (Holland et al., 2006; Stephenson et al., 2011;
37 Larsen et al., 2008; See Chapter 28). There is only limited evidence on changes either creating or reviving terrestrial
38 and maritime boundary disputes among Arctic countries (Borgerson, 2008; Lusthaus, 2010). Further, there is little
39 evidence that the changing Arctic will become a site for violent conflict (Berkman, 2010; Brosnan et al., 2011;
40 Young 2009; Young, 2012), given political institutions such as the Arctic Council are providing a forum for
41 resolving resource sharing, new transportation practices, and boundary disputes. Research on livelihoods and
42 cultural change dimensions of human security, however, also concludes that climate and ecological shifts will
43 contribute significant challenges for adaptation (Nuttall, 2012; Hovelsrud et al., 2011b).

44
45 _____ END BOX 12-6 HERE _____

46
47 The impacts of climate-induced water variability on transboundary water basins constitute a cluster of geopolitical
48 concerns. The high levels of international interdependence on transboundary rivers such as the Nile, Limpopo, Amu
49 Darya, Syr Darya, Mekong, Ganges, Brahmaputra, and Indus connect the conditions of the rivers with national
50 development trajectories. Climate change is anticipated to affect the timing and rate of flow of these rivers,
51 contributing to concern over negative outcomes from additional stresses stemming from increased consumption and
52 increased populations.

1 Research on transboundary conflict and cooperation prioritizes rate of change rather than absolute scarcity in
2 connection with the risk of conflict over water, particularly between states (De Stefano et al. 2012). This focus stems
3 from higher perceived risk of conflict when institutions at local, state, and regional levels have less time to adapt to
4 scarcity or variability by dealing with disputes through diplomatic and other non-violent mechanisms (Wolf et al.
5 2003; De Stefano et al. 2010; De Stefano et al. 2012). Sudden changes in flow that heighten risk and challenge
6 institutional responses include declines in seasonal snow or glacial melt. Transboundary basin institutions and
7 international legal mechanisms have demonstrated the ability to lessen the likelihood of violent conflict (McCaffrey,
8 2000; Sadoff and Grey, 2002; Dellapenna and Gupta 2009; Tir and Stinnett, 2012;). Other research emphasize these
9 transboundary water institutions receive limited financial and political investment, do not always include all
10 riparians, and are present in only a limited number of transboundary basins (Conca et al., 2002).

11
12 Research on bilateral and multilateral interactions between two or more states from 1948 to 2008 shows significant
13 formal cooperation among river basin riparian states while most interactions are low levels of cooperation and low
14 levels of conflict (Wolf et al., 2003; De Stefano et al., 2010). Some find that the presence of a shared river basin is
15 correlated with increased risk of state-to-state or dyadic conflict (Gleditsch et al., 2006), but the evidence suggests
16 only a limited number of overtly violent conflicts between states and no cases of water causing two states to engage
17 in formal war. Zeitoun and Warner (2006) and Zeitoun and Mirumachi (2008) distinguish between equitable and
18 inequitable cooperation among transboundary riparians cooperating through joint water management institutions.
19 Relative power differentials between countries, territories, or groups stemming from upstream or downstream
20 position, economic power, or military power can undercut the wider conflict reduction impacts of formal
21 institutional cooperation.

22
23 Geoengineering - intentional large-scale interventions in the earth system - either to reduce the sun's radiation that
24 reaches the surface of the earth or to increase the uptake of carbon dioxide from the atmosphere (See Chapter 20), is
25 increasingly considered a strategy to address climate change. The uncertainty and high likelihood of differential
26 impacts of geoengineering (such as reduced precipitation in Asia (Ricke et al. 2011) with negative food production
27 implications), are anticipated sources of tension or conflict between states (Robock 2008; Preston, 2013). The ability
28 of states to unilaterally deploy geoengineering under limited international legal mechanisms creates the potential for
29 conflict. A history of security institutions deploying geoengineering and weather modification presents the prospect
30 of military involvement in climate change responses or reactions to them (Fleming, 2010). The degree of
31 securitization of climate change is debated (Brzoska, 2012, add cites), but in the case of geoengineering, concern
32 stems from possible dual use that potentially would violate the 1977 UN Convention on the Prohibition of Military
33 or Any Other Hostile Use of Environmental Modification Techniques (Keith, 2000; Robock, 2008; Corner and
34 Pidgeon, 2010).

35 36 37 **12.7. Synthesis**

38
39 The evidence reviewed in this Chapter shows that climate change poses risks to various dimensions of human
40 security, which arise through diverse causal processes, and which will be manifest at different scales. There is high
41 agreement in the literature for this conclusion that comes from multiple lines of evidence. There are, however,
42 multiple and competing perspectives on the nature and causes of insecurity arising from climate change (Barnett
43 2010). For example, farmers in the Sahel are concerned about the risks climate change poses to their livelihoods
44 (Mertz et al. 2009), whereas people in Tuvalu report that the cultural impacts of migration are a primary concern
45 (Mortreux and Barnett 2009). Organisations whose mandates include various aspects of human security also tend to
46 focus on some risks of climate change over others. For example the International Council on Human Rights Policy is
47 concerned with the risks climate change poses to human rights, the International Organization for Migration is
48 concerned with the implications of climate change for migration, and the United States National Intelligence
49 Council is focused on the risk climate change will increase political instability. In this respect the framing of climate
50 change as an issue of human security facilitates conversations across the boundaries of diverse policy communities
51 (Gasper 2010).

52
53 The risks that climate change poses to human security arise through multiple and interacting processes: those
54 processes also operate across diverse spatial and temporal scales. High levels of complexity means that no

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

11
12 [INSERT FIGURE 12-3 HERE

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

16
17 A key finding of this Chapter is that institutions are integral to the risks climate change poses to all dimensions of
18 human security. Again there is high agreement on this finding, with multiple lines of evidence from food security, to
19 migration, to conflict resolution. The risks climate change poses to human security sometimes arise directly through
20 interaction of material effects of changes in climate, through physical, biological and ultimately impacts in society.
21 But evidence in this Chapter suggest that often the risks to human security also arise through ways in which
22 institutions anticipate and react to these perceived or actual changes (Barnett et al. 2010; Ribot 2011; Artur and
23 Hilhorst 2012). These institutional responses can significantly dampen or amplify the way changes in climate give
24 rise to human insecurity (see Figure 12-3). For example, although declining productivity in crops and fisheries
25 impacts on the food available to semi-subsistence farming and fishing households, anticipated or actual increasing
26 scarcity on food markets also causes higher food prices, which can further undermine food security in those
27 households (Chapter 7, and Badjeck et al., 2010; Downing 2002; Oluoko-Odingo 2011).

28
29 Adaptation and mitigation strategies can also dampen or increase human insecurity. With respect to both adaptation
30 and mitigation strategies, there is an emerging consensus that those that are imposed on communities are more likely
31 to impact negatively on human security than those that facilitate communities to respond in ways that are consistent
32 with their capabilities and values (medium agreement, limited evidence) (Ensor and Berger, 2009; Barnett and
33 O'Neill 2011, Marino 2012, Mercer et al. 2012). Adaptation strategies that seek to reduce exposure to climate
34 change, through the development of large infrastructure or the resettlement of communities against their will, carry
35 risks of disrupted livelihoods, displaced populations, deterioration of valued cultural expressions and practices, and
36 in some cases violent conflict. Conversely, strategies such as the provision of microfinance, assistance to overcome
37 barriers to mobility, and improving access to education and health care, enhance the ability of vulnerable
38 populations to make and implement decisions that are consistent with their own capabilities and values. Hence such
39 interventions are increasingly being shown to offset the adverse effects of climate change on livelihoods, unwanted
40 migration, culture, and violent conflict. Similarly, mitigation policies that entail changes in property regimes that are
41 not consistent with resource ownership and use can impact negatively on human security (Bumpus and Liverman
42 2008; Beymer-Farris and Bassett, 2012). There is as yet more limited evidence to demonstrate that mitigation
43 activities that align with local interests and institutions can have co-benefits for human security, mitigation, and
44 adaptation (Klein et al., 2005; Ayers and Huq, 2009; Laukkonen et al., 2009; Moser 2012).

45
46 Thus, climate change is not yet the primary risk to human security: it is one of many drivers of human security that
47 vary in priority depending on location and circumstance. For regions where human insecurity is prevalent, these
48 additional factors include poverty, discrimination, and inadequate provision of public services and public health, and
49 opportunities for education. Investments in institutional responses to facilitate adaptation can dampen many of the
50 potential adverse effects of climate change on human security (see Figure 12-3). Conversely, inappropriate climate
51 policy responses may accelerate and amplify human insecurity.

52
53 There remains much uncertainty about the future impacts of climate change on human security. On the basis of
54 current evidence about the observed impacts of climate change on environmental conditions, climate change will be

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

10 Frequently Asked Questions

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

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

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

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

30 **FAQ 12.3: Will climate change cause war between countries?**

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

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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 <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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; 	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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). 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> 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). 	<ul style="list-style-type: none"> 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	<p>Health:</p> <ul style="list-style-type: none"> 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) 	<p>Health:</p> <ul style="list-style-type: none"> 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).
		<p>Education:</p> <ul style="list-style-type: none"> 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). 	<p>Loss of lives:</p> <ul style="list-style-type: none"> 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 <i>et al.</i> , 2008; Stadel, 2008; Jacka, 2009; Bogale and Korf, 2009; Green, <i>et al.</i> , 2010; Burch, 2010; Schroeder, 2010; Osbahr <i>et al.</i> , 2010; McNeely, 2011; Gero <i>et al.</i> , 2011; Sánchez-Cortés and Chavero, 2011; Roncoli, <i>et al.</i> , 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 <i>et al.</i> , 2003; Desta and Coppock, 2004; Herbert, 2005; Zamani <i>et al.</i> , 2006; Ford <i>et al.</i> , 2006, 2008; Crona, 2006; Aguilar <i>et al.</i> , 2009; Kuruppu and Liverman 2011, Rudiak-Gould, 2012; Roncoli <i>et al.</i> , 2011; Gearheard <i>et al.</i> , 2010; Hovelsrud and Smit, 2010; Nyong <i>et al.</i> , 2007; Tyler <i>et al.</i> , 2007; Angassa and Oba, 2008; Osbahr <i>et al.</i> , 2010; Lefale, 2010; Cate, 2008; Gregory and Trousdale, 2009; Harries and Penning-Rowsell, 2011; Gero <i>et al.</i> , 2011; Fazey <i>et al.</i> , 2010; Furgal and Seguin, 2006; Sudmeier-Rioux <i>et al.</i> , 2012; Anik and Khan, 2012; Kuhlicke, 2010; Valdivia <i>et al.</i> , 2010; Kesavan and Swaminathan, 2006; Jacka, 2009; Pearce <i>et al.</i> , 2010; Adler, <i>et al.</i> , 2012; Gómez-Baggethun <i>et al.</i> , 2012; Burningham <i>et al.</i> , 2008; West and Hovelsrud, 2010; Nursey-Bray <i>et al.</i> , 2012; Armitage <i>et al.</i> , 2011; Dumar, 2010; King, 2008; Nielsen and Reenberg, 2010; Onta and Resurrection, 2011; de Sherbinin <i>et al.</i> , 2008; Kalikoski <i>et al.</i> , 2010; Hovelsrud <i>et al.</i> , 2010a,b; Rybråten and Hovelsrud, 2010; McNeely, 2011; Marshall 2011; Berkes and Armitage, 2010; Ford and Goldhar, 2012; Eakin <i>et al.</i> , 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 <i>et al.</i> , 2000, 2010; Ingram <i>et al.</i> , 2002; Tàbara <i>et al.</i> , 2003; Alcántara-Ayala <i>et al.</i> , 2004; Gearheard <i>et al.</i> , 2010; Roncoli, 2006; Forbes, 2007; Anderson <i>et al.</i> , 2007; Vogel <i>et al.</i> , 2007; Nyong <i>et al.</i> , 2007; Tyler <i>et al.</i> , 2007; Catto and Parewick, 2008; Frazier <i>et al.</i> , 2010; Marfai <i>et al.</i> , 2008; Mercer <i>et al.</i> , 2009; Pearce <i>et al.</i> , 2009; Marin, 2010; Mark <i>et al.</i> , 2010; Smit <i>et al.</i> 2010; Burns <i>et al.</i> , 2010; Hovelsrud and Smit, 2010; Kalanda-Joshua <i>et al.</i> , 2011; Flint <i>et al.</i> , 2011; Ravera <i>et al.</i> , 2011; Sánchez-Cortés and Chavero, 2011; Huntington, 2011; Eira <i>et al.</i> , 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.	<p>↑ 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).</p> <p>↑ Mexico: Increased propensity to migrate to the United States related to years with negative crop productivity (Feng et al., 2010)</p> <p>↑ Western Sahara: Droughts play a crucial role in patterns of international migration from refugee camps (Gila et al., 2011).</p> <p>↑ Kenya: Households farming high quality soil are less likely to migrate, especially temporary labour migration (Gray, 2011).</p> <p>↑ India: Temporary migration identified as 'the most important' coping strategy in times of drought in rural villages (Jülich, 2011).</p> <p>↑ 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).</p> <p>↑ Canada: Higher population loss associated with settlements containing areas of poorer quality agricultural soils during droughts of 1930s (McLeman and Ploeger 2011).</p> <p>↑ Guatemala: Outmigration was commonly attributed to soil degradation, resulting in migration to the expanding agricultural frontiers by open forests (López-Carr, 2012).</p> <p>↑ 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).</p>
Evidence for decreased migration, mobility or significantly trapped populations.	<p>↓ Mali: Reduced international migration during 1980s drought and an increase in cyclical migration (Findley, 1994).</p> <p>↓ 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)</p> <p>↓ Uganda: High soil quality marginally increases migration, especially permanent non-labor migration. (Gray, 2011).</p>
Evidence for socially-differentiated mobility outcomes.	<p>⌚ 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).</p> <p>⌚ 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).</p> <p>⌚ 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).</p> <p>⌚ 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).</p> <p>⌚ Ethiopia: Male migration increases with drought. However, marriage related moves by women decrease with drought. (Gray and Mueller, 2012).</p> <p>⌚ 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).</p> <p>⌚ 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).</p> <p>⌚ 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).</p>

Flooding	
Evidence for increasing migration, mobility or increased displacement.	<p>↑ 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).</p> <p>↑ Vietnam: Cumulative impacts of seasonal flooding increases outmigration rates in the Mekong Delta (Dun, 2011).</p> <p>↑ Bangladesh: 22% of households affected by tidal-surge floods, and 16% affected by riverbank erosion, moved to urban areas. (Penning-Rowsell et al., 2013).</p>
Evidence for decreased migration, mobility or significantly trapped populations.	<p>↓ Bangladesh: No out-migration detected after 2004 tornado in Bangladesh as a result of the effective distribution of disaster aid (Paul, 2005).</p> <p>↓ Senegal: Over 40 percent of new migrant populations located in high risk flood zones in Dakar (Quoted in Black et al., 2011b).</p>
Evidence for socially-differentiated mobility outcomes.	<p>↕ 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).</p> <p>↕ Bangladesh: Wide variation among groups in attitudes and capabilities for migration as an adaptation to the impact of cyclone Aila (Kartiki, 2011)</p>

Sea level rise	
Evidence for increasing migration, mobility or increased displacement.	<p>↑ 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).</p> <p>↑ Vanuatu: Whole village displacement associated with inundation, both from sea level rise and tectonic movement on Torres Islands (Ballu et al., 2011).</p> <p>↑ 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).</p> <p>↑ 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).</p> <p>↑ 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).</p>
Evidence for decreased migration, mobility or significantly trapped populations.	<p>↓ 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).</p>

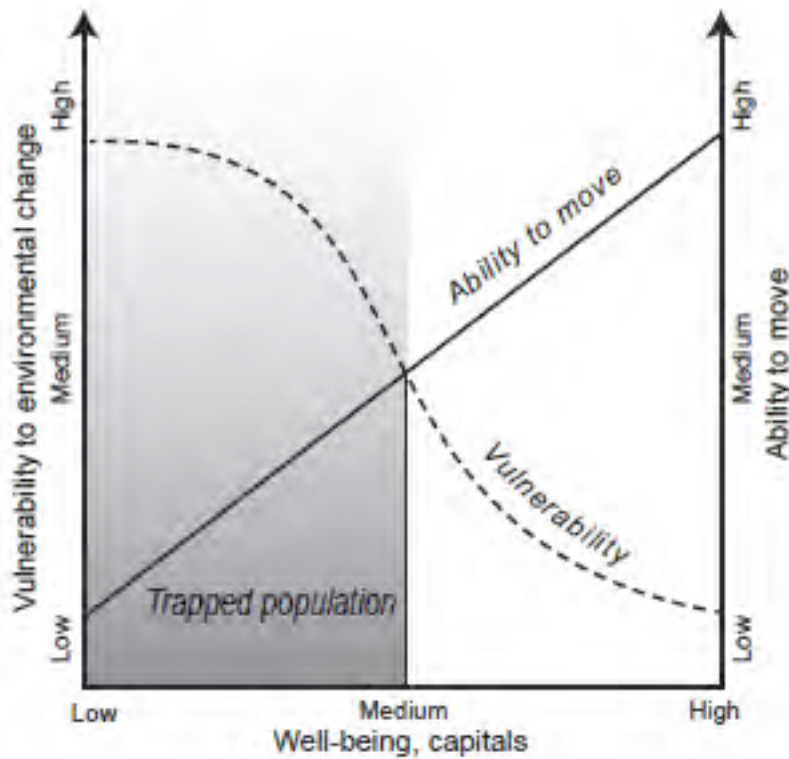


Figure 12-1: Relationship between vulnerability to environmental change and mobility. Lack of mobility and high vulnerability are positively correlated. Adapted from Black et al. (2013).

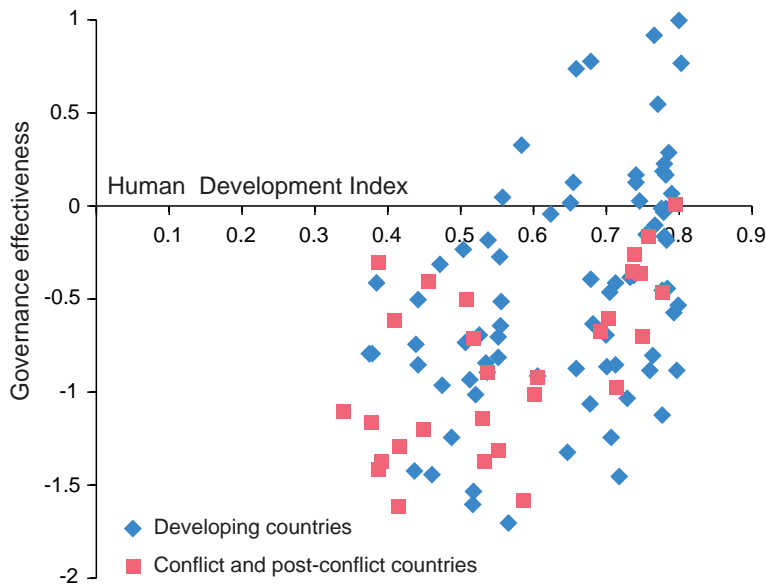


Figure 12-2: Conflict and post-conflict societies exhibit low levels of governance and human development. Source: Adger (2010).

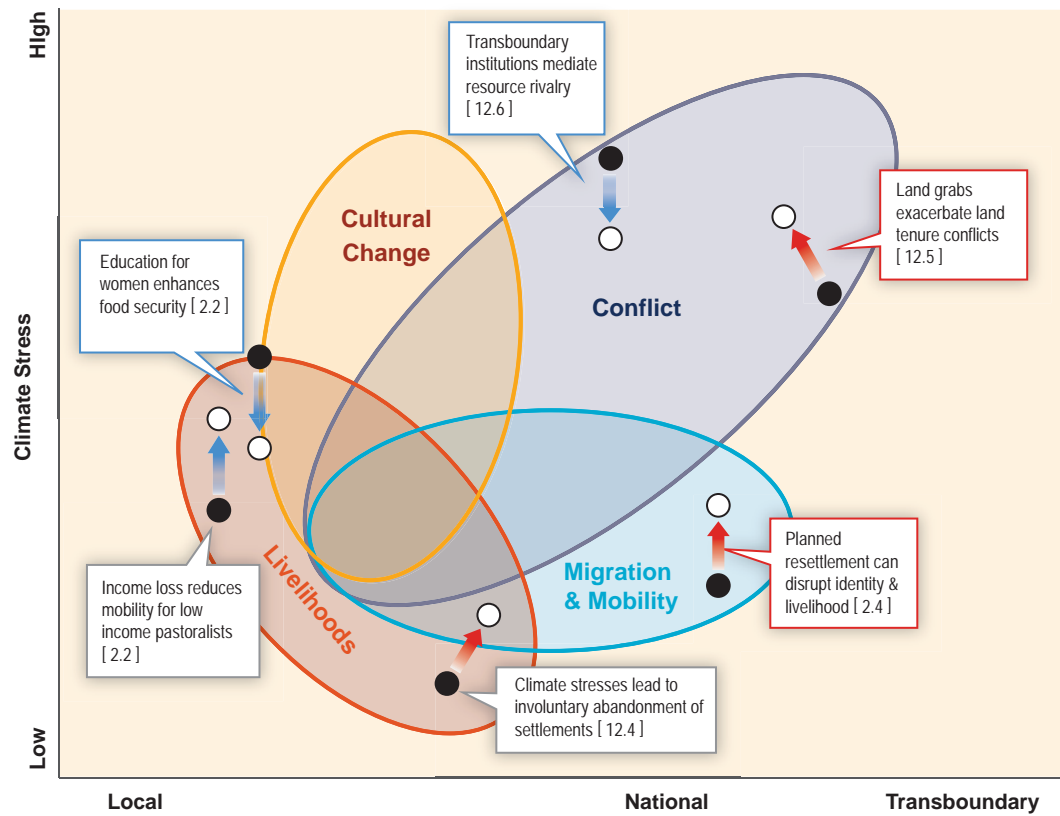


Figure 12-3: Synthesis of evidence on the impacts of climate change on elements of human security and the interactions between elements. Examples of positive and negative changes in security associated with interventions indicated by arrows.